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Classification And Management Of Riparian And Wetland Sites In Montana

by

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SOLCAN	38 (1)	31 (7)	—	20 (20)	12 (21)	27 (20)	—	—
SOLGIG	—	8 (3)	20 (40)	—	2 (3)	9 (20)	11 (1)	10 (3)
SOLIDA	—	8 (3)	—	—	—	—	—	—
SOLMIS	25 (3)	8 (3)	—	—	—	—	—	—
SOLOCC	—	—	—	—	7 (7)	—	—	—
SONARV	13 (3)	8 (20)	—	—	7 (29)	—	—	—
SONASP	—	—	—	—	7 (1)	—	—	—
STRAMP	—	—	—	20 (1)	—	—	—	—
TANVUL	—	—	—	—	2 (1)	—	—	—
TARLAE	—	—	—	—	2 (1)	—	—	—
TAROFF	13 (1)	31 (5)	—	60 (8)	—	—	—	—
THAOCC	—	8 (3)	—	—	—	—	—	—
TRADUB	—	8 (1)	—	—	—	—	5 (1)	10 (1)
TRIREP	38 (7)	—	—	20 (60)	—	—	—	—
URTDIO	—	8 (3)	20 (1)	—	—	—	—	—
VERAME	—	—	—	—	2 (3)	—	—	—
VERBRA	—	—	—	—	2 (20)	—	—	—
VERCAT	—	—	—	—	2 (1)	—	—	—
VIOCAN	—	—	—	—	2 (1)	—	—	—
XANSTR	—	—	—	—	7 (30)	—	—	10 (3)
Ferns and Allies								
EQUARV	13 (20)	15 (1)	20 (30)	—	14 (1)	9 (1)	—	10 (3)
EQULAE	13 (1)	8 (20)	—	20 (1)	7 (1)	—	—	10 (10)

Appendix 17. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	SALBEB C.T.	SALCAN/ CARROS H.T.	SALDRU/ CALCAN H.T.	SALDRU/ CARROS H.T.	SALDRU C.T.	SALPLA/ CARAQU H.T.	SALWOL/ CARAQU H.T.	SALWOL/ DESCES H.T.
No. Of Stands	27	24	26	43	2	57	19	20
Trees								
ABILAS	—	—	8 (2)	2 (1)	—	5 (1)	—	5 (1)
BETPAP	4 (1)	—	—	—	—	—	—	—
JUNSCO	11 (2)	—	—	2 (1)	—	—	—	—
LAROCC	—	—	4 (1)	—	—	—	—	—
PICEAX	7 (1)	4 (1)	19 (2)	12 (1)	—	16 (1)	5 (1)	10 (2)
PINCON	—	4 (1)	12 (8)	9 (1)	—	9 (3)	5 (1)	5 (1)
PINPON	7 (5)	—	—	—	—	—	—	—
POPANG	4 (3)	—	—	—	—	—	—	—
POPTRE	19 (2)	—	4 (3)	2 (1)	—	4 (1)	—	—
POPTRI	7 (5)	—	4 (1)	—	50 (1)	—	—	—
PSEMEN	4 (1)	—	4 (3)	2 (1)	—	—	—	—
Shrubs								
ACEGLA	—	—	—	2 (3)	—	—	—	—
ALNINC	15 (23)	—	23 (3)	30 (13)	—	—	—	—
ALNSIN	—	—	4 (1)	2 (30)	—	—	—	—
AMEALN	7 (1)	—	—	5 (1)	—	—	—	—
ARTCAN	—	—	—	—	—	—	16 (1)	10 (2)
BERREP	4 (1)	—	—	—	—	—	—	—
BETGLA	—	71 (33)	—	19 (13)	50 (1)	26 (11)	5 (20)	25 (13)
BETOCC	15 (16)	8 (12)	—	—	—	—	11 (3)	—
CORCAN	7 (2)	—	4 (10)	2 (1)	—	—	—	—
CORSTO	30 (11)	33 (7)	15 (20)	23 (6)	—	2 (30)	—	—
CRADOU	7 (5)	—	—	2 (1)	—	—	—	—
CRASUC	4 (3)	—	—	—	—	—	—	—
JUNCOM	4 (1)	4 (1)	—	2 (1)	—	2 (1)	—	—
KALMIC	—	—	—	—	—	4 (5)	—	—
LEDGLA	4 (10)	—	—	—	—	—	—	—
LINBOR	—	—	4 (3)	—	—	—	—	—
LONINV	4 (10)	—	19 (2)	12 (3)	—	2 (20)	—	—
LONUTA	—	—	—	—	—	11 (3)	16 (14)	5 (20)
MENFER	—	—	—	2 (1)	—	2 (1)	—	—
POTFRU	26 (2)	75 (12)	4 (3)	12 (1)	50 (1)	19 (9)	47 (10)	70 (12)
PRUVIR	—	—	—	2 (1)	—	—	—	—
RHAALN	4 (10)	—	—	16 (6)	—	4 (1)	—	—
RIBESX	19 (1)	—	23 (5)	23 (6)	—	4 (2)	5 (1)	—
RIBHUD	7 (7)	—	8 (5)	14 (4)	—	—	—	—
RIBINE	—	—	—	2 (20)	—	—	—	—
RIBLAC	—	—	4 (3)	—	—	5 (1)	—	—
RIBMIS	4 (3)	—	—	—	—	—	—	—
RIBODO	—	—	—	2 (1)	—	—	—	—
RIBSET	11 (10)	4 (1)	35 (6)	—	—	2 (10)	—	—
RIBVIS	4 (1)	—	—	—	—	—	—	—
ROSACI	—	—	12 (1)	5 (2)	—	—	—	—
ROSAXX	15 (8)	—	4 (1)	2 (1)	—	—	—	—
ROSWOO	44 (7)	8 (1)	—	5 (7)	—	5 (1)	—	—

RUBIDA	4 (1)	—	8 (1)	7 (4)	—	—	—	—
RUBPAR	4 (1)	—	4 (10)	—	—	—	—	—
SALBAR	—	—	4 (1)	—	—	—	—	—
SALBEB	100 (32)	8 (2)	4 (1)	12 (14)	—	5 (8)	—	5 (1)
SALBOO	—	4 (1)	42 (7)	44 (14)	—	11 (1)	11 (2)	—
SALBRA	—	4 (1)	4 (1)	—	—	5 (11)	—	5 (10)
SALCAN	—	96 (14)	—	2 (1)	—	9 (6)	—	5 (1)
SALCOM	—	—	—	—	—	7 (16)	—	—
SALDRU	—	13 (1)	100 (45)	100 (41)	100 (2)	9 (2)	16 (1)	—
SALEXI	7 (2)	—	4 (3)	2 (10)	50 (1)	—	—	—
SALFAR	—	8 (10)	—	—	50 (1)	2 (1)	—	—
SALGEY	—	—	19 (2)	23 (3)	—	7 (3)	26 (2)	10 (3)
SALGLA	—	4 (30)	—	—	—	—	—	—
SALIXX	—	—	—	2 (40)	—	—	—	—
SALLAS	—	—	—	2 (3)	50 (1)	—	—	—
SALLUT	15 (3)	21 (3)	—	2 (10)	—	—	—	—
SALPLA	—	38 (3)	19 (18)	12 (4)	—	95 (26)	32 (2)	20 (2)
SALPSE	4 (30)	8 (2)	4 (40)	5 (15)	—	2 (50)	—	5 (10)
SALSER	—	13 (1)	—	—	—	—	—	—
SALWOL	4 (1)	8 (3)	4 (1)	5 (7)	—	33 (11)	100 (40)	100 (38)
SAMBUC	4 (1)	—	—	—	—	—	—	—
SHECAN	15 (8)	—	4 (1)	—	—	—	—	—
SOLDUL	4 (1)	—	—	—	—	—	—	—
SPIDOU	—	—	—	2 (1)	—	2 (30)	—	—
SYMALB	15 (2)	—	—	—	—	—	—	—
SYMOCC	7 (20)	—	—	—	—	—	—	—
SYMPHO	7 (5)	—	—	—	—	—	—	—
TOXRYD	—	—	—	2 (1)	—	—	—	—
VACCES	—	—	—	2 (10)	—	—	—	—
VACOCC	7 (35)	—	—	—	—	4 (1)	—	—
VACSCO	—	—	—	2 (1)	—	4 (1)	—	—
Graminoids								
AGRCAN	4 (3)	13 (1)	—	—	—	4 (1)	5 (1)	40 (2)
AGRDAS	—	—	4 (1)	—	—	2 (1)	—	10 (7)
AGRDIE	—	—	—	2 (40)	—	—	—	—
AGREXA	4 (10)	—	4 (1)	5 (1)	—	5 (17)	—	5 (1)
AGRHUM	—	—	—	—	—	11 (4)	—	—
AGRIDA	—	—	—	—	—	4 (2)	—	—
AGROST	4 (1)	—	—	5 (5)	—	—	—	—
AGRREP	—	—	4 (1)	2 (3)	—	—	—	10 (1)
AGRSCA	4 (1)	—	8 (2)	14 (9)	—	23 (2)	21 (5)	20 (1)
AGRSMI	4 (10)	—	—	—	—	—	—	—
AGRSPI	—	—	—	—	50 (1)	2 (1)	—	—
AGRSTO	52 (14)	21 (1)	12 (27)	12 (6)	50 (1)	2 (1)	5 (3)	—
AGRTEN	4 (30)	—	—	2 (20)	—	—	—	—
AGRTHU	—	—	—	2 (20)	—	—	—	—
ALOAEQ	—	—	—	2 (1)	—	—	—	—
ALOALP	4 (1)	—	—	2 (10)	—	14 (6)	5 (10)	5 (3)
ALOPRA	—	—	—	5 (7)	—	—	—	—
BECSYZ	4 (20)	—	—	—	—	—	—	—
BROCAR	4 (1)	—	—	—	—	—	—	—
BROCIL	26 (3)	4 (3)	35 (3)	16 (6)	50 (1)	12 (1)	21 (1)	45 (1)
BROINE	15 (7)	—	8 (2)	—	—	2 (1)	—	5 (3)
BROMOL	4 (1)	—	—	—	—	—	—	—
BROMUS	—	—	—	5 (2)	—	—	—	—
BROSEC	—	—	4 (1)	—	—	—	—	—
CALCAN	26 (10)	8 (2)	77 (32)	37 (16)	—	14 (24)	—	—

CALSTR	7 (3)	33 (5)	19 (24)	5 (1)	50 (1)	16 (10)	16 (1)	25 (1)
CARAPE	—	—	—	2 (1)	—	—	—	—
CARAQU	4 (10)	71 (16)	4 (1)	19 (24)	50 (1)	54 (23)	89 (28)	20 (2)
CARATH	4 (40)	—	—	—	—	—	—	5 (1)
CARATO	—	—	—	—	—	2 (1)	—	—
CARAUR	4 (10)	17 (2)	—	2 (1)	—	4 (1)	—	10 (2)
CARBEB	4 (1)	—	—	2 (3)	—	—	—	—
CARBRU	—	—	4 (20)	—	—	—	—	—
CARBUX	—	33 (5)	—	—	—	4 (5)	—	5 (1)
CARCAN	—	—	4 (1)	12 (26)	—	11 (9)	16 (1)	—
CARCAP	4 (10)	17 (2)	—	—	—	—	—	—
CARCRA	4 (10)	—	—	—	—	—	—	—
CARCUS	4 (1)	—	—	2 (20)	50 (3)	—	—	—
CARDIA	—	4 (3)	—	—	—	5 (27)	—	—
CARDIO	—	8 (5)	—	—	—	—	—	—
CARDIS	4 (10)	—	8 (1)	2 (3)	—	4 (5)	—	—
CARDOU	—	—	—	—	—	2 (20)	—	—
CAREXX	4 (1)	—	—	2 (1)	—	4 (2)	—	20 (7)
CARFLA	—	—	—	2 (1)	—	—	—	—
CARHEL	4 (10)	—	—	—	—	—	—	—
CARILL	—	—	—	5 (5)	—	7 (14)	—	—
CARINT	4 (20)	21 (3)	—	—	—	5 (5)	—	—
CARLAE	—	—	—	—	—	2 (1)	—	—
CARLAN	11 (7)	13 (4)	—	7 (7)	—	2 (1)	—	15 (27)
CARLAS	4 (1)	13 (1)	—	—	—	2 (3)	—	—
CARLEN	4 (1)	—	4 (3)	7 (10)	—	—	—	—
CARLEP	—	8 (1)	—	2 (10)	—	—	—	—
CARLIM	—	25 (18)	4 (10)	—	—	4 (1)	—	—
CARLIV	—	25 (28)	—	—	—	2 (20)	—	—
CARLUZ	—	—	—	—	—	5 (13)	—	—
CARMIC	4 (3)	—	15 (1)	5 (5)	50 (1)	7 (1)	11 (30)	15 (1)
CARNEB	7 (2)	8 (3)	—	5 (20)	—	5 (4)	5 (1)	—
CAROED	—	8 (2)	—	—	—	2 (1)	—	—
CARPAC	4 (3)	—	8 (1)	5 (5)	—	9 (1)	5 (40)	—
CARPET	—	—	—	—	—	2 (10)	—	—
CARPRA	4 (20)	—	—	—	—	—	—	5 (3)
CARRAY	4 (1)	—	—	—	—	—	—	—
CARRET	—	—	—	2 (20)	—	—	—	—
CARROS	26 (21)	67 (23)	23 (1)	86 (33)	—	58 (27)	42 (18)	15 (1)
CARSCI	—	21 (6)	—	—	—	—	—	—
CARSCO	—	—	4 (1)	—	—	30 (19)	—	10 (10)
CARSIM	—	58 (25)	4 (40)	—	—	9 (12)	16 (27)	15 (24)
CARSPE	—	—	—	2 (1)	—	—	—	—
CARSTR	4 (3)	—	—	—	—	—	—	—
CARUNI	—	—	—	—	—	—	—	5 (20)
CARVES	15 (15)	—	4 (3)	12 (22)	—	2 (30)	16 (9)	—
CINLAT	—	—	—	2 (1)	—	—	—	5 (1)
DACGLO	4 (1)	—	—	—	—	—	—	—
DANINT	4 (1)	—	—	—	—	—	11 (1)	5 (1)
DANTHO	—	—	—	2 (1)	—	—	—	—
DESATR	—	—	—	—	—	2 (20)	—	—
DESCES	15 (7)	25 (5)	15 (8)	14 (4)	—	56 (5)	68 (12)	80 (10)
ELEPAL	4 (1)	—	—	—	—	—	—	—
ELEPAU	—	21 (3)	—	—	—	28 (21)	11 (10)	—
ELYCAN	4 (1)	—	—	—	—	—	—	10 (1)
ELYCIN	4 (1)	—	—	2 (1)	—	—	—	—

ELYGLA	11 (4)	—	8 (2)	—	—	—	—	—
ELYVIR	4 (20)	—	—	—	—	—	—	—
ERICHA	—	—	—	—	—	4 (5)	—	—
ERIPOL	—	4 (1)	—	—	—	2 (3)	—	—
ERIVIR	—	—	—	—	—	2 (1)	—	—
FESIDA	—	—	—	—	—	2 (1)	—	10 (1)
FESOCC	4 (1)	—	—	—	—	—	—	—
FESOVI	—	—	—	—	—	2 (1)	—	5 (20)
FESPRA	4 (20)	—	—	—	—	—	—	—
FESRUB	7 (3)	—	—	—	—	—	—	—
FESSUB	4 (1)	—	—	—	—	—	—	—
FESTUC	4 (1)	—	—	—	—	—	—	—
GLYCER	4 (20)	—	—	—	—	—	—	—
GLYELA	—	—	—	2 (1)	—	—	—	—
GLYGRA	7 (30)	—	4 (3)	14 (6)	—	2 (1)	5 (10)	—
GLYSTR	—	—	15 (3)	12 (1)	—	4 (1)	—	—
HIEODO	—	—	—	—	—	—	—	5 (1)
HORBRA	—	—	—	9 (5)	—	4 (2)	—	—
HORJUB	4 (1)	—	—	—	—	—	5 (1)	—
JUNALP	—	8 (1)	—	2 (1)	—	4 (10)	—	—
JUNBAL	30 (20)	50 (23)	—	14 (9)	—	21 (12)	32 (8)	65 (25)
JUNCUS	—	—	—	—	—	2 (1)	—	—
JUNENS	4 (10)	—	4 (1)	14 (3)	—	4 (10)	—	—
JUNDRU	—	—	—	—	—	4 (2)	—	—
JUNLON	—	8 (2)	—	—	—	—	—	—
JUNMER	—	—	—	—	—	5 (4)	—	—
JUNNOD	—	8 (5)	—	—	—	2 (40)	—	—
JUNREG	—	—	4 (30)	2 (20)	—	—	—	—
JUNTEN	7 (10)	—	—	—	—	4 (1)	—	—
JUNVAS	—	—	—	2 (1)	—	—	—	—
LUZCAM	—	—	—	5 (1)	—	7 (3)	16 (1)	10 (1)
LUZPAR	—	—	4 (1)	—	—	5 (1)	—	—
MUHAND	—	4 (3)	—	—	—	—	5 (1)	5 (3)
MUHASP	—	—	—	2 (1)	—	—	—	—
MUHFIL	4 (3)	8 (20)	—	—	—	4 (1)	5 (20)	20 (11)
MUHGLO	—	46 (3)	—	—	—	4 (1)	—	—
MUHRIC	—	25 (5)	—	—	—	—	5 (1)	—
PHAARU	4 (20)	—	—	7 (37)	—	—	—	—
PHLALP	4 (1)	—	8 (1)	—	—	28 (2)	16 (14)	25 (1)
PHLPRA	56 (10)	—	—	16 (5)	50 (3)	5 (4)	5 (20)	40 (9)
POAALP	—	—	—	—	—	2 (1)	—	—
POACOM	—	—	—	2 (10)	50 (1)	—	—	—
POACUS	—	—	—	—	—	2 (1)	—	—
POAGRA	—	—	—	—	—	4 (1)	—	—
POALEP	—	—	—	—	—	4 (2)	—	—
POAPAL	26 (5)	—	31 (7)	37 (13)	—	4 (1)	5 (10)	20 (11)
POAPRA	63 (19)	4 (3)	15 (1)	23 (6)	50 (80)	9 (2)	42 (6)	55 (14)
POAXXX	—	—	4 (3)	—	—	2 (1)	—	—
PUCPAU	—	—	4 (1)	—	—	—	—	—
SCIACU	—	13 (53)	—	—	—	4 (7)	—	—
SCIMIC	4 (10)	—	—	7 (1)	—	—	—	—
STIOCC	—	—	—	—	—	2 (1)	—	5 (1)
TRISPI	—	—	4 (1)	—	—	2 (1)	—	5 (1)
TRIWOL	—	—	4 (1)	14 (3)	—	16 (6)	11 (2)	25 (1)
Forbs								
ACHMIL	22 (2)	—	19 (1)	12 (3)	50 (1)	14 (1)	21 (6)	30 (1)
ACTRUB	7 (2)	—	12 (1)	2 (1)	—	—	—	—

AGAURT	4 (3)	—	—	—	—	—	—	—
AGOLAC	—	—	—	—	—	2 (1)	—	—
AGOSER	—	—	—	—	—	—	5 (1)	5 (1)
ALLBRE	4 (1)	—	4 (1)	—	—	—	5 (1)	—
ALLSCH	—	33 (2)	—	—	—	2 (1)	—	5 (1)
ANAMAR	—	—	12 (1)	—	—	—	—	—
ANGARG	11 (14)	—	38 (1)	12 (5)	—	4 (1)	—	50 (3)
ANTALP	—	—	—	—	—	2 (1)	—	—
ANTANA	—	29 (5)	—	—	—	4 (1)	—	30 (1)
ANTCOR	—	—	—	—	—	5 (1)	21 (25)	5 (1)
ANTMIC	4 (1)	—	8 (2)	2 (1)	—	4 (2)	11 (1)	5 (1)
ANTNEG	—	—	—	2 (3)	—	—	—	—
ANTUMB	—	—	—	2 (1)	—	9 (3)	—	—
APOCAN	7 (3)	—	—	2 (20)	—	—	—	—
AQUFLA	—	—	4 (1)	—	—	—	—	—
ARAGLA	—	—	4 (1)	—	—	—	—	—
ARAMIC	—	—	4 (1)	—	—	—	—	—
ARCMIN	4 (3)	—	—	—	—	—	—	—
ARECON	—	—	—	—	—	—	—	5 (1)
AREMAC	—	—	—	2 (3)	—	—	—	—
ARESER	4 (1)	—	—	—	—	—	—	5 (3)
ARNAMP	—	—	—	—	—	2 (1)	—	—
ARNCHA	4 (1)	—	4 (3)	7 (1)	—	5 (1)	—	10 (2)
ARNCOR	—	—	4 (1)	—	—	—	—	—
ARNLAT	4 (1)	—	4 (1)	—	—	2 (1)	—	—
ARNMOL	—	—	4 (1)	—	—	2 (1)	—	—
ARTLIN	—	—	—	—	50 (20)	—	—	—
ASTCHI	4 (3)	—	—	—	—	—	11 (2)	15 (8)
ASTCIL	—	—	4 (1)	—	—	—	—	—
ASTCON	—	—	4 (1)	—	50 (1)	—	—	—
ASTEAT	4 (10)	—	—	2 (1)	—	—	—	—
ASTERX	11 (7)	—	—	—	—	—	5 (1)	20 (12)
ASTFOL	7 (2)	4 (1)	8 (1)	2 (3)	—	5 (10)	5 (3)	20 (12)
ASTJUN	—	46 (2)	—	—	—	2 (3)	—	—
ASTLAE	—	—	—	5 (1)	—	—	—	—
ASTMIS	—	—	—	—	—	—	—	5 (1)
ASTMOD	11 (1)	—	54 (5)	33 (3)	—	4 (5)	—	—
ASTOCC	30 (7)	8 (5)	50 (4)	28 (6)	—	51 (8)	37 (6)	20 (13)
ASTRAG	4 (1)	—	—	—	—	—	—	—
BARORT	—	—	—	—	50 (1)	—	—	5 (1)
BIDCER	—	—	—	2 (1)	—	—	—	—
CALLEP	—	—	—	—	—	14 (14)	5 (1)	5 (30)
CAMQUA	—	—	—	—	—	—	5 (1)	—
CAMROT	—	—	—	—	—	4 (1)	—	—
CARNUT	7 (1)	—	—	—	—	—	—	—
CASMIN	—	—	—	5 (2)	—	4 (1)	—	—
CASSUL	—	4 (1)	—	—	—	—	—	—
CASTIL	7 (1)	—	4 (1)	—	—	—	—	—
CHRLEU	4 (1)	—	—	—	—	—	—	—
CICMAC	11 (7)	8 (2)	—	2 (3)	—	—	5 (1)	—
CIRALP	4 (10)	—	—	—	—	—	—	—
CIRARV	26 (5)	—	8 (5)	12 (1)	—	2 (3)	5 (3)	—
CIRSCA	15 (1)	—	4 (1)	7 (11)	—	9 (1)	11 (10)	30 (4)
CIRSIU	4 (1)	—	—	—	—	—	—	—
CIRSUB	—	—	—	—	—	4 (1)	—	—
CIRVUL	7 (2)	—	4 (3)	—	—	—	—	—

COLLIN	—	—	4 (10)	—	—	—	—	5 (1)
CONARV	4 (1)	—	—	—	—	—	—	—
CRERUN	—	4 (3)	—	—	—	2 (1)	—	—
CYNOFF	4 (1)	—	—	—	—	—	—	—
DELDEP	—	—	—	—	—	—	5 (1)	—
DESRIC	—	—	—	2 (1)	—	—	—	—
DISTRA	4 (1)	—	4 (1)	—	—	—	—	—
DODECA	—	4 (1)	—	—	—	2 (1)	5 (1)	—
DODJEF	—	—	—	—	—	12 (12)	—	5 (1)
DODPUL	—	17 (2)	—	—	—	—	5 (3)	10 (2)
EPIALP	—	—	—	2 (3)	—	—	—	—
EPIANG	15 (4)	—	38 (1)	19 (1)	—	5 (1)	5 (1)	5 (1)
EPICIL	11 (5)	17 (1)	23 (1)	47 (3)	—	18 (1)	21 (3)	15 (1)
EPIGLA	—	—	4 (10)	—	—	9 (2)	—	—
EPILAT	—	—	4 (20)	—	—	—	—	—
EPILOB	—	—	4 (1)	—	—	—	—	—
EPIMIN	4 (1)	—	—	—	—	—	—	—
EPIPAL	—	—	—	—	—	2 (1)	—	—
ERIACR	—	—	—	—	—	2 (3)	—	—
ERIGER	—	—	—	—	—	—	—	10 (1)
ERIGLA	—	—	—	—	—	—	—	5 (3)
ERIPER	—	—	—	—	—	2 (10)	5 (10)	—
ERIPUM	—	—	—	—	—	2 (1)	—	—
ERIUMB	—	—	—	—	—	2 (1)	—	—
FLOPRO	4 (1)	—	—	—	—	—	—	—
FORBXX	—	—	—	2 (20)	—	—	—	—
FRAGAR	—	—	—	—	—	—	—	5 (1)
FRASPE	—	—	—	—	—	—	—	5 (1)
FRAVES	4 (1)	—	—	—	—	—	—	—
FRAVIR	22 (7)	13 (1)	27 (5)	21 (3)	—	21 (9)	37 (7)	55 (7)
GAIARI	—	—	—	—	50 (3)	—	—	—
GALAPA	—	—	4 (1)	7 (1)	—	2 (3)	—	—
GALBIF	—	—	4 (1)	—	—	—	—	—
GALBOR	26 (1)	46 (12)	4 (1)	2 (1)	—	7 (1)	5 (1)	35 (4)
GALIUM	4 (1)	—	—	—	—	—	—	—
GALTRF	4 (1)	8 (2)	12 (4)	33 (3)	—	7 (1)	26 (5)	—
GALTRI	19 (1)	4 (1)	31 (2)	9 (1)	—	2 (1)	5 (1)	—
GENAFF	4 (1)	—	—	—	—	2 (1)	5 (3)	5 (1)
GENAMA	—	—	—	—	—	4 (1)	—	—
GENCAL	—	—	—	—	—	5 (5)	—	—
GENDET	—	—	—	—	—	2 (1)	—	10 (2)
GENTIA	—	13 (1)	—	—	—	—	5 (1)	5 (1)
GERANI	7 (1)	—	—	—	—	—	—	—
GERRIC	15 (5)	—	12 (1)	7 (2)	—	2 (1)	—	—
GERVIS	7 (2)	—	4 (1)	2 (1)	—	—	—	—
GEUMAC	30 (2)	—	69 (2)	60 (4)	50 (1)	21 (1)	47 (2)	40 (1)
GEURIV	—	—	—	2 (1)	—	4 (1)	5 (1)	—
GEUTRI	—	—	—	—	—	—	—	5 (1)
GLYLEP	7 (2)	—	—	—	—	—	—	—
GNAPHA	—	—	4 (1)	—	—	—	—	—
HABDIL	11 (1)	—	4 (1)	9 (1)	50 (1)	5 (1)	—	5 (3)
HABENA	—	—	—	—	—	—	—	5 (1)
HABHYP	—	21 (2)	—	2 (1)	—	5 (1)	—	—
HABSAC	—	—	—	2 (1)	—	—	—	—
HACFLO	7 (1)	—	—	—	—	—	—	5 (1)
HELNUT	7 (3)	—	—	—	—	—	—	—
HERLAN	26 (9)	—	42 (6)	12 (3)	—	—	—	—

HIEGRA	—	4 (10)	—	—	—	4 (10)	—	—
HIERAC	—	—	—	—	—	2 (1)	—	—
HYPPER	7 (1)	—	—	—	—	—	—	—
IRIMIS	22 (1)	—	—	—	—	—	—	—
IRIPSE	—	—	—	2 (1)	—	—	—	—
LATOCH	4 (3)	—	—	—	—	—	—	—
LEMMIN	—	—	—	5 (1)	—	—	—	—
LIGCAN	4 (1)	—	—	2 (1)	—	—	—	—
LIGFIL	—	—	—	—	—	—	—	5 (1)
LIGTEN	—	—	—	2 (10)	—	19 (10)	26 (5)	—
LILPHI	—	17 (1)	—	—	—	—	—	—
LINDAL	4 (3)	—	—	—	—	—	—	—
LINPER	—	—	—	—	—	2 (1)	—	5 (1)
LLOSER	—	—	—	—	—	2 (1)	—	—
LOBKAL	—	8 (1)	—	—	—	—	—	—
LUPARG	4 (1)	—	—	2 (1)	—	2 (1)	—	5 (20)
LUPINU	—	—	—	—	—	—	5 (1)	—
LYCUNI	—	—	—	2 (1)	—	—	—	—
LYSCIL	19 (1)	—	—	2 (20)	—	—	—	—
LYSTHY	—	4 (3)	—	—	—	—	—	—
MARVUL	—	4 (1)	—	—	—	—	—	—
MEDLUP	4 (1)	—	—	—	—	—	—	—
MEDSAT	4 (1)	—	—	—	—	—	—	—
MELALB	4 (1)	—	—	—	—	—	—	—
MELOFF	7 (1)	—	—	—	—	—	—	—
MENARV	22 (8)	—	19 (10)	33 (6)	—	4 (2)	5 (20)	5 (1)
MENTRI	—	38 (30)	—	—	—	5 (15)	—	—
MERCIL	—	—	23 (1)	5 (5)	—	2 (1)	—	—
MIMGUT	7 (7)	—	—	9 (5)	—	—	—	—
MIMLEW	—	—	4 (1)	—	—	—	—	—
MIMMOS	—	—	4 (1)	5 (7)	—	—	—	—
MITBRE	—	—	8 (2)	—	—	2 (10)	—	—
MITPEN	—	—	—	—	—	2 (1)	—	—
MONFIS	4 (3)	—	—	—	—	—	—	—
MYOLAX	4 (1)	—	—	2 (1)	—	—	—	—
OSMCHI	4 (1)	—	8 (5)	—	—	—	—	—
OSMOCC	4 (1)	—	—	—	—	—	—	—
PARFIM	—	—	—	—	—	9 (2)	—	5 (1)
PARNAS	—	4 (1)	—	—	—	—	—	5 (1)
PARPAL	—	29 (1)	—	2 (10)	—	4 (1)	—	5 (3)
PARPAR	—	—	—	—	—	4 (1)	—	—
PEDBRA	—	—	—	—	—	2 (1)	—	—
PEDGRO	—	13 (4)	8 (1)	12 (3)	—	39 (3)	21 (3)	25 (5)
PEDICU	—	—	—	—	—	—	—	10 (2)
PENPRO	—	—	—	2 (1)	—	2 (1)	—	5 (1)
PENRYD	—	—	—	—	—	2 (1)	16 (13)	—
PENSTE	4 (1)	—	—	—	—	—	—	—
PERGAI	4 (1)	—	—	5 (1)	—	4 (15)	—	—
PETSAG	4 (20)	4 (10)	—	12 (12)	50 (1)	2 (1)	—	—
PHAFRA	—	—	—	—	—	2 (1)	—	—
PHAPRO	—	—	—	2 (1)	—	—	—	—
PLAERI	4 (1)	—	—	—	—	—	—	—
PLAMAJ	—	—	4 (1)	—	—	—	—	—
POLAMP	4 (3)	4 (3)	—	7 (30)	—	—	—	—
POLAUS	—	—	—	2 (10)	—	—	—	—
POLBIS	—	—	—	—	—	5 (1)	11 (5)	—

POLDOU	—	—	—	—	—	2 (1)	—	10 (1)
POLOCC	4 (1)	—	—	7 (5)	—	11 (2)	16 (1)	5 (20)
POLPOL	—	—	—	—	—	—	5 (1)	—
POLPUN	—	—	—	2 (1)	—	—	—	—
POLVIV	—	4 (1)	—	—	—	—	—	5 (1)
POLYGO	—	—	4 (10)	—	—	—	—	—
POTANS	11 (1)	—	—	—	50 (1)	—	—	—
POTBIE	—	—	—	—	—	—	5 (1)	—
POTDIV	—	—	—	—	—	12 (2)	16 (20)	—
POTGRA	19 (1)	—	8 (2)	5 (3)	50 (1)	4 (2)	16 (1)	55 (1)
POTGRM	—	—	—	—	—	2 (1)	—	—
POTPAL	—	—	—	26 (8)	—	2 (3)	5 (1)	—
POTRIV	—	—	4 (1)	—	—	—	—	—
PRIINC	—	—	—	—	—	2 (1)	—	—
PRUVUL	4 (1)	—	—	—	50 (1)	—	—	—
PYRASA	7 (10)	4 (1)	23 (4)	9 (1)	—	4 (3)	11 (10)	5 (1)
PYRCHL	—	—	4 (3)	—	—	—	—	—
PYRMIN	—	—	4 (1)	—	—	—	—	—
RANGME	—	—	4 (3)	—	—	—	—	—
RANMAC	4 (1)	—	4 (1)	—	—	—	—	—
RANNAT	—	—	—	—	—	—	—	5 (1)
RANREP	4 (1)	—	—	—	—	—	—	—
RANUNC	—	—	—	—	—	—	5 (1)	—
RORPAL	—	—	4 (10)	2 (1)	—	—	5 (1)	—
RORTRU	—	—	4 (3)	—	—	—	—	—
RUBPUB	4 (3)	—	—	2 (3)	—	—	—	—
RUDOCC	—	—	—	2 (30)	—	—	—	—
RUMACE	4 (1)	—	—	—	—	—	—	—
RUMCRI	4 (1)	—	4 (1)	2 (1)	—	—	—	—
RUMPAU	—	—	—	—	—	2 (1)	—	—
SANMAR	4 (1)	—	—	—	—	—	—	—
SAUAME	—	—	—	2 (1)	—	—	—	—
SAXARG	—	—	4 (1)	5 (10)	—	—	—	—
SAXIFR	—	—	—	—	—	2 (1)	—	—
SAXORE	—	—	—	—	—	4 (2)	—	—
SCUGAL	4 (1)	—	—	5 (5)	—	—	—	—
SENCYM	—	—	—	—	—	26 (7)	—	5 (1)
SENECI	—	—	—	—	—	2 (1)	—	—
SENERE	—	—	—	2 (10)	—	—	—	—
SENFOE	—	—	—	—	—	4 (5)	—	—
SENHYD	—	—	—	—	—	2 (3)	—	10 (12)
SENINT	7 (15)	—	—	5 (1)	—	16 (8)	16 (18)	40 (11)
SENPAU	4 (3)	—	4 (1)	—	—	—	—	—
SENPSE	—	4 (3)	27 (3)	14 (3)	—	5 (2)	5 (1)	15 (1)
SENSPH	—	—	—	2 (1)	—	2 (1)	—	5 (20)
SENTRI	7 (1)	—	35 (3)	19 (2)	—	11 (3)	—	5 (3)
SILMEN	—	4 (1)	—	—	—	—	—	—
SISYRI	—	4 (1)	—	—	—	—	—	—
SIUSUA	—	—	—	2 (1)	—	—	—	5 (3)
SMIRAC	—	—	4 (3)	—	—	—	—	—
SMISTE	30 (12)	4 (1)	27 (1)	12 (2)	—	2 (1)	—	15 (14)
SOLCAN	44 (11)	17 (6)	4 (3)	5 (10)	—	2 (10)	—	5 (1)
SOLGIG	4 (20)	—	—	—	—	—	—	—
SOLIDA	—	—	—	—	—	—	—	5 (3)
SOLMIS	4 (40)	—	—	—	—	—	—	—
SOLMUL	—	—	—	—	—	2 (1)	—	—
SPAMIN	—	8 (2)	—	—	—	—	—	—

SPIROM	—	13 (1)	—	—	—	9 (1)	—	5 (1)
STAPAL	4 (1)	—	—	—	—	—	—	—
STATOM	—	—	—	—	—	—	5 (1)	—
STECRA	4 (10)	—	—	—	—	—	—	—
STELOG	—	—	—	2 (1)	—	2 (1)	—	—
STELON	—	—	4 (10)	9 (5)	50 (1)	9 (1)	5 (1)	5 (1)
STEUMB	—	—	—	2 (10)	—	—	—	—
STRAMP	4 (1)	—	8 (1)	—	—	—	—	—
SWEPER	4 (20)	4 (10)	—	—	—	18 (2)	5 (3)	5 (3)
TANVUL	4 (1)	—	—	—	—	—	—	—
TARCER	4 (1)	—	—	—	50 (1)	2 (1)	—	—
TARLAE	—	—	4 (3)	—	—	—	—	—
TAROFF	26 (3)	8 (1)	23 (3)	9 (10)	—	11 (7)	16 (8)	55 (3)
THAALP	—	—	—	—	—	2 (1)	—	5 (1)
THADAS	—	—	—	—	—	—	—	5 (3)
THAFEN	4 (3)	—	—	—	—	—	—	—
THALIC	7 (2)	—	—	—	—	—	5 (1)	5 (1)
THAOCC	15 (8)	—	23 (4)	7 (5)	—	2 (1)	5 (3)	10 (1)
THAVEN	—	4 (10)	—	—	—	—	—	5 (1)
THLARV	4 (1)	—	—	—	—	—	—	—
TOFGLU	—	—	—	—	—	2 (1)	—	—
TRADUB	4 (1)	—	—	—	—	—	—	—
TRILON	—	—	—	—	—	9 (3)	11 (7)	25 (3)
TRIMAR	—	58 (6)	—	—	—	7 (6)	—	15 (1)
TRIPAL	—	25 (1)	—	—	—	4 (5)	—	—
TRIPRA	4 (1)	—	—	—	—	—	—	—
TRIREP	30 (14)	—	—	9 (9)	—	—	5 (10)	15 (1)
TROLAX	—	—	4 (3)	—	—	7 (8)	5 (1)	5 (30)
TYPLAT	4 (1)	13 (1)	—	2 (1)	—	2 (1)	—	—
URTDIO	11 (1)	13 (21)	35 (2)	7 (4)	—	4 (2)	—	—
VALDIO	—	—	—	—	—	2 (3)	—	—
VALEDU	—	33 (3)	—	—	—	2 (1)	21 (1)	50 (3)
VALERI	—	—	—	—	—	2 (1)	—	—
VALOCC	—	4 (10)	—	2 (1)	—	—	—	—
VALSIT	—	—	—	—	—	—	—	5 (1)
VERAME	7 (5)	—	8 (1)	12 (5)	—	—	—	—
VERCAT	—	—	—	—	—	—	5 (1)	—
VERONI	—	—	—	—	—	2 (1)	—	—
VERSER	—	—	—	—	—	—	5 (1)	—
VERVER	—	—	4 (1)	—	—	—	—	—
VERWOR	—	—	—	—	—	11 (1)	—	5 (1)
VICAME	11 (1)	—	12 (1)	2 (1)	—	2 (1)	—	—
VICIAX	7 (1)	—	—	—	—	—	—	—
VIOADU	—	—	—	—	—	2 (1)	—	—
VIOCAN	4 (3)	—	4 (3)	2 (3)	—	2 (1)	—	—
VIOLAX	4 (20)	13 (4)	19 (6)	14 (3)	50 (1)	25 (7)	16 (12)	15 (1)
VIONEP	—	33 (1)	—	—	—	—	5 (3)	10 (22)
VIOORB	—	—	4 (1)	—	—	—	—	—
VIOPAL	4 (10)	—	—	2 (1)	—	5 (8)	—	—
XANSTR	—	—	—	—	—	—	—	—
ZIGELE	4 (1)	21 (1)	—	—	—	—	—	—
Ferns and Allies								
ATHFIL	4 (10)	—	8 (2)	—	—	—	—	—
BOTLUN	—	—	4 (1)	2 (1)	—	2 (1)	—	—
BOTVIR	—	—	—	2 (1)	—	—	—	—
DRYSPI	—	—	—	2 (10)	—	—	—	—

EQUARV	22 (3)	33 (5)	42 (9)	37 (6)	—	11 (6)	—	—
EQUFLU	—	—	—	5 (10)	—	—	—	—
EQUHYE	4 (1)	—	4 (1)	7 (4)	—	—	—	—
EQULAE	22 (4)	4 (1)	—	2 (1)	—	4 (1)	—	15 (7)
EQUPAL	—	—	4 (1)	2 (1)	50 (1)	—	—	—
EQUPRA	—	—	8 (2)	2 (1)	—	—	—	—
EQUVAR	—	4 (1)	—	—	—	4 (1)	—	—

Appendix 18. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	SALGEY/ CALCAN H.T.	SALGEY/ CARROS H.T.	SALGEY C.T.	SALEXI C.T.	SALLAS C.T.	SALLUT/ CALCAN H.T.	SALLUT/ CARROS H.T.	SALLUT C.T.
No. Of Stands	32	71	71	118	10	5	14	5
Trees								
ABILAS	3 (3)	—	—	—	—	—	—	—
ACENEG	—	—	—	3 (2)	—	—	—	—
FRAPEN	—	—	—	3 (2)	—	—	—	—
JUNSCO	6 (1)	1 (3)	4 (1)	3 (2)	—	20 (1)	—	—
PICEAX	—	13 (1)	8 (1)	—	—	20 (1)	—	—
PINCON	—	4 (4)	3 (1)	—	—	20 (1)	—	—
PINFLE	—	—	1 (1)	—	—	—	—	—
PINPON	—	—	—	3 (1)	—	—	—	—
POPANG	3 (3)	—	—	1 (3)	10 (1)	—	—	—
POPDEL	—	—	—	8 (6)	—	—	—	20 (3)
POPTRE	3 (1)	4 (1)	8 (1)	—	—	20 (1)	—	—
POPTRI	—	1 (3)	6 (1)	9 (4)	10 (1)	—	—	—
PSEMEN	3 (3)	—	4 (1)	—	—	—	—	—
SALAMY	—	—	—	5 (2)	10 (20)	—	—	—
Shrubs								
ACEGLA	—	—	1 (1)	—	—	—	—	—
ALNINC	9 (18)	8 (5)	17 (14)	3 (10)	10 (1)	—	—	—
AMEALN	3 (1)	—	3 (20)	—	—	—	—	—
ARCUVA	—	1 (1)	3 (20)	—	—	20 (10)	—	—
ARTCAN	—	—	1 (1)	1 (1)	30 (4)	—	—	—
BETGLA	9 (20)	13 (14)	7 (11)	1 (1)	—	20 (40)	36 (15)	—
BETOCC	19 (12)	3 (5)	17 (18)	2 (1)	—	40 (1)	14 (40)	20 (3)
CLELIG	—	—	1 (1)	3 (12)	—	—	—	—
CLEMAT	—	—	—	1 (1)	—	—	—	—
CLEOCC	—	—	—	1 (3)	—	—	—	—
CORSTO	16 (14)	4 (4)	15 (17)	21 (15)	—	40 (20)	43 (10)	20 (10)
CRADOU	—	—	1 (3)	—	—	—	—	—
JUNCOM	—	3 (1)	4 (1)	—	—	—	—	—
LINBOR	—	1 (1)	—	—	—	—	—	—
LONINV	3 (3)	7 (3)	6 (3)	—	—	—	7 (1)	—
LONUTA	6 (10)	13 (6)	3 (15)	—	—	—	—	—
POTFRU	38 (3)	31 (10)	28 (6)	—	—	20 (20)	50 (7)	—
PRUVIR	—	1 (1)	7 (15)	8 (8)	—	—	—	—
RHAALN	3 (40)	1 (30)	1 (1)	—	—	—	—	—
RHUARO	—	—	—	1 (20)	—	—	—	—
RIBAME	—	—	—	1 (20)	—	—	—	—
RIBESX	28 (5)	23 (3)	31 (3)	5 (8)	—	20 (3)	7 (1)	—
RIBHUD	6 (12)	3 (5)	3 (30)	1 (3)	—	—	—	—
RIBLAC	3 (3)	4 (1)	4 (1)	—	—	—	—	—
RIBMIS	—	—	1 (1)	1 (3)	—	—	—	—
RIBODO	—	—	6 (2)	3 (18)	—	—	—	—
RIBSET	3 (1)	6 (1)	14 (7)	—	—	—	7 (1)	—
ROSACI	6 (20)	—	11 (6)	2 (32)	—	—	—	—
ROSARK	—	—	—	1 (1)	—	—	—	—
ROSAXX	—	3 (1)	3 (10)	4 (9)	—	—	—	—

ROSWOO	9 (8)	6 (1)	18 (11)	40 (21)	20 (35)	60 (2)	29 (2)	20 (1)
RUBIDA	9 (1)	1 (1)	8 (1)	3 (1)	—	—	7 (3)	—
RUBUSX	—	—	1 (1)	—	—	—	—	—
SALBEB	34 (7)	14 (15)	38 (22)	3 (16)	—	60 (54)	50 (20)	20 (3)
SALBOO	84 (24)	59 (26)	92 (32)	5 (2)	—	—	7 (10)	20 (3)
SALBRA	6 (3)	4 (7)	—	—	—	20 (10)	7 (10)	—
SALCAN	—	1 (1)	—	—	—	20 (1)	14 (40)	—
SALCOM	—	1 (10)	—	—	—	—	—	—
SALDRU	28 (16)	25 (11)	28 (18)	—	—	—	—	20 (1)
SALERI	—	—	—	2 (3)	—	—	—	—
SALEXI	9 (17)	4 (5)	15 (19)	100 (60)	20 (1)	—	7 (1)	60 (4)
SALFAR	—	3 (1)	—	—	—	—	—	—
SALGEY	53 (40)	79 (32)	41 (26)	1 (3)	—	—	14 (20)	—
SALGLA	—	—	—	—	—	—	7 (30)	—
SALLAS	3 (10)	—	4 (9)	6 (11)	100 (52)	—	—	—
SALLUT	9 (5)	1 (40)	10 (11)	11 (3)	—	100 (11)	100 (23)	100 (17)
SALPLA	3 (3)	24 (13)	8 (6)	1 (20)	—	—	29 (10)	—
SALPSE	3 (1)	4 (5)	1 (3)	1 (1)	—	—	7 (20)	—
SALSER	—	—	—	—	—	—	21 (11)	—
SALTWE	3 (60)	—	—	—	—	—	—	—
SALWOL	16 (11)	1 (40)	7 (16)	—	—	—	—	—
SHECAN	—	1 (1)	3 (1)	1 (1)	—	—	—	—
SOLDUL	—	—	—	3 (18)	—	—	—	—
SYMALB	3 (1)	—	—	1 (1)	—	—	—	—
SYMOCC	3 (3)	—	7 (17)	19 (23)	10 (20)	—	—	20 (1)
SYMPHO	—	—	1 (1)	—	—	—	—	—
TAMCHI	—	—	—	1 (40)	—	—	—	—
TOXRYD	—	—	—	4 (2)	—	—	—	—
VACSCO	—	1 (10)	—	—	—	—	—	—
VIBEDU	—	—	1 (1)	—	—	—	—	—
Graminoids								
AGRCAN	16 (2)	3 (1)	11 (2)	2 (10)	—	20 (10)	14 (2)	—
AGRCRI	—	—	—	—	20 (10)	—	—	—
AGRDAS	—	—	1 (1)	2 (5)	—	—	—	—
AGREXA	—	3 (7)	6 (1)	—	—	—	—	—
AGRIDA	—	1 (1)	1 (3)	—	—	—	—	—
AGRINT	—	—	—	1 (1)	—	—	—	—
AGROPY	—	1 (1)	1 (1)	2 (20)	—	—	—	—
AGROST	—	—	1 (40)	—	—	20 (1)	14 (1)	—
AGRREP	6 (5)	—	17 (1)	15 (24)	—	—	—	20 (1)
AGRSCA	6 (5)	21 (8)	7 (4)	—	—	—	7 (1)	—
AGRSMI	—	—	—	9 (22)	30 (13)	—	—	—
AGRSPI	—	—	1 (3)	—	—	—	—	—
AGRSTO	28 (10)	15 (8)	41 (18)	31 (28)	20 (5)	40 (7)	21 (8)	60 (37)
AGRTEN	—	—	—	1 (3)	—	—	—	—
ALOAEQ	3 (1)	6 (6)	1 (1)	2 (2)	20 (1)	—	—	—
ALOALP	9 (1)	8 (8)	4 (1)	—	—	—	—	—
ALOPEC	—	—	1 (1)	—	—	—	—	20 (3)
ALOPRA	3 (3)	—	3 (2)	—	—	—	7 (10)	—
ARILON	—	—	—	1 (1)	—	—	—	—
BECSYZ	—	1 (1)	1 (3)	2 (1)	—	—	—	40 (2)
BROANO	—	—	1 (1)	—	—	—	—	—
BROCAR	9 (2)	—	6 (3)	—	—	—	—	—
BROCIL	22 (6)	18 (3)	28 (4)	—	—	20 (1)	29 (1)	—
BROINE	13 (3)	1 (80)	10 (7)	24 (26)	10 (60)	—	—	20 (3)
BROJAP	—	—	—	2 (2)	10 (1)	—	—	—
BROTEC	—	—	—	3 (6)	10 (1)	—	—	—

CALCAN	41 (30)	27 (11)	11 (4)	1 (1)	10 (3)	40 (30)	7 (20)	—
CALSTR	44 (17)	11 (7)	14 (2)	2 (7)	10 (1)	20 (1)	36 (5)	—
CARAQU	6 (1)	45 (20)	1 (1)	2 (7)	20 (32)	—	29 (51)	—
CARATH	—	3 (20)	—	—	—	—	7 (3)	—
CARATO	—	1 (3)	—	—	—	—	—	—
CARAUR	3 (1)	1 (1)	—	—	—	—	7 (3)	—
CARBEB	—	—	1 (1)	1 (10)	—	—	—	—
CARBUX	—	—	1 (10)	—	—	—	—	—
CARCAN	3 (1)	6 (10)	—	—	—	—	—	—
CARCAP	—	—	—	—	—	—	7 (1)	—
CARCON	—	1 (3)	—	—	—	—	—	—
CARDIA	—	—	—	—	—	—	7 (3)	—
CARDIO	3 (1)	—	—	—	—	—	—	—
CARDIS	6 (15)	10 (12)	6 (6)	—	—	—	—	—
CARDOU	—	—	1 (1)	—	—	—	—	—
CARECH	—	—	—	—	—	20 (1)	—	—
CAREXX	—	1 (1)	8 (2)	3 (1)	10 (1)	—	—	—
CARHOO	3 (1)	—	4 (1)	1 (1)	—	—	—	—
CARILL	3 (20)	—	—	—	—	—	—	—
CARINT	—	4 (1)	1 (10)	—	—	—	14 (20)	—
CARLAN	6 (10)	15 (7)	8 (7)	8 (4)	10 (10)	—	7 (20)	—
CARLAS	—	—	1 (40)	—	—	—	—	—
CARLEP	—	—	1 (30)	1 (60)	—	—	7 (10)	—
CARLIM	3 (1)	1 (1)	1 (3)	—	—	—	—	—
CARMIC	19 (4)	14 (5)	23 (3)	—	—	—	—	—
CARMOL	—	1 (30)	1 (30)	—	—	—	—	—
CARMUL	3 (1)	1 (1)	—	—	—	—	—	—
CARNEB	6 (12)	—	4 (3)	2 (1)	—	20 (1)	14 (10)	20 (20)
CARPAC	16 (7)	6 (1)	8 (9)	—	—	—	—	—
CARPRA	9 (1)	3 (20)	1 (1)	—	—	—	7 (20)	20 (1)
CARPRT	3 (1)	—	3 (3)	1 (80)	—	—	—	—
CARRET	—	—	—	1 (1)	—	—	—	—
CARROS	28 (2)	83 (41)	15 (6)	6 (21)	20 (2)	—	79 (35)	—
CARSAR	—	—	—	—	—	20 (10)	—	—
CARSCI	3 (1)	—	—	—	—	—	—	—
CARSCO	—	1 (1)	1 (1)	1 (1)	—	—	—	—
CARSIM	3 (10)	3 (2)	—	—	—	—	29 (1)	—
CARSPR	3 (1)	—	—	—	—	—	—	—
CARSTI	—	—	—	2 (1)	—	—	—	—
CARUNI	—	—	—	—	10 (1)	—	—	—
CARVES	3 (1)	10 (19)	3 (2)	2 (5)	10 (3)	—	7 (70)	—
DACGLO	—	—	1 (1)	3 (20)	—	—	—	—
DANINT	3 (1)	1 (1)	1 (1)	—	—	20 (1)	—	—
DESCES	28 (3)	27 (10)	23 (5)	4 (6)	20 (3)	60 (5)	36 (7)	20 (3)
DICACU	—	—	—	2 (2)	—	—	—	—
ECHCRU	—	—	—	1 (20)	—	—	—	—
ELECOM	—	—	1 (1)	2 (12)	—	—	7 (1)	—
ELEPAL	3 (3)	1 (1)	1 (1)	8 (11)	20 (2)	—	—	20 (1)
ELYCAN	—	—	—	2 (20)	—	—	—	—
ELYCIN	—	1 (1)	1 (1)	3 (9)	—	—	—	—
ELYGLA	—	—	3 (5)	1 (1)	10 (1)	—	—	—
ELYVIR	—	—	—	3 (21)	—	—	—	—
ERIPOL	—	—	—	—	—	—	7 (1)	—
FESIDA	—	—	4 (5)	—	—	—	—	—
FESPRA	—	—	1 (10)	—	—	—	—	—
FESRUB	—	—	—	1 (1)	—	40 (2)	7 (40)	20 (3)

GLYBOR	—	3 (1)	—	—	—	—	—	—
GLYCER	—	—	—	—	—	—	—	20 (1)
GLYELA	—	—	—	—	10 (1)	—	—	—
GLYGRA	3 (3)	6 (16)	3 (25)	2 (10)	10 (1)	—	14 (1)	—
GLYSTR	16 (10)	17 (7)	13 (2)	1 (1)	—	20 (3)	—	—
GRASSX	—	3 (2)	—	—	—	—	—	—
HIEODO	—	—	1 (3)	—	—	—	—	—
HOLLAN	—	—	—	—	—	—	7 (1)	—
HORBRA	—	3 (1)	7 (2)	1 (1)	—	—	—	—
HORJUB	—	1 (1)	1 (1)	9 (7)	10 (10)	—	—	40 (2)
JUNALP	—	—	—	—	—	—	7 (1)	—
JUNART	—	—	—	2 (7)	—	—	—	—
JUNBAL	22 (10)	31 (9)	38 (9)	1 (10)	10 (3)	40 (40)	43 (14)	40 (12)
JUNBUF	—	1 (1)	—	—	—	—	—	—
JUNCUS	3 (3)	—	—	1 (1)	—	—	—	—
JUNENS	6 (1)	3 (2)	3 (2)	—	—	—	—	—
JUNHAL	—	—	—	1 (20)	—	—	—	—
JUNLON	—	1 (1)	—	—	10 (1)	—	—	—
JUNNOD	—	—	—	—	—	—	—	20 (10)
JUNTEN	—	1 (1)	1 (1)	1 (1)	—	—	—	—
JUNTOR	—	1 (1)	—	1 (1)	—	—	—	—
JUNTRA	—	—	—	1 (3)	—	—	—	—
KOECRI	—	—	3 (2)	—	—	—	—	—
LUZCAM	—	3 (15)	1 (1)	—	—	—	—	—
LUZPAR	3 (1)	1 (1)	3 (1)	—	—	—	—	—
LUZULA	—	—	1 (3)	—	—	—	—	—
MUHAND	—	—	3 (1)	—	—	20 (1)	—	—
MUHASP	—	—	1 (1)	2 (5)	—	—	—	—
MUHFIL	6 (5)	3 (22)	3 (2)	1 (1)	—	20 (10)	—	—
MUHLEN	—	1 (1)	—	—	—	—	7 (1)	—
PHAARU	6 (2)	1 (1)	6 (8)	22 (31)	20 (70)	—	—	—
PHLALP	6 (10)	3 (5)	3 (5)	—	—	—	—	—
PHLPRA	41 (5)	17 (4)	48 (7)	13 (7)	30 (1)	40 (3)	7 (1)	40 (2)
POACOM	—	—	—	3 (8)	—	—	—	—
POACUS	—	1 (1)	—	—	—	—	—	—
POAGLA	3 (1)	—	—	—	—	—	—	—
POALEP	3 (10)	—	—	—	—	—	—	—
POAPAL	56 (12)	45 (11)	51 (10)	24 (15)	20 (10)	—	29 (4)	60 (7)
POAPRA	56 (11)	39 (6)	59 (15)	27 (19)	—	40 (40)	7 (1)	40 (1)
POASCA	3 (3)	—	3 (1)	—	—	—	—	—
POAXXX	—	1 (3)	3 (2)	1 (3)	—	—	—	—
SCIACU	—	—	—	2 (2)	—	—	—	—
SCIFLU	—	—	—	1 (40)	—	—	—	—
SCIMAR	—	—	—	1 (30)	—	—	—	—
SCIMIC	3 (50)	3 (7)	3 (1)	2 (5)	10 (3)	—	—	—
SCIPAL	—	1 (3)	—	—	—	—	—	—
SCIPUN	—	—	—	3 (6)	—	—	—	—
SPAGRA	—	—	—	1 (80)	—	—	—	—
SPAPEC	—	—	—	2 (50)	—	—	—	—
STICOM	—	—	—	2 (5)	30 (20)	—	—	—
STIOCC	6 (1)	—	7 (1)	—	—	—	—	—
STIRIC	—	—	1 (3)	—	—	—	—	—
STIVIR	—	—	1 (1)	—	—	—	—	—
TRIWOL	3 (3)	7 (11)	6 (6)	—	—	—	—	—
Forbs								
ACHMIL	28 (5)	10 (7)	41 (2)	1 (1)	10 (1)	20 (1)	7 (1)	—
ACOCOL	—	—	1 (1)	—	—	—	—	—

ACTRUB	6 (5)	1 (1)	10 (5)	—	—	20 (1)	—	—
AGOGLA	6 (1)	—	—	—	—	—	—	—
AGRSTR	—	1 (1)	—	—	—	—	—	—
ALLBRE	—	—	3 (2)	—	—	—	—	—
ALLCER	—	—	—	2 (1)	—	—	—	—
ALLIUM	6 (1)	3 (1)	1 (1)	—	—	—	—	—
ALLSCH	3 (1)	—	—	3 (1)	—	40 (2)	—	—
ALLTEX	3 (1)	—	—	—	—	—	—	—
AMBPSI	—	—	—	1 (3)	—	—	—	—
AMBTRI	—	—	—	1 (1)	—	—	—	—
ANAMAR	—	1 (1)	—	—	—	—	—	—
ANDROS	—	—	1 (1)	—	—	—	—	—
ANEMUL	—	—	3 (1)	—	—	—	—	—
ANGARG	6 (2)	10 (1)	17 (2)	1 (1)	—	—	7 (10)	—
ANTANA	—	4 (1)	3 (20)	—	—	20 (20)	7 (1)	—
ANTCOR	—	1 (50)	—	—	—	—	—	—
ANTENN	3 (3)	—	1 (1)	—	—	—	—	—
ANTMIC	—	1 (1)	3 (1)	—	—	—	—	—
ANTUMB	3 (10)	1 (20)	—	—	—	—	—	—
APOAND	—	—	—	3 (28)	—	—	—	—
APOCAN	—	—	—	8 (15)	—	—	—	—
APOCYN	—	—	—	—	—	—	—	20 (10)
ARABIS	—	—	1 (1)	—	—	—	—	—
ARAGLA	3 (1)	—	1 (1)	—	—	—	—	—
ARCLAP	—	—	—	1 (1)	—	—	—	—
ARCMIN	3 (1)	—	4 (5)	1 (3)	—	—	—	—
ARCTIU	—	—	—	1 (1)	—	20 (3)	—	—
ARELAT	—	—	1 (1)	—	—	—	—	—
AREMAC	—	1 (1)	1 (3)	—	—	—	—	—
ARNAMP	—	—	—	1 (1)	—	—	—	—
ARNCHA	6 (2)	7 (3)	8 (4)	—	—	—	—	—
ARNICA	—	—	1 (1)	—	—	—	—	—
ARNLAT	3 (3)	—	—	2 (1)	—	—	—	—
ARTDRA	—	1 (1)	—	2 (1)	—	—	—	—
ARTLIN	—	—	—	4 (7)	—	20 (10)	—	—
ARTLUD	—	—	4 (1)	1 (1)	—	—	—	—
ASCLEP	—	—	—	1 (3)	—	—	—	—
ASCSPE	—	—	—	6 (1)	—	—	—	—
ASCVIR	—	—	—	1 (1)	—	—	—	—
ASTALP	—	—	1 (1)	—	—	—	—	—
ASTBRA	—	—	—	1 (60)	—	—	—	—
ASTCHI	6 (2)	7 (10)	6 (2)	4 (4)	—	40 (3)	7 (3)	—
ASTCIL	—	—	1 (3)	—	—	—	—	—
ASTEAT	—	6 (4)	1 (1)	—	—	—	—	20 (1)
ASTENG	—	—	1 (1)	—	—	—	—	—
ASTERI	—	—	—	1 (1)	—	—	—	—
ASTERX	6 (20)	3 (17)	10 (10)	3 (1)	—	—	7 (20)	20 (1)
ASTFAL	—	—	3 (1)	—	—	—	—	—
ASTFOL	6 (20)	17 (7)	3 (12)	1 (1)	—	—	—	—
ASTHES	3 (1)	—	3 (10)	—	—	—	—	—
ASTJUN	—	—	—	1 (3)	—	—	7 (1)	—
ASTLAE	—	1 (3)	4 (1)	1 (30)	—	—	—	—
ASTMOD	13 (6)	7 (1)	17 (1)	—	—	—	7 (10)	—
ASTOCC	41 (5)	38 (6)	37 (4)	2 (5)	20 (1)	20 (3)	21 (1)	20 (1)
ASTRAG	—	—	7 (1)	—	—	—	—	—
ASTSUB	6 (2)	—	—	—	—	—	—	—

BARORT	—	—	—	1 (3)	—	—	—	—
BERINC	—	—	1 (1)	—	—	—	—	—
CALSEP	—	—	—	4 (2)	—	—	—	—
CAMMIC	—	—	1 (1)	—	—	—	—	—
CAMQUA	—	—	1 (1)	—	—	—	—	—
CAMROT	—	—	3 (1)	1 (1)	—	—	—	—
CAPBUR	—	—	—	1 (1)	—	—	—	—
CARCAR	—	—	—	1 (1)	—	—	—	—
CARDAM	3 (1)	1 (1)	—	—	—	—	—	—
CARNUT	—	—	—	2 (5)	—	—	—	—
CARPES	—	1 (1)	—	—	—	—	—	—
CASMIN	6 (2)	4 (2)	3 (2)	—	—	—	—	—
CASTIL	3 (1)	—	—	—	—	—	7 (3)	—
CENMAC	—	—	1 (3)	6 (18)	—	—	—	—
CERARV	6 (7)	—	—	—	—	—	—	—
CERAST	—	3 (1)	—	—	—	—	—	—
CERVUL	—	1 (3)	—	—	—	—	—	—
CHEALB	—	—	—	4 (1)	—	—	—	—
CHENOP	—	—	—	1 (1)	—	—	—	—
CHERUB	—	—	1 (1)	—	—	—	—	—
CHRLEU	—	1 (50)	1 (10)	—	—	—	—	—
CHRVIL	—	—	—	—	—	—	—	20 (1)
CICMAC	3 (1)	1 (10)	1 (1)	3 (5)	10 (1)	—	14 (5)	—
CIRALP	—	—	1 (1)	—	—	—	—	—
CIRARV	22 (3)	15 (7)	37 (7)	41 (15)	10 (1)	—	—	40 (7)
CIRCAN	—	—	3 (1)	—	—	—	—	—
CIRSCA	22 (1)	7 (4)	18 (2)	—	—	—	—	—
CIRSIU	3 (1)	—	1 (1)	2 (1)	—	—	—	—
CIRVUL	3 (1)	—	4 (1)	—	—	—	—	—
CLEHIR	3 (1)	—	—	—	—	—	—	—
COLLIN	3 (1)	—	—	1 (1)	—	—	—	—
CONARV	—	—	—	4 (5)	—	—	—	—
CONCAN	—	—	—	1 (1)	—	—	—	—
CORTIN	—	—	—	2 (10)	—	—	—	—
CYNOFF	3 (1)	—	6 (2)	4 (17)	—	—	—	—
DELPHI	—	1 (1)	—	—	—	—	—	—
DELVER	—	—	—	—	—	—	7 (1)	—
DESPIN	—	—	1 (3)	1 (1)	—	—	—	—
DESRIC	—	—	1 (1)	—	—	—	—	—
DESRIC	—	—	1 (1)	—	—	—	—	—
DESSOP	—	—	1 (1)	1 (10)	10 (1)	—	—	—
DISTRA	—	—	1 (1)	—	—	—	—	—
DODECA	3 (1)	—	1 (1)	—	—	20 (10)	—	—
DODPUL	—	3 (2)	—	—	—	—	—	—
DRABAX	—	1 (1)	—	—	—	—	—	—
ECHLOB	—	—	—	1 (1)	—	—	—	—
EPIANG	25 (6)	14 (1)	24 (2)	1 (1)	—	—	—	—
EPICIL	19 (3)	45 (4)	21 (4)	8 (7)	10 (1)	—	29 (1)	40 (1)
EPIGLA	—	3 (1)	—	—	—	—	—	—
EPILAT	—	—	1 (1)	—	—	—	—	—
EPILOB	—	1 (10)	1 (1)	—	—	—	—	20 (40)
EPIPAL	—	3 (2)	—	—	10 (1)	—	—	—
EPIPAN	—	—	—	1 (1)	—	—	—	—
ERILOB	—	—	—	1 (3)	—	—	—	—
ERIUMB	—	—	1 (1)	—	—	—	—	—
ERYCHE	3 (1)	1 (1)	4 (1)	1 (3)	—	—	—	—
ERYREP	—	—	1 (1)	—	—	—	—	—

ERYSIM	—	1 (1)	—	—	—	—	—	—
EUPESU	—	—	—	3 (11)	—	—	—	—
FILARV	—	—	1 (1)	1 (1)	—	—	—	—
FRAVIR	44 (6)	23 (6)	34 (8)	1 (1)	—	20 (10)	14 (5)	—
GAIARI	—	—	—	1 (3)	—	—	—	—
GALAPA	—	—	4 (15)	3 (7)	—	—	7 (10)	—
GALBOR	16 (4)	10 (2)	11 (2)	2 (2)	—	20 (10)	14 (1)	—
GALIUM	—	—	3 (1)	—	—	—	—	—
GALTRF	16 (3)	17 (9)	1 (1)	2 (35)	—	—	14 (1)	—
GALTRI	9 (5)	10 (1)	15 (4)	3 (10)	—	20 (1)	7 (40)	—
GENAFF	—	3 (1)	1 (1)	—	—	20 (10)	—	—
GENDET	—	3 (1)	3 (1)	—	—	—	7 (1)	—
GERANI	3 (3)	1 (3)	1 (1)	—	—	40 (3)	7 (1)	—
GERRIC	9 (1)	6 (1)	20 (5)	—	—	—	—	—
GERVIS	—	3 (3)	8 (3)	1 (1)	—	—	—	—
GEUALE	3 (3)	—	1 (1)	—	—	—	—	—
GEUMAC	66 (2)	58 (5)	58 (3)	3 (5)	20 (1)	40 (1)	29 (1)	—
GEURIV	3 (20)	7 (2)	6 (1)	—	—	—	—	—
GEUTRI	3 (1)	—	3 (1)	—	—	—	—	—
GLYLEP	3 (1)	—	—	18 (5)	30 (17)	—	—	—
HABDIL	—	—	3 (1)	—	—	—	—	—
HABENA	3 (1)	3 (1)	4 (1)	—	—	—	—	20 (1)
HABHYP	—	—	1 (1)	—	—	20 (1)	—	—
HACDEF	—	—	1 (3)	—	—	—	—	—
HACFLO	—	—	3 (1)	—	—	—	—	—
HELANN	—	—	—	1 (1)	—	—	—	—
HELAUT	—	—	—	5 (1)	—	20 (1)	—	—
HELNUT	—	—	—	2 (2)	—	—	7 (1)	—
HERLAN	31 (5)	7 (6)	23 (4)	3 (10)	—	—	7 (10)	—
HIEGRA	—	—	—	—	—	20 (10)	—	—
HUMLUP	—	—	—	1 (3)	—	—	—	—
HYDROP	—	—	1 (3)	—	—	—	—	—
HYPPER	—	1 (10)	—	3 (1)	—	—	—	—
IMPAUR	—	—	1 (20)	—	—	—	—	—
IRIMIS	3 (1)	—	4 (1)	2 (1)	—	20 (3)	—	—
IRIPSE	—	—	—	2 (1)	—	—	—	—
KOCSCO	—	—	—	2 (12)	—	—	—	—
LACBIE	—	—	1 (1)	—	—	—	—	—
LACOBL	—	—	1 (1)	—	—	—	—	—
LACSER	—	1 (1)	3 (2)	4 (4)	—	—	—	—
LACTUC	3 (3)	1 (1)	1 (1)	2 (2)	—	—	—	—
LATHYR	3 (1)	—	—	1 (1)	—	—	—	—
LATOCH	—	—	1 (1)	—	—	20 (1)	—	—
LEMMIN	—	1 (20)	—	—	—	—	—	—
LIGTEN	3 (1)	4 (13)	3 (20)	—	—	—	—	—
LINPER	—	—	4 (1)	—	—	—	—	—
LINVUL	3 (1)	—	—	—	—	—	—	—
LITRUD	—	—	1 (1)	—	—	—	—	—
LOBMAR	—	—	—	1 (1)	—	—	—	—
LUPARG	—	1 (1)	3 (1)	—	—	—	—	—
LUPINU	—	—	1 (3)	—	—	—	—	—
LYCALB	—	—	—	1 (1)	—	—	—	—
LYCAME	—	—	—	1 (3)	—	—	—	—
LYCASP	—	—	—	1 (1)	—	—	—	—
LYSCIL	—	1 (3)	1 (1)	4 (11)	—	—	7 (1)	—
LYSTHY	—	—	—	1 (1)	—	—	—	—

MEDLUP	—	—	—	4 (1)	—	20 (1)	—	20 (1)
MEDSAT	—	—	—	3 (1)	—	—	—	20 (1)
MELALB	—	—	1 (3)	8 (10)	10 (1)	—	—	20 (20)
MELOFF	—	—	3 (1)	8 (6)	—	—	—	20 (1)
MENARV	19 (5)	23 (6)	27 (2)	27 (7)	50 (9)	40 (5)	29 (1)	60 (5)
MENTHA	—	—	—	—	—	—	—	20 (3)
MENTRI	—	—	1 (1)	—	—	—	—	—
MERCIL	13 (1)	6 (1)	11 (4)	—	—	—	—	—
MICROS	3 (1)	—	—	—	—	—	—	—
MIMGUT	—	7 (2)	3 (1)	1 (1)	10 (1)	—	7 (20)	—
MITBRE	—	—	1 (1)	—	—	—	—	—
MITSTA	—	1 (10)	—	—	—	—	—	20 (1)
MONFIS	—	—	1 (1)	—	—	—	—	—
MYOSCO	—	—	—	1 (10)	—	—	—	—
NASOFF	3 (3)	—	—	—	—	—	—	—
NEPCAT	—	—	—	—	10 (1)	—	—	—
OENVIL	—	—	—	1 (1)	—	—	—	—
ORTLUT	—	—	1 (1)	—	—	—	—	—
OSMCHI	—	—	3 (1)	—	—	—	—	—
OSMDEP	—	—	1 (1)	—	—	—	—	—
OSMOCC	—	—	4 (1)	—	—	—	—	—
OSMPUR	—	—	1 (3)	—	—	—	—	—
OXYDEF	—	—	1 (1)	—	—	—	—	—
PARFIM	3 (1)	—	—	—	—	—	—	—
PARPAR	6 (2)	—	—	—	—	—	—	—
PARPAL	—	—	1 (1)	—	—	—	14 (1)	—
PEDGRO	6 (2)	11 (3)	1 (1)	—	—	—	—	—
PEDICU	3 (1)	3 (1)	1 (3)	—	—	—	—	—
PENPRO	6 (1)	1 (1)	—	—	—	—	—	—
PENRYD	3 (1)	—	—	—	—	—	—	—
PENSTE	—	1 (1)	1 (1)	—	—	—	—	—
PERGAI	3 (10)	3 (1)	1 (1)	1 (1)	—	—	—	—
PETSAG	—	4 (14)	3 (15)	—	—	—	7 (20)	—
PHAHAS	—	—	1 (1)	1 (1)	—	—	—	—
PHAPRO	—	—	—	1 (1)	—	—	—	—
PHYPAR	—	—	—	3 (1)	—	—	—	—
PLAMAJ	3 (1)	1 (1)	3 (1)	4 (2)	—	—	14 (1)	60 (10)
POLAMP	3 (20)	3 (1)	1 (1)	8 (23)	10 (3)	—	7 (3)	—
POLAVI	—	1 (3)	—	—	—	—	—	—
POLDOU	3 (3)	—	—	—	—	—	—	—
POLLAP	—	—	—	2 (30)	—	—	—	—
POLOCC	9 (18)	10 (8)	4 (1)	—	—	—	—	—
POLPUL	—	1 (20)	1 (1)	—	—	—	—	—
POLSAW	—	—	—	2 (1)	—	—	—	—
POLYGO	—	—	3 (1)	—	—	—	—	—
POTAMO	—	1 (3)	—	—	—	—	—	—
POTANS	—	—	3 (2)	4 (21)	—	—	7 (1)	20 (3)
POTARE	—	—	—	1 (3)	—	—	—	—
POTDIE	—	1 (1)	—	—	—	—	—	—
POTDIV	3 (1)	3 (10)	—	—	—	—	—	—
POTENT	—	—	—	1 (1)	—	—	—	—
POTGLA	3 (1)	—	1 (1)	—	—	—	—	—
POTGRA	25 (2)	10 (3)	20 (2)	3 (1)	—	20 (1)	—	—
POTNOR	—	1 (1)	—	—	—	—	—	—
POTPAL	3 (20)	1 (30)	1 (1)	—	—	—	—	—
POTPAR	—	—	—	2 (7)	—	—	—	—
PRIINC	3 (1)	—	—	—	—	—	—	—

PRUVUL	—	—	3 (1)	1 (3)	—	20 (1)	—	—
PYRASA	6 (2)	7 (2)	8 (2)	—	—	—	—	—
PYRSEC	—	—	—	—	—	20 (1)	—	—
RANINA	3 (1)	—	—	—	—	—	—	—
RANMAC	—	—	—	1 (1)	—	—	—	—
RANNAT	—	3 (3)	1 (1)	—	—	—	—	—
RANREP	3 (1)	—	—	—	—	—	—	—
RANUNC	—	—	1 (1)	—	—	—	—	—
RORCUR	—	—	—	1 (1)	—	—	—	—
RORIPP	—	—	—	2 (2)	—	—	—	—
RORPAL	—	4 (1)	1 (1)	3 (3)	—	—	—	—
RORSYL	—	—	—	1 (20)	—	—	—	—
RUBPUB	—	—	1 (1)	—	—	—	—	—
RUDLAC	—	—	4 (14)	1 (10)	—	—	—	—
RUDOCC	—	1 (3)	4 (7)	—	—	—	—	—
RUMCRI	6 (1)	10 (2)	3 (1)	14 (3)	20 (15)	—	—	20 (3)
RUMEXX	—	4 (7)	3 (1)	—	—	—	7 (1)	—
RUMMAR	—	—	—	3 (9)	—	—	—	—
RUMOCC	—	1 (1)	—	—	—	—	—	—
RUMSAL	—	—	—	1 (1)	—	—	—	—
SALIBE	—	—	—	2 (12)	—	—	—	—
SANMAR	—	1 (1)	3 (1)	—	—	—	—	—
SAXARG	—	1 (1)	1 (10)	—	—	—	—	—
SAXORE	3 (1)	3 (2)	1 (1)	—	—	—	—	—
SCUGAL	—	4 (1)	—	—	—	—	—	—
SEDLAN	—	—	1 (1)	—	—	—	—	—
SENCAN	—	—	1 (1)	—	—	—	—	—
SENFOE	—	—	1 (20)	—	—	—	—	—
SENHYD	3 (1)	7 (3)	—	1 (20)	—	—	7 (1)	—
SENINT	13 (1)	14 (8)	6 (4)	—	—	—	—	—
SENPAU	—	—	1 (1)	—	—	—	—	—
SENPSE	16 (2)	13 (3)	24 (7)	—	—	—	—	—
SENSER	3 (3)	—	3 (1)	—	—	—	—	—
SENSPH	—	3 (15)	—	—	—	—	—	—
SENTRI	—	3 (1)	4 (1)	—	—	—	7 (3)	—
SILCSE	—	—	—	1 (20)	—	—	—	—
SILENE	—	1 (1)	—	—	—	—	—	—
SISALT	—	—	—	2 (2)	—	—	—	—
SISIDA	3 (1)	—	1 (1)	—	—	20 (1)	—	—
SISLOE	3 (1)	—	—	1 (10)	—	—	—	—
SISYRI	—	—	1 (1)	1 (1)	—	—	—	—
SIUSUA	—	—	1 (1)	3 (1)	10 (3)	—	—	—
SMIRAC	—	—	1 (3)	—	—	—	—	—
SMISTE	34 (3)	11 (6)	45 (5)	4 (2)	—	20 (1)	14 (1)	—
SOLCAN	28 (14)	13 (7)	31 (4)	15 (11)	—	20 (1)	21 (8)	40 (5)
SOLGIG	3 (20)	1 (1)	1 (1)	5 (6)	10 (1)	—	7 (3)	—
SOLIDA	3 (1)	—	1 (3)	2 (2)	—	—	—	20 (3)
SOLMIS	3 (1)	—	—	3 (2)	—	—	—	—
SOLOCC	6 (12)	—	—	3 (8)	—	—	—	—
SONARV	—	—	3 (5)	3 (7)	—	—	—	—
SONASP	—	—	1 (1)	1 (1)	—	—	—	—
SONCHU	—	—	—	—	—	—	7 (1)	—
SONOLE	—	—	—	1 (3)	—	—	—	—
STAPAL	—	—	—	3 (1)	—	—	—	—
STEAME	—	1 (1)	—	—	—	—	—	—
STELLA	3 (1)	1 (10)	3 (2)	—	—	—	—	—

STELON	3 (1)	11 (3)	8 (1)	—	—	—	—	—
STEUMB	—	—	1 (1)	—	—	—	—	—
STRAMP	—	—	1 (3)	—	—	20 (1)	—	—
SWEPER	3 (1)	1 (1)	—	—	—	20 (1)	7 (1)	—
TANVUL	—	—	—	8 (15)	—	—	—	20 (1)
TARCER	—	—	1 (3)	—	—	—	—	—
TARLAE	—	—	—	1 (1)	—	—	—	—
TAROFF	28 (7)	23 (2)	42 (3)	8 (1)	10 (1)	20 (1)	7 (3)	20 (1)
THADAS	—	—	—	2 (1)	—	—	—	—
THAFEN	3 (1)	3 (1)	4 (8)	—	—	—	7 (3)	—
THALIC	—	3 (1)	3 (2)	1 (1)	—	—	7 (1)	—
THAOCC	13 (6)	1 (10)	18 (2)	—	—	20 (1)	14 (2)	—
THAVEN	—	—	—	1 (1)	—	—	—	—
THEMON	—	—	3 (1)	—	10 (3)	—	—	—
THLARV	—	—	—	1 (1)	—	—	—	—
TRADUB	3 (1)	—	3 (1)	1 (1)	—	—	—	—
TRIFOL	—	1 (10)	—	—	—	—	—	—
TRIGLE	—	—	1 (1)	—	—	—	—	—
TRIHYB	—	1 (1)	4 (7)	—	10 (1)	—	—	20 (1)
TRILON	—	6 (3)	6 (1)	—	—	—	—	—
TRIMAR	6 (5)	—	—	—	—	20 (1)	—	—
TRIPAL	—	—	—	—	—	—	14 (1)	—
TRIPRA	3 (1)	—	—	1 (1)	20 (1)	—	—	20 (1)
TRIREP	19 (9)	11 (6)	11 (9)	3 (1)	20 (1)	—	—	—
TYPLAT	—	1 (1)	—	6 (12)	—	—	14 (1)	—
URTDIO	19 (5)	3 (5)	31 (9)	8 (5)	—	20 (1)	7 (1)	20 (3)
VALDIO	—	1 (1)	—	—	—	—	—	—
VALEDU	9 (14)	3 (1)	7 (5)	—	—	—	—	—
VALERI	—	1 (1)	1 (1)	—	—	—	—	—
VALOCC	—	—	—	—	—	20 (1)	7 (1)	—
VALSIT	3 (1)	—	—	—	—	—	—	—
VERAME	6 (2)	13 (6)	4 (2)	2 (1)	—	—	—	—
VERANA	—	—	—	1 (1)	10 (1)	—	—	—
VERBRA	—	—	—	—	—	—	—	20 (1)
VERCAL	—	—	1 (1)	—	—	—	—	—
VERCAT	—	1 (1)	—	—	—	—	—	—
VERHAS	—	—	—	1 (20)	—	—	—	—
VERSCU	—	—	—	1 (1)	—	—	—	—
VERTHA	—	—	1 (1)	4 (1)	—	—	—	20 (1)
VERWOR	—	1 (10)	—	—	—	—	—	—
VICAME	—	1 (3)	3 (1)	—	—	—	14 (2)	—
VIOADU	—	—	—	—	—	—	14 (5)	—
VIOCAN	—	—	7 (11)	—	—	—	—	—
VIOLAX	19 (5)	14 (7)	13 (4)	—	—	40 (5)	36 (4)	—
VIOMAC	—	1 (10)	—	—	—	—	—	—
VIONEP	—	1 (1)	—	—	—	—	—	—
VIOORB	—	—	1 (1)	—	—	—	—	—
XANSTR	—	—	—	8 (2)	—	—	—	—
ZIGELE	—	—	1 (1)	—	—	20 (1)	—	—
ZIZAPT	—	1 (1)	1 (1)	—	—	20 (1)	—	—
Ferns and Allies								
EQUARV	25 (8)	18 (13)	27 (4)	20 (20)	30 (1)	20 (1)	29 (28)	20 (3)
EQUFLU	—	—	—	3 (2)	—	—	—	—
EQUHYE	—	3 (5)	—	3 (4)	—	20 (1)	—	—
EQULAE	6 (1)	6 (2)	7 (1)	6 (1)	—	20 (10)	—	—
EQUPRA	—	—	3 (5)	1 (1)	—	—	—	—
EQUVAR	—	1 (1)	3 (25)	—	10 (40)	—	—	—

Appendix 19. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	ALNINC C.T.	ALNSIN C.T.	BETGLA/ CARROS H.T.	BETOCC C.T.	CORSTO C.T.	KALMIC/ CARSCO H.T.	POTFRU/ DESCES H.T.	SPIDOU C.T.
No. Of Stands	51	7	33	23	16	12	76	11
Trees								
ABIGRA	2 (1)	—	—	—	—	—	—	—
ABILAS	16 (1)	71 (1)	—	—	—	33 (1)	—	—
DEADLP	—	—	—	4 (1)	—	—	—	—
JUNSCO	4 (2)	—	—	4 (3)	6 (3)	—	—	—
LAROCC	—	—	—	—	—	17 (1)	—	—
PICEAX	20 (2)	43 (1)	3 (1)	4 (1)	6 (1)	17 (1)	1 (1)	—
PINALB	—	—	—	—	—	25 (1)	—	—
PINCON	—	—	3 (3)	4 (1)	—	8 (1)	3 (1)	—
PINFLE	—	—	3 (1)	9 (1)	—	—	—	—
POPANG	6 (1)	—	—	9 (1)	—	—	—	—
POPTRE	2 (3)	14 (1)	6 (2)	4 (3)	—	—	9 (1)	—
POPTRI	14 (6)	—	—	9 (5)	13 (5)	—	—	—
PSEMEN	12 (1)	14 (1)	—	13 (1)	—	—	—	—
SALAMY	—	—	—	4 (3)	—	—	—	—
Shrubs								
ACEGLA	12 (1)	14 (1)	—	9 (7)	6 (10)	—	—	—
ALNINC	100 (51)	—	6 (7)	26 (29)	—	—	1 (1)	9 (3)
ALNSIN	—	100 (69)	—	—	—	—	—	—
AMEALN	8 (3)	—	3 (10)	9 (15)	6 (1)	—	1 (1)	—
ARCUVA	—	—	6 (10)	4 (1)	—	—	3 (1)	—
ARTCAN	—	—	—	—	—	—	12 (30)	—
ARTTRI	—	—	—	—	—	—	3 (3)	—
BERREP	2 (1)	—	—	4 (1)	—	—	—	—
BETGLA	4 (1)	—	100 (29)	—	6 (10)	—	8 (3)	—
BETOCC	12 (5)	—	—	100 (52)	—	—	1 (3)	—
CELSCA	—	—	—	9 (1)	—	—	—	—
CLELIG	4 (10)	—	—	4 (1)	13 (15)	—	—	—
CLEOCC	2 (1)	—	—	—	—	—	—	—
CORCAN	8 (5)	—	3 (3)	—	—	—	—	—
CORSTO	49 (14)	14 (1)	21 (14)	48 (11)	100 (56)	—	—	18 (1)
CRACOL	—	—	—	—	6 (10)	—	—	—
CRADOU	6 (5)	—	—	—	—	—	—	—
DRYDRU	—	—	—	4 (1)	—	—	—	—
ELACOM	2 (1)	—	—	—	—	—	—	—
GAUHUM	—	—	—	—	—	17 (10)	—	—
JUNCOM	6 (1)	—	6 (1)	4 (1)	—	—	—	—
JUNHOR	—	—	—	9 (2)	—	—	—	—
KALMIC	—	—	—	—	—	100 (16)	—	—
LEDGLA	—	—	—	—	—	17 (10)	—	—
LONINV	8 (1)	43 (3)	9 (2)	—	13 (30)	—	—	9 (1)
LONUTA	—	—	—	—	—	8 (10)	—	—
MENFER	2 (1)	14 (1)	—	—	—	—	—	—
OPLHOR	2 (70)	14 (10)	—	—	—	—	—	—
PHILEW	2 (10)	—	—	9 (7)	6 (10)	—	—	—
PHYEMP	—	—	—	—	—	25 (4)	1 (1)	—

POTFRU	2 (3)	—	82 (13)	9 (3)	—	—	100 (24)	—
PRUVIR	—	—	—	13 (33)	6 (1)	—	—	—
RHAALN	14 (13)	—	9 (20)	4 (3)	6 (10)	—	1 (1)	9 (20)
RIBAME	—	—	—	—	—	—	—	18 (10)
RIBESX	14 (5)	—	—	17 (4)	13 (3)	—	3 (2)	—
RIBHUD	12 (16)	—	3 (1)	4 (3)	6 (1)	—	—	—
RIBINE	2 (1)	—	—	—	—	—	—	—
RIBIRR	2 (1)	—	—	—	—	—	—	—
RIBLAC	16 (2)	57 (7)	—	—	6 (1)	—	1 (1)	—
RIBODO	2 (1)	—	—	—	6 (60)	—	—	—
RIBSET	—	—	—	13 (1)	13 (1)	—	1 (1)	—
ROSACI	10 (3)	—	3 (1)	—	6 (1)	—	4 (14)	9 (20)
ROSARK	2 (3)	—	—	—	—	—	—	—
ROSAXX	2 (1)	14 (1)	—	9 (25)	6 (10)	—	—	—
ROSGYM	2 (10)	—	—	—	—	—	—	—
ROSWOO	20 (9)	—	12 (1)	48 (7)	50 (15)	—	11 (2)	—
RUBIDA	37 (3)	—	3 (3)	4 (3)	31 (11)	—	—	18 (7)
RUBPAR	14 (1)	29 (7)	3 (10)	4 (1)	6 (1)	—	—	—
RUBURS	2 (3)	—	—	—	—	—	—	—
SALBAR	2 (1)	14 (30)	—	—	—	—	1 (10)	—
SALBEB	16 (2)	14 (3)	15 (5)	39 (6)	19 (5)	—	11 (1)	9 (3)
SALBOO	12 (3)	—	9 (2)	9 (1)	—	—	4 (1)	—
SALBRA	—	—	—	—	—	—	5 (6)	—
SALCAN	4 (2)	—	45 (2)	—	—	—	5 (2)	—
SALDRU	22 (2)	14 (3)	18 (1)	—	—	—	—	9 (1)
SALEXI	6 (2)	—	—	17 (2)	19 (1)	—	—	9 (1)
SALEAS	—	—	—	—	—	8 (1)	—	—
SALFAR	—	—	3 (3)	—	—	—	3 (10)	—
SALGEY	4 (1)	—	9 (3)	—	—	—	12 (2)	—
SALLAS	2 (1)	—	—	—	6 (1)	—	—	—
SALLUT	10 (1)	—	6 (2)	17 (2)	6 (3)	—	1 (3)	—
SALPLA	—	—	21 (1)	—	6 (1)	—	1 (1)	—
SALPSE	—	—	9 (14)	9 (12)	6 (3)	—	—	—
SALSCO	2 (3)	14 (10)	—	—	—	—	—	—
SALSER	—	—	12 (10)	—	6 (30)	—	—	—
SALWOL	—	—	3 (1)	—	—	—	4 (2)	—
SAMRAC	2 (1)	14 (20)	—	—	—	—	—	—
SHECAN	2 (1)	—	—	4 (1)	—	—	1 (20)	—
SOLDUL	2 (30)	—	—	—	13 (5)	—	—	—
SORBUS	—	14 (1)	—	—	—	—	—	—
SORSCO	—	—	—	4 (1)	—	—	—	—
SPIBET	—	—	3 (1)	—	—	—	—	—
SPIDEN	2 (3)	—	—	—	—	—	1 (30)	—
SPIDOU	4 (40)	—	—	4 (20)	—	—	—	100 (79)
SYMALB	22 (3)	—	—	17 (17)	6 (20)	—	1 (1)	—
SYMOCC	4 (30)	14 (1)	3 (1)	13 (8)	31 (7)	—	—	—
SYMPHO	6 (7)	—	—	4 (10)	6 (10)	—	—	—
TAXBRE	2 (1)	—	—	—	—	—	—	—
TETCAN	—	—	—	—	—	—	1 (3)	—
TOXRYD	—	—	—	9 (10)	13 (3)	—	—	—
VACCES	—	—	3 (1)	—	—	—	—	—
VACCIN	2 (1)	—	—	—	—	—	—	—
VACGLO	—	14 (1)	—	—	—	—	—	—
VACOCC	—	—	—	—	—	17 (65)	—	—
VACSCO	—	—	—	—	—	25 (4)	1 (3)	—
Graminoids								
AGRCAN	2 (1)	—	3 (10)	9 (2)	—	—	37 (2)	—

AGRDIE	—	14 (3)	—	—	—	—	—	—
AGREXA	4 (1)	—	—	—	—	—	—	—
AGRHUM	—	—	—	—	—	25 (27)	—	—
AGRIDA	2 (10)	—	—	—	—	—	—	—
AGROPY	2 (1)	—	—	4 (3)	—	—	1 (3)	—
AGRREP	8 (1)	—	—	—	31 (13)	—	5 (5)	—
AGRSCA	6 (1)	14 (1)	—	4 (20)	—	—	5 (6)	—
AGRSMI	—	—	—	—	—	—	5 (15)	—
AGRSPI	2 (20)	—	—	—	—	—	1 (1)	—
AGRSTO	35 (13)	—	18 (14)	52 (22)	38 (14)	8 (20)	4 (15)	—
AGRTEN	4 (2)	—	—	—	—	8 (10)	1 (50)	—
AGRTHU	—	14 (1)	—	—	—	25 (27)	—	—
AGRVAR	—	—	—	—	—	8 (20)	—	—
ALOALP	—	—	—	—	—	—	8 (7)	—
ALOAEQ	—	—	—	—	—	—	1 (1)	—
ALOPEC	—	—	—	—	—	—	1 (3)	—
ALOPRA	—	—	—	—	—	—	—	9 (1)
BECSYZ	—	—	—	—	6 (10)	—	—	—
BROANO	—	—	—	—	—	—	1 (1)	—
BROCAR	—	—	3 (1)	—	—	—	—	—
BROCIL	12 (2)	—	12 (1)	13 (1)	6 (3)	—	17 (4)	9 (1)
BROINE	8 (11)	—	—	9 (3)	6 (1)	—	5 (1)	—
BROMUS	—	29 (3)	—	—	—	—	—	—
CALAMA	—	—	—	4 (3)	—	—	—	—
CALCAN	27 (29)	29 (7)	6 (25)	9 (10)	6 (20)	33 (20)	4 (17)	18 (40)
CALPUR	—	—	—	4 (1)	6 (10)	—	1 (1)	—
CALSTR	12 (8)	—	18 (3)	9 (1)	—	—	11 (7)	—
CARAQU	6 (1)	—	67 (15)	—	6 (3)	8 (60)	13 (13)	—
CARATH	—	—	6 (2)	—	6 (1)	—	3 (2)	—
CARATR	—	—	—	—	—	—	1 (10)	—
CARAUR	—	—	15 (1)	—	—	—	1 (1)	—
CARBAC	—	—	—	—	—	—	1 (10)	—
CARBEB	2 (1)	—	—	—	6 (10)	—	—	—
CARBUX	—	—	27 (6)	—	6 (3)	—	5 (13)	—
CARCAN	—	—	—	—	—	17 (5)	—	—
CARCAP	—	—	15 (2)	—	6 (10)	—	—	—
CARCUS	—	—	3 (30)	—	—	—	—	—
CARDEW	2 (1)	—	—	—	6 (1)	—	—	—
CARDIO	—	—	3 (3)	—	—	8 (20)	—	—
CARDIS	4 (1)	—	—	—	6 (3)	—	—	—
CARELE	—	—	—	—	—	—	1 (3)	—
CAREXX	—	—	3 (1)	17 (2)	—	8 (1)	16 (5)	—
CARHAY	2 (1)	—	—	—	—	—	—	—
CARHOO	—	—	—	4 (1)	6 (10)	—	1 (3)	—
CARINT	—	—	15 (13)	—	6 (10)	—	1 (20)	—
CARLAE	—	—	—	4 (1)	—	—	1 (1)	—
CARLAN	8 (1)	—	—	4 (20)	6 (1)	8 (3)	5 (7)	—
CARLAS	—	—	6 (2)	—	—	—	1 (1)	9 (20)
CARLEN	2 (1)	—	3 (1)	—	—	17 (5)	3 (1)	—
CARLEP	—	—	15 (3)	—	6 (20)	17 (5)	—	—
CARLIM	—	—	21 (9)	—	—	—	8 (6)	—
CARLIV	—	—	42 (11)	—	—	—	7 (15)	—
CARLUZ	—	—	—	—	—	25 (27)	—	—
CARMIC	6 (1)	14 (1)	—	4 (3)	—	8 (10)	4 (10)	—
CARMUL	—	—	3 (1)	—	—	—	—	—
CARNEB	2 (80)	—	3 (20)	9 (42)	—	—	1 (3)	—

CARNIG	—	—	—	—	—	50 (35)	—	—
CARNOR	—	—	—	—	—	—	1 (10)	—
CAROED	—	—	21 (2)	—	—	—	4 (1)	—
CARPAC	2 (3)	—	—	—	—	—	5 (16)	—
CARPAR	2 (30)	—	—	—	—	—	1 (1)	—
CARPET	—	—	—	—	—	—	1 (1)	—
CARPHA	—	—	—	—	—	17 (20)	—	—
CARPRA	—	—	—	—	—	—	9 (6)	—
CARPRI	—	—	—	—	—	—	1 (3)	—
CARPRT	—	—	—	—	—	—	12 (12)	—
CARRET	—	—	—	—	6 (1)	—	—	—
CARROS	14 (12)	—	39 (12)	9 (7)	19 (2)	8 (10)	12 (13)	18 (60)
CARRUP	—	—	—	—	—	8 (50)	—	—
CARSCI	—	—	15 (9)	—	—	—	7 (4)	—
CARSCO	—	—	—	—	—	58 (22)	1 (10)	—
CARSIM	2 (10)	—	58 (19)	—	—	—	12 (12)	—
CARSPR	—	—	—	4 (20)	—	—	—	—
CARSTI	2 (1)	—	—	—	—	—	—	—
CARUNI	—	—	—	—	—	—	1 (1)	—
CARVES	2 (3)	—	—	—	—	—	—	18 (12)
CARVUL	—	—	—	—	6 (3)	—	—	—
CINLAT	22 (7)	29 (3)	—	—	6 (1)	—	1 (10)	—
DACGLO	4 (1)	—	—	9 (7)	6 (1)	—	—	—
DANINT	—	—	—	—	—	42 (12)	12 (5)	—
DANSPI	—	—	—	—	—	—	3 (7)	—
DANTHO	—	—	—	—	—	—	1 (1)	—
DESCES	—	—	24 (6)	—	—	58 (16)	59 (15)	—
DESELO	—	14 (1)	—	—	—	—	—	—
ELEACI	—	—	—	—	6 (1)	—	1 (10)	—
ELECOM	—	—	—	4 (3)	—	—	—	—
ELEPAL	—	—	18 (17)	—	—	—	1 (10)	—
ELEPAU	—	—	30 (17)	—	—	—	5 (45)	—
ELYCIN	—	—	—	—	—	—	1 (1)	—
ELYGLA	18 (1)	57 (4)	3 (1)	4 (1)	13 (20)	—	—	—
ERIPOL	—	—	—	—	—	—	1 (1)	—
FESIDA	—	—	—	—	—	—	18 (13)	—
FESOCC	—	14 (1)	—	—	—	—	—	—
FESRUB	—	—	—	4 (3)	—	—	4 (15)	—
FESSCA	—	—	3 (1)	—	—	—	5 (14)	—
GLYELA	14 (10)	—	3 (1)	—	—	8 (1)	—	—
GLYGRA	12 (6)	—	—	4 (3)	6 (10)	—	—	18 (3)
GLYSTR	6 (4)	—	9 (4)	—	13 (40)	—	—	—
HORBRA	—	—	—	—	—	—	8 (6)	—
HORJUB	4 (1)	—	—	4 (1)	—	—	—	—
JUNALP	—	—	—	—	—	—	1 (1)	—
JUNART	—	—	—	—	6 (10)	—	—	—
JUNBAL	8 (6)	—	61 (15)	17 (11)	—	—	59 (19)	—
JUNBUF	—	—	—	—	—	—	1 (10)	—
JUNCUS	—	—	—	—	—	—	4 (2)	—
JUNDRU	—	—	—	—	—	17 (5)	—	—
JUNENS	2 (10)	—	3 (1)	—	—	—	—	—
JUNFIL	—	—	3 (1)	—	—	—	—	—
JUNHAL	—	—	—	—	—	8 (1)	—	—
JUNLON	—	—	3 (1)	—	—	—	3 (15)	—
JUNMER	—	—	—	—	—	8 (20)	1 (3)	—
JUNNOD	—	—	6 (2)	—	—	—	—	—
JUNTEN	—	—	—	—	6 (10)	—	—	—

JUNTOR	—	—	—	—	6 (10)	—	—	—
JUNTRI	—	—	—	—	—	—	1 (1)	—
KOECRI	—	—	3 (1)	—	—	—	12 (4)	—
LUZPAR	4 (2)	—	—	—	—	—	—	—
LUZPIP	—	14 (1)	—	—	—	—	—	—
MELICA	—	—	—	—	—	—	1 (1)	—
MELSPE	—	—	—	—	—	—	4 (1)	—
MELSUB	—	—	—	—	—	—	1 (1)	—
MUHAND	—	—	—	—	—	—	1 (1)	—
MUHFIL	—	—	—	—	6 (3)	8 (30)	14 (16)	—
MUHGLO	—	—	55 (5)	—	6 (1)	—	5 (2)	—
MUHRIC	—	—	39 (5)	—	—	—	5 (10)	—
PHAARU	16 (31)	—	6 (1)	4 (1)	25 (13)	—	—	18 (17)
PHLALP	—	—	—	—	—	25 (5)	7 (1)	—
PHLPRA	39 (6)	—	9 (1)	39 (5)	13 (30)	—	37 (14)	—
POAALP	—	—	—	—	—	—	1 (1)	—
POACOM	2 (1)	—	—	—	—	—	1 (50)	—
POACUS	—	—	—	—	—	—	4 (1)	—
POAINT	2 (40)	—	—	—	—	—	4 (54)	—
POAPAL	33 (16)	—	6 (3)	22 (10)	38 (9)	—	7 (7)	—
POAPRA	29 (15)	—	6 (20)	48 (25)	13 (25)	—	49 (22)	9 (1)
POASAN	—	—	—	—	—	—	1 (3)	—
POAXXX	—	—	—	4 (60)	—	—	3 (2)	—
SCIACU	—	—	30 (21)	4 (1)	—	—	5 (18)	—
SCIAME	—	—	3 (10)	—	—	—	—	—
SCIMIC	2 (1)	—	—	—	—	—	—	—
SPAGRA	—	—	—	—	—	—	1 (3)	—
SPHOBT	—	—	—	—	—	—	1 (3)	—
STIOCC	—	—	—	—	—	—	29 (7)	—
STIRIC	—	—	—	—	—	—	7 (9)	—
TRICAN	2 (1)	14 (3)	—	—	—	—	—	—
TRICER	—	14 (3)	—	—	—	—	—	—
TRISPI	—	14 (1)	—	—	—	—	—	—
TRIWOL	—	—	3 (1)	—	—	—	11 (4)	—
Forbs								
ACHMIL	8 (1)	—	9 (1)	17 (1)	6 (1)	—	63 (3)	—
ACOCOL	2 (3)	—	—	—	—	—	—	—
ACTRUB	8 (1)	14 (10)	—	—	—	—	—	—
AGAFOE	—	—	—	—	6 (20)	—	—	—
AGAURT	—	—	—	9 (3)	6 (1)	—	—	—
AGOGLA	—	—	—	—	—	—	5 (1)	—
ALLCER	—	—	—	—	—	—	1 (1)	—
ALLGEY	—	—	—	—	—	—	1 (10)	—
ALLIUM	—	—	—	4 (1)	—	—	—	—
ALLSCH	—	—	55 (1)	—	—	—	14 (4)	—
ALYALY	—	—	—	—	—	—	3 (2)	—
ANAMAR	6 (1)	43 (1)	—	—	—	—	—	—
ANEMON	—	—	—	4 (1)	—	—	—	—
ANEMUL	—	—	3 (1)	—	—	—	4 (1)	—
ANEPAR	—	—	9 (1)	—	—	—	4 (3)	—
ANEPAT	—	—	—	—	—	—	1 (3)	—
ANGARG	20 (2)	43 (1)	6 (1)	—	—	—	11 (3)	—
ANGDAW	2 (1)	29 (2)	—	—	—	—	—	—
ANTANA	—	—	30 (2)	—	—	—	7 (1)	—
ANTCOR	—	—	—	—	—	—	1 (10)	—
ANTENN	—	—	—	—	—	—	4 (7)	—

ANTMIC	—	—	3 (1)	—	—	—	21 (3)	—
ANTUMB	—	—	—	—	—	—	1 (1)	—
APOAND	—	—	—	9 (12)	—	—	—	—
APOCAN	—	—	—	—	19 (1)	—	—	—
ARABIS	—	—	—	—	—	—	1 (1)	—
ARADRU	—	—	—	—	—	—	3 (1)	—
ARAGLA	2 (1)	—	—	—	—	—	8 (1)	—
ARANUD	4 (1)	—	—	4 (20)	—	—	—	—
ARANUT	—	—	—	—	—	—	1 (1)	—
ARCMIN	—	—	3 (3)	—	—	—	—	—
ARECON	—	—	—	—	—	—	1 (1)	—
ARNAMP	—	14 (3)	—	—	—	—	—	—
ARNCHA	2 (1)	14 (1)	3 (1)	—	—	—	8 (6)	—
ARNCOR	—	29 (15)	—	—	—	—	—	—
ARNICA	—	14 (10)	—	—	—	—	1 (10)	—
ARNLON	2 (1)	—	—	—	—	—	1 (1)	—
ARNMOL	2 (1)	—	—	—	—	—	—	—
ARNRYD	—	—	—	—	—	—	1 (3)	—
ARTABS	—	—	—	—	6 (1)	—	—	—
ARTLUD	—	—	—	—	—	—	1 (20)	—
ASACAU	2 (1)	—	—	—	—	—	—	—
ASTADS	—	—	—	—	—	—	1 (3)	—
ASTCAM	—	—	—	—	—	—	1 (1)	—
ASTCHI	4 (1)	—	—	4 (3)	—	—	16 (2)	—
ASTCON	4 (1)	—	—	—	—	—	—	—
ASTEAT	8 (3)	—	3 (1)	—	—	—	1 (1)	—
ASTERX	8 (6)	—	—	26 (7)	—	—	11 (5)	—
ASTEUC	—	—	—	—	—	—	1 (1)	—
ASTFOL	6 (2)	29 (5)	3 (1)	—	—	50 (28)	12 (6)	—
ASTHES	4 (2)	—	3 (1)	—	—	—	3 (10)	—
ASTINT	2 (1)	—	—	—	—	—	—	—
ASTJUN	—	—	58 (1)	—	—	—	5 (1)	—
ASTLAE	—	—	—	4 (1)	—	—	1 (10)	—
ASTLEP	—	—	—	—	—	—	1 (1)	—
ASTMOD	8 (8)	—	—	—	—	—	3 (5)	—
ASTOCC	20 (7)	—	12 (1)	9 (2)	6 (3)	8 (20)	21 (7)	—
ASTRAG	4 (1)	—	—	—	—	—	7 (1)	—
ASTSUB	6 (1)	—	3 (1)	—	6 (1)	—	5 (4)	—
BARORT	—	—	—	—	—	—	1 (3)	—
BESRUB	—	—	—	—	—	—	1 (1)	—
CALLEP	—	—	—	—	—	25 (23)	3 (25)	—
CAMQUA	—	—	—	—	—	—	4 (4)	—
CAMROT	—	—	—	4 (1)	—	—	12 (2)	—
CARBUL	—	—	3 (20)	—	—	—	—	—
CARNUT	4 (1)	—	—	4 (1)	—	—	—	—
CASMIN	2 (1)	—	—	—	—	—	—	—
CASSES	—	—	—	—	—	—	1 (1)	—
CASSUL	—	—	—	—	—	—	1 (1)	—
CASTIL	—	—	—	4 (1)	—	—	—	—
CENMAC	4 (17)	—	—	4 (1)	6 (1)	—	1 (1)	—
CERARV	—	—	—	—	—	—	4 (5)	—
CERVUL	6 (1)	—	—	—	—	—	—	—
CHEALB	—	—	—	—	—	—	1 (1)	—
CHRLEU	8 (1)	—	—	4 (1)	6 (10)	—	—	—
CICMAC	6 (1)	—	6 (1)	13 (1)	6 (10)	—	—	—
CIRALP	4 (2)	14 (3)	3 (10)	—	—	—	—	—
CIRARV	22 (10)	—	3 (1)	26 (7)	31 (2)	—	5 (5)	9 (20)

CIRHOO	—	—	—	—	—	—	4 (1)	—
CIRSCA	—	—	—	4 (1)	—	—	39 (1)	—
CIRSIU	—	—	—	—	—	—	1 (1)	—
CIRVUL	4 (1)	—	3 (3)	—	6 (1)	—	1 (3)	—
COLLIN	—	—	—	—	—	—	4 (1)	—
COLPAR	—	—	—	—	—	—	1 (1)	—
COMAND	—	—	—	—	—	—	1 (1)	—
COMUMB	—	—	3 (1)	—	—	—	—	—
CORYDA	—	—	—	—	—	—	1 (1)	—
CRERUN	2 (1)	—	12 (1)	—	—	—	—	—
CYNOFF	2 (3)	—	—	4 (1)	6 (10)	—	3 (1)	—
DALPUR	—	—	—	—	—	—	1 (1)	—
DESPIN	—	—	—	—	—	—	1 (1)	—
DESRIC	—	—	—	—	—	—	1 (1)	—
DISHOO	—	14 (20)	—	—	—	—	—	—
DISTRA	—	29 (1)	3 (1)	9 (12)	—	—	—	—
DODECA	—	—	3 (1)	—	—	—	8 (3)	—
DODJEF	—	—	—	—	—	67 (13)	—	—
DODPUL	—	—	30 (1)	—	—	—	11 (1)	—
EPIALP	2 (1)	—	—	—	—	—	—	9 (1)
EPIANG	6 (1)	29 (20)	6 (1)	4 (1)	—	—	7 (1)	—
EPICIL	29 (3)	29 (2)	6 (1)	13 (10)	13 (5)	8 (1)	8 (1)	—
EPIGLA	—	—	—	—	—	8 (1)	1 (1)	—
EPILOB	—	—	—	—	—	—	1 (1)	—
EPIPAN	2 (1)	—	3 (1)	—	13 (1)	—	—	—
ERIACR	—	—	—	—	—	—	1 (1)	—
ERICOR	—	—	3 (1)	—	—	—	—	—
ERIGER	—	—	3 (1)	—	—	—	3 (5)	—
ERIGLA	—	—	—	—	—	—	1 (3)	—
ERILON	—	—	—	—	—	—	3 (1)	—
ERIPER	2 (3)	14 (1)	—	—	—	—	—	—
ERISPE	—	—	—	—	—	—	1 (10)	—
ERYCHE	—	—	—	—	—	—	9 (1)	9 (1)
ERYGRA	—	—	—	—	—	17 (1)	—	—
FRASPE	—	—	—	—	—	—	1 (1)	—
FRAVES	4 (5)	—	—	—	—	—	1 (3)	—
FRAVIR	16 (2)	—	18 (3)	30 (1)	6 (3)	—	47 (5)	—
GAIARI	—	—	3 (1)	—	—	—	3 (3)	—
GALAPA	6 (1)	—	15 (4)	—	13 (12)	—	1 (1)	18 (1)
GALBOR	6 (1)	—	73 (7)	22 (5)	13 (2)	—	55 (2)	—
GALIUM	2 (1)	—	—	—	—	—	—	—
GALTRF	2 (10)	—	3 (1)	—	—	—	5 (1)	—
GALTRI	37 (2)	71 (3)	3 (3)	13 (1)	31 (4)	—	—	—
GENAFF	—	—	—	—	—	—	8 (1)	—
GENAQU	—	—	—	—	—	—	1 (1)	—
GENCAL	—	—	—	—	—	58 (28)	1 (10)	—
GENDET	2 (1)	—	3 (1)	4 (1)	—	—	11 (1)	—
GENTIA	—	—	27 (1)	—	—	—	3 (2)	—
GERANI	4 (2)	—	3 (3)	4 (1)	—	—	1 (1)	—
GERCAR	2 (1)	—	—	—	—	—	—	—
GERRIC	6 (1)	—	—	9 (1)	—	—	1 (1)	—
GERVIS	—	—	—	4 (3)	—	—	5 (2)	—
GEUALE	2 (1)	—	—	—	—	—	3 (1)	—
GEUMAC	43 (3)	14 (1)	15 (1)	—	19 (1)	—	29 (4)	18 (7)
GEURIV	2 (1)	—	—	—	—	—	—	—
GEUTRI	—	—	—	—	—	—	17 (1)	—

GLYLEP	2 (20)	—	—	4 (20)	—	—	—	—
GNACHI	—	—	—	—	—	8 (1)	—	—
GNAPHA	—	—	—	—	—	—	1 (1)	—
HABDIL	8 (1)	14 (1)	3 (1)	—	—	—	—	—
HABENA	4 (1)	14 (1)	—	9 (1)	—	—	1 (3)	—
HABHYP	—	—	18 (3)	—	—	—	1 (1)	—
HABVIR	—	—	3 (1)	—	—	—	—	—
HABSAC	2 (1)	29 (1)	—	—	—	—	—	—
HAPLAN	2 (10)	—	—	—	—	—	—	—
HEDSUL	—	—	3 (1)	—	—	—	1 (3)	—
HELAUT	—	—	—	—	6 (3)	—	—	—
HELNUT	—	—	—	13 (20)	—	—	1 (1)	—
HERLAN	39 (3)	71 (8)	—	13 (2)	6 (1)	—	3 (5)	9 (10)
HIEALB	—	14 (1)	—	—	—	—	—	—
HIEGRA	—	—	—	—	—	—	1 (1)	—
HIERAC	—	—	—	—	—	—	1 (1)	—
HYPFOR	—	—	—	—	—	8 (1)	—	—
HYPPER	6 (1)	—	—	—	—	—	—	—
IMPAUR	—	—	—	—	—	—	—	9 (3)
IRIMIS	—	—	—	—	—	—	8 (3)	—
IRIPSE	—	—	—	—	6 (1)	—	—	—
LACSER	4 (1)	—	—	—	—	—	—	—
LIAPUN	—	—	—	—	—	—	1 (3)	—
LIGCAN	—	—	3 (3)	—	—	—	—	—
LIGTEN	—	—	—	—	—	58 (26)	—	—
LIGUST	—	—	—	—	—	17 (1)	—	—
LILPHI	—	—	18 (1)	—	—	—	—	—
LINPER	—	—	—	—	—	—	18 (1)	—
LOBKAL	—	—	9 (1)	—	—	—	—	—
LUPARG	2 (1)	—	3 (1)	—	—	8 (1)	3 (2)	—
LUPSER	—	—	—	—	—	—	1 (1)	—
LYSAME	2 (3)	—	—	—	—	—	—	—
LYSCIL	—	—	—	—	19 (14)	—	—	—
MEDFAL	—	—	—	—	—	—	1 (1)	—
MEDLUP	2 (3)	—	—	—	—	—	1 (3)	—
MEDSAT	4 (2)	—	—	—	—	—	—	—
MELALB	—	—	—	9 (1)	—	—	—	—
MELOFF	4 (2)	—	—	13 (1)	—	—	1 (1)	—
MENARV	31 (4)	—	6 (3)	4 (3)	13 (5)	—	3 (5)	18 (2)
MENTRI	—	—	24 (6)	—	—	—	1 (3)	—
MERCIL	4 (2)	—	3 (1)	—	—	—	—	—
MICNIG	—	—	—	—	—	—	3 (1)	—
MICROS	—	—	—	—	—	—	1 (1)	—
MIMGUT	8 (5)	—	—	4 (1)	—	—	—	—
MIMLEW	—	14 (3)	—	—	—	—	—	—
MIMMOS	2 (1)	—	—	—	—	—	—	—
MIMULU	—	14 (3)	—	—	—	—	—	—
MITBRE	—	14 (1)	—	—	—	—	—	—
MITELL	4 (7)	14 (1)	—	—	—	—	—	—
MONCOR	2 (1)	—	—	—	—	—	—	—
MONFIS	—	—	3 (1)	—	—	—	1 (1)	—
MONSIB	2 (1)	—	—	—	—	—	—	—
NASOFF	—	—	—	4 (1)	—	—	—	—
NEPCAT	—	—	—	—	6 (1)	—	—	—
ORTLUT	—	—	—	—	—	—	1 (1)	—
OSMCHI	16 (2)	43 (3)	—	4 (10)	6 (10)	—	—	—
OSMOCC	—	—	—	4 (10)	—	—	—	—

OXYDEF	—	—	—	—	—	—	1 (1)	—
OXYSER	—	—	—	—	—	—	3 (1)	—
OXYSPL	—	—	—	—	—	—	1 (1)	—
OXYTRO	—	—	—	4 (1)	—	—	—	—
PARFIM	2 (3)	29 (17)	—	—	—	—	1 (1)	18 (10)
PARPAL	—	—	36 (1)	—	6 (1)	—	1 (1)	—
PEDBRA	—	—	—	—	—	8 (3)	—	—
PEDCON	—	—	—	—	—	—	1 (1)	—
PEDGRO	—	—	3 (1)	—	—	25 (1)	5 (6)	—
PEDICU	2 (1)	—	—	—	—	—	—	—
PENPRO	—	—	—	—	—	—	7 (1)	—
PENRYD	—	—	—	—	—	—	1 (10)	—
PENSTE	—	—	—	—	—	—	7 (1)	—
PERGAI	—	—	—	—	—	—	7 (7)	—
PETASI	2 (30)	—	—	—	—	—	—	—
PETSAG	—	—	3 (1)	—	—	—	1 (20)	—
PHLHOO	—	—	—	—	—	—	1 (1)	—
PLAMAJ	4 (7)	—	—	—	—	—	—	—
POLAMP	2 (3)	—	—	—	13 (1)	—	—	—
POLBIS	—	—	—	—	—	8 (1)	5 (2)	—
POLDOU	—	—	—	—	—	—	4 (1)	—
POLOCC	—	—	3 (1)	—	—	—	3 (1)	9 (10)
POLVIV	—	—	—	—	—	—	1 (30)	—
POTANS	—	—	3 (1)	—	—	—	8 (7)	—
POTDIV	2 (1)	—	—	—	—	—	3 (7)	—
POTENT	2 (1)	—	—	—	—	—	1 (1)	—
POTFLA	—	—	—	—	13 (1)	—	—	—
POTGRA	—	—	6 (1)	—	—	—	64 (3)	—
POTNIV	—	—	—	—	—	—	1 (3)	—
POTNOR	2 (3)	—	—	—	—	25 (17)	—	—
POTPAL	2 (10)	—	6 (1)	—	—	—	—	9 (40)
PRUVUL	10 (2)	—	—	—	—	—	—	—
PYRASA	2 (10)	—	6 (2)	—	6 (10)	—	—	—
PYRELL	—	—	—	4 (3)	—	—	—	—
PYRMIN	—	14 (3)	—	—	—	—	—	—
PYROLA	—	29 (1)	—	—	—	—	—	—
PYRSEC	2 (1)	—	—	—	—	—	—	—
PYRUNI	2 (1)	14 (3)	—	—	—	—	—	—
RANGME	—	—	—	—	6 (10)	—	—	—
RANMAC	2 (1)	—	—	—	—	—	—	—
RANPEN	2 (1)	—	—	—	—	—	—	—
RANSCE	—	—	3 (40)	—	—	—	—	—
RANUNI	—	—	—	—	—	—	1 (1)	—
RATCOL	—	—	—	—	—	—	1 (1)	—
RORCAL	—	—	—	—	6 (1)	—	—	—
RORPAL	—	—	—	—	19 (2)	—	—	—
RUBACA	—	—	3 (1)	—	—	—	—	—
RUBPUB	4 (5)	—	—	—	—	—	—	—
RUDLAC	2 (1)	—	—	4 (20)	—	—	—	—
RUDOCC	—	—	—	—	6 (10)	—	—	9 (1)
RUMACT	2 (1)	—	—	—	—	—	—	—
RUMCRI	—	—	—	—	6 (1)	—	3 (1)	—
RUMEXX	2 (1)	—	—	—	—	—	—	—
RUMMAR	2 (1)	—	—	—	—	—	—	—
SANMAR	—	—	—	4 (20)	—	—	—	—
SAXARG	4 (1)	—	—	—	—	—	—	—

SAXIFR	—	—	—	—	6 (3)	—	—	—
SCHPAL	—	—	—	—	—	—	1 (1)	—
SCUGAL	4 (2)	—	3 (3)	—	—	—	—	—
SENCAN	—	—	—	—	—	—	1 (1)	—
SENCYM	2 (1)	14 (1)	—	—	—	8 (1)	1 (3)	—
SENDIM	2 (1)	—	—	—	—	—	1 (1)	—
SENECI	2 (1)	—	—	—	—	—	—	—
SENFOE	—	—	—	—	—	—	4 (4)	—
SENFUS	—	—	—	—	—	8 (1)	—	—
SENHYD	—	—	—	—	—	—	1 (1)	—
SENINT	2 (1)	—	6 (2)	—	—	—	13 (5)	—
SENLUG	2 (1)	—	—	—	—	—	1 (1)	—
SENPAP	—	—	—	—	—	—	1 (1)	—
SENPAU	—	—	—	—	—	—	1 (1)	—
SENPSE	6 (4)	—	6 (1)	—	—	—	8 (3)	—
SENSER	2 (1)	—	—	—	—	—	—	—
SENTRI	20 (3)	57 (4)	—	4 (10)	—	8 (10)	1 (3)	—
SIBPRO	—	—	—	—	—	—	3 (7)	—
SILACA	—	—	—	—	—	—	1 (1)	—
SILMEN	—	—	—	4 (10)	—	—	—	—
SISALT	—	—	—	—	6 (1)	—	—	—
SISIDA	—	—	—	—	—	—	3 (1)	—
SISYRI	—	—	—	—	—	—	4 (1)	—
SIUSUA	—	—	—	—	—	—	1 (1)	—
SMIRAC	2 (1)	—	3 (1)	—	6 (1)	—	—	—
SMISTE	27 (2)	—	15 (3)	35 (8)	13 (2)	—	14 (1)	—
SOLCAN	22 (2)	—	18 (2)	13 (9)	25 (6)	—	13 (9)	9 (3)
SOLGIG	2 (1)	—	—	4 (1)	—	—	—	—
SOLIDA	—	—	—	—	—	—	1 (1)	—
SOLMIS	—	—	—	9 (1)	—	—	4 (8)	—
SOLMUL	—	—	—	—	—	—	1 (1)	—
SOLNEM	—	—	6 (2)	—	—	—	—	—
SOLROS	—	—	—	—	6 (3)	—	—	—
SONARV	—	—	—	4 (3)	—	—	—	—
SPAMIN	—	—	3 (20)	—	—	—	—	—
SPIROM	—	—	12 (1)	—	—	8 (1)	1 (3)	—
STAPAL	—	—	3 (1)	—	—	—	—	—
STECAL	—	14 (1)	—	—	—	—	—	—
STELLA	—	—	—	—	—	—	—	9 (1)
STELON	8 (3)	—	—	—	—	—	7 (2)	—
STRAMP	14 (1)	71 (1)	—	4 (1)	—	—	—	—
TANVUL	2 (1)	—	—	—	6 (1)	—	—	—
TARCER	2 (1)	—	3 (1)	—	6 (1)	—	3 (1)	—
TARLAE	2 (3)	—	—	—	—	—	—	—
TAROFF	25 (1)	14 (1)	3 (1)	9 (1)	13 (5)	—	39 (7)	—
THAALP	—	—	—	—	—	—	3 (5)	—
THADAS	—	—	—	4 (1)	6 (20)	—	—	—
THAFEN	—	—	—	—	—	—	4 (1)	—
THALIC	—	—	3 (1)	4 (1)	—	—	11 (1)	—
THAOCC	20 (3)	29 (2)	3 (20)	4 (1)	6 (3)	—	1 (1)	—
THAVEN	—	14 (3)	3 (1)	4 (3)	—	—	—	—
THEMON	—	—	—	—	—	—	1 (1)	—
THLARV	—	—	—	—	—	—	4 (1)	—
TIATRI	4 (2)	29 (5)	—	—	—	—	—	—
TOFGLU	—	—	—	—	—	25 (10)	1 (10)	—
TRACAR	2 (1)	—	—	—	—	—	—	—
TRADUB	—	—	—	4 (1)	—	—	5 (1)	—

TRIAGR	2 (1)	—	—	—	—	—	1 (1)	—
TRIFOL	—	—	—	—	—	—	1 (1)	—
TRILON	2 (1)	—	—	—	—	—	9 (1)	—
TRIMAR	—	—	64 (8)	9 (2)	—	—	9 (7)	—
TRIMIC	2 (1)	—	—	—	—	—	—	—
TRIPAL	—	—	15 (2)	—	—	—	1 (1)	—
TRIPRA	2 (3)	—	—	—	—	—	1 (3)	—
TRIREP	22 (7)	—	—	9 (2)	6 (3)	—	5 (2)	—
TROLAX	—	—	3 (1)	—	6 (3)	—	3 (10)	—
TYPLAT	6 (1)	—	3 (3)	—	—	—	—	—
URTDIO	29 (5)	14 (3)	6 (5)	9 (42)	38 (7)	—	1 (10)	9 (1)
VACPYR	4 (1)	14 (3)	—	—	6 (1)	—	—	—
VALDIO	—	—	3 (1)	—	—	—	3 (1)	—
VALEDU	—	—	45 (3)	—	—	—	24 (3)	—
VALERI	—	—	3 (10)	—	—	—	—	—
VALOCC	—	—	—	—	—	—	1 (1)	—
VERAME	6 (10)	—	3 (1)	4 (40)	—	—	—	—
VERTHA	4 (1)	—	—	4 (1)	13 (1)	—	—	—
VERVIR	4 (3)	14 (3)	—	—	—	—	—	—
VERWOR	—	—	—	—	—	17 (1)	—	—
VICAME	2 (1)	—	9 (1)	—	13 (2)	—	—	—
VICIAX	—	—	—	—	—	—	1 (1)	—
VIOADU	—	—	9 (2)	—	6 (1)	—	1 (1)	—
VIOLAX	20 (3)	29 (2)	3 (1)	—	6 (20)	17 (1)	8 (10)	—
VIOMAC	2 (3)	—	—	—	—	—	—	—
VIONEP	—	—	36 (2)	—	—	—	5 (3)	—
VIOORB	4 (5)	—	3 (1)	—	—	—	—	—
VIOPAL	—	—	—	—	—	8 (1)	1 (1)	—
XANSTR	—	—	—	—	—	—	—	—
XERTEN	—	—	—	—	—	8 (1)	1 (10)	—
ZIZAPT	—	—	3 (1)	—	—	—	—	—
ZIZAUR	—	—	3 (10)	—	—	—	—	—
ZIGELE	—	—	21 (3)	—	—	—	4 (1)	—
ZIGVEN	—	—	—	—	—	—	1 (1)	—
ZIZAPT	—	—	—	—	—	—	1 (1)	—
Ferns and Allies								
ATHFIL	24 (14)	57 (19)	—	—	—	—	—	—
BOTVIR	—	—	3 (1)	—	—	—	—	—
DRYCRI	2 (1)	—	—	—	—	—	—	—
EQUARV	31 (14)	14 (1)	24 (2)	17 (20)	6 (3)	—	4 (8)	—
EQUFLU	—	14 (1)	—	—	—	—	—	—
EQUHYE	12 (1)	—	—	9 (20)	13 (1)	—	—	—
EQULAE	12 (1)	—	6 (40)	39 (10)	—	—	17 (2)	—
EQUPAL	—	—	6 (2)	—	—	8 (3)	—	—
EQUPRA	27 (5)	—	3 (1)	—	—	—	—	—
EQUSYL	—	—	—	4 (1)	—	—	—	—
EQUVAR	—	—	—	—	—	—	3 (2)	—
FERNXX	2 (1)	—	—	—	—	—	—	—
GYMDRY	4 (22)	43 (5)	—	—	—	—	—	—
PTEAQU	2 (1)	—	—	—	—	—	—	—
SELDEN	—	—	—	—	—	—	3 (27)	—

Appendix 20. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	ARTCAN/ AGRSMI H.T.	ARTCAN/ FESIDA H.T.	CRASUC C.T.	PRUVIR C.T.	ROSWOO C.T.	SARVER/ AGRSMI H.T.	SHEARG C.T.	SYMOCC C.T.	TAMCHI C.T.
No. Of Stands	43	6	22	25	59	11	18	55	4
Trees									
ABIGRA	—	—	—	—	—	—	—	2 (1)	—
ABILAS	—	—	—	—	2 (1)	—	—	—	—
ACENEG	—	—	—	8 (3)	3 (2)	—	—	2 (3)	—
DEADLP	—	—	—	—	—	—	—	—	25 (1)
ELAANG	—	—	—	—	2 (1)	—	—	—	—
FRAPEN	—	—	—	4 (3)	10 (1)	—	6 (3)	2 (1)	—
JUNSCO	5 (2)	—	—	4 (3)	5 (2)	—	6 (3)	2 (1)	—
LAROCC	—	—	—	—	2 (1)	—	—	2 (1)	—
PICEAX	—	—	—	—	—	—	—	2 (1)	—
PINCON	—	—	—	—	5 (4)	—	—	—	—
PINPON	—	—	14 (2)	—	2 (1)	—	6 (3)	—	—
POPDEL	5 (10)	—	—	—	—	—	—	—	50 (2)
POPTRE	—	—	5 (3)	4 (3)	2 (3)	—	—	—	—
POPTRI	—	—	14 (1)	4 (1)	5 (4)	—	—	2 (10)	—
PSEMEN	—	—	—	—	—	—	—	4 (1)	—
SALALB	—	—	—	—	—	—	—	2 (1)	—
SALAMY	2 (1)	—	—	—	7 (16)	—	—	—	—
THUPLI	—	—	—	—	—	—	—	2 (3)	—
Shrubs									
ACEGLA	—	—	5 (1)	—	—	—	—	2 (3)	—
ALNINC	—	—	5 (1)	—	—	—	—	2 (1)	—
AMEALN	—	—	27 (16)	12 (11)	3 (1)	—	—	2 (3)	—
AMEHUM	—	—	—	4 (3)	—	—	17 (34)	—	—
ARTCAN	100 (31)	100 (23)	—	8 (3)	—	9 (1)	6 (3)	5 (1)	50 (2)
ARTFRI	33 (3)	—	—	4 (1)	—	—	28 (3)	2 (1)	—
ARTTRI	2 (1)	33 (2)	—	4 (1)	2 (3)	9 (1)	—	2 (1)	—
ATRCON	2 (3)	—	—	—	—	—	—	—	—
BERREP	—	—	14 (5)	8 (2)	—	—	—	—	—
BETOCC	—	—	—	8 (12)	2 (1)	—	—	—	—
CELSCA	—	—	—	8 (2)	—	—	—	—	—
CERLAN	5 (2)	—	—	—	—	—	—	—	—
CHRNAU	5 (12)	—	—	4 (1)	—	9 (1)	—	—	—
CHRVIS	5 (3)	—	—	—	2 (1)	—	—	—	25 (1)
CLELIG	5 (20)	—	—	32 (18)	5 (8)	—	6 (3)	5 (2)	—
CLEOCC	—	—	5 (1)	—	—	—	—	—	—
CORCAN	—	—	—	—	2 (3)	—	—	—	—
CORSTO	—	—	27 (12)	12 (5)	10 (5)	—	6 (3)	4 (5)	—
CRACOL	—	—	5 (3)	—	—	—	—	—	—
CRADOU	—	—	75 (36)	12 (11)	3 (5)	—	—	2 (3)	—
CRASUC	2 (70)	—	27 (73)	—	—	—	6 (3)	—	—
GUTSAR	5 (1)	—	—	—	—	—	—	—	—
JUNCOM	—	—	—	—	—	—	—	4 (2)	—
JUNHOR	—	—	—	—	—	—	11 (12)	—	—
LONINV	—	—	5 (1)	—	2 (3)	—	—	—	—
PARQUI	—	—	—	—	10 (1)	—	—	—	—

PARVIT	—	—	—	4 (3)	—	—	11 (12)	7 (2)	—
PHILEW	—	—	9 (5)	4 (10)	—	—	—	2 (3)	—
POTFRU	—	17 (3)	—	4 (1)	2 (1)	—	—	4 (2)	—
PRUAME	—	—	9 (12)	—	—	—	—	2 (1)	—
PRUVIR	—	—	32 (19)	100 (47)	2 (1)	—	22 (22)	5 (3)	—
RHAALN	—	—	14 (14)	—	—	—	—	2 (3)	—
RHUARO	7 (1)	—	—	24 (8)	5 (2)	—	28 (3)	7 (12)	—
RIBAME	—	—	—	—	—	—	11 (12)	2 (3)	—
RIBCER	—	—	5 (1)	—	—	—	—	—	—
RIBESX	—	—	5 (3)	—	3 (1)	—	—	—	—
RIBHUD	—	—	5 (1)	—	—	—	—	—	—
RIBINE	—	—	5 (60)	—	—	—	—	—	—
RIBLAC	—	—	5 (1)	4 (1)	2 (3)	—	—	4 (2)	—
RIBMIS	—	—	5 (20)	—	2 (1)	—	11 (3)	2 (3)	—
RIBODO	—	—	5 (1)	28 (12)	10 (4)	—	44 (28)	7 (7)	—
RIBSET	—	—	—	20 (2)	5 (1)	—	—	5 (8)	—
ROSACI	—	—	—	4 (3)	8 (19)	—	6 (3)	5 (14)	—
ROSARK	—	—	—	4 (1)	—	—	—	—	—
ROSAXX	2 (3)	—	9 (10)	4 (3)	3 (15)	—	—	—	—
ROSWOO	21 (5)	17 (3)	50 (16)	—	88 (28)	—	83 (13)	51 (17)	—
RUBIDA	—	—	9 (12)	8 (12)	3 (10)	—	6 (20)	4 (2)	—
SALBEB	—	—	5 (1)	—	—	—	—	—	25 (1)
SALBOO	—	—	5 (1)	—	—	—	—	—	—
SALDRU	—	—	—	—	2 (3)	—	—	—	—
SALEXI	—	17 (3)	—	4 (10)	15 (6)	—	6 (1)	4 (1)	75 (14)
SALLUT	—	—	—	—	—	—	6 (3)	—	—
SALSCO	—	—	5 (1)	—	—	—	—	—	—
SAMBUC	—	—	—	—	2 (1)	—	—	—	—
SARVER	9 (13)	—	—	—	—	100 (38)	—	—	—
SHEARG	2 (20)	—	—	4 (20)	2 (1)	—	100 (73)	4 (1)	—
SHECAN	—	—	5 (3)	—	—	—	—	—	—
SOLDUL	—	—	14 (10)	—	7 (2)	—	—	—	—
SPIDOU	—	—	—	—	—	—	—	2 (3)	—
SYMALB	—	—	32 (33)	—	5 (14)	—	—	7 (21)	—
SYMOCC	44 (18)	17 (1)	32 (31)	72 (16)	44 (25)	—	100 (59)	91 (66)	—
SYMPHO	—	—	5 (10)	—	—	—	—	2 (20)	—
TAMCHI	2 (1)	—	—	—	—	—	—	—	100 (28)
TOXRYD	—	—	14 (21)	16 (18)	19 (5)	—	50 (9)	13 (21)	—
VITRIP	—	—	—	—	2 (1)	—	—	—	—
VITVUL	—	—	—	4 (1)	—	—	—	—	—
Graminoids									
AGRCAN	14 (18)	50 (8)	9 (10)	20 (1)	8 (3)	—	44 (14)	16 (7)	25 (3)
AGRCRI	5 (30)	—	—	—	—	9 (1)	—	2 (20)	—
AGROPY	—	17 (3)	5 (1)	—	3 (2)	9 (3)	—	—	—
AGRREP	5 (22)	17 (20)	18 (7)	—	27 (12)	—	—	7 (21)	—
AGRSCA	—	—	—	—	2 (1)	—	—	—	—
AGRSMI	95 (53)	33 (1)	18 (11)	16 (23)	19 (5)	64 (46)	39 (3)	27 (22)	75 (30)
AGRSPI	—	—	5 (3)	—	3 (1)	—	—	—	—
AGRSTO	—	—	36 (18)	—	22 (25)	9 (3)	17 (28)	11 (30)	—
AGRTHU	—	—	—	—	2 (3)	—	—	—	—
AGRTRI	—	—	—	—	—	9 (1)	—	—	—
ALOAEQ	—	—	—	—	2 (10)	—	—	—	—
ALOALP	—	17 (3)	—	—	2 (20)	—	—	—	—
ANDGER	—	—	—	—	—	—	6 (3)	2 (3)	—
ANDSCO	—	—	—	—	—	—	11 (3)	—	—
BOUGRA	19 (14)	—	—	—	—	18 (10)	—	2 (1)	—
BROANO	—	—	—	—	2 (3)	—	—	—	—

BROCAR	—	17 (1)	—	—	2 (3)	—	—	—	—
BROCIL	—	—	5 (1)	—	8 (6)	—	—	—	—
BROINE	9 (8)	17 (1)	14 (17)	8 (30)	24 (17)	—	6 (3)	20 (51)	—
BROJAP	28 (21)	—	9 (25)	4 (40)	3 (2)	55 (57)	17 (67)	5 (10)	—
BROTEC	—	—	9 (10)	12 (1)	—	18 (12)	—	5 (1)	—
CALCAN	—	—	—	—	3 (12)	—	—	—	—
CALLON	16 (18)	17 (40)	—	—	3 (30)	—	—	4 (30)	25 (3)
CALSTR	5 (1)	—	—	—	5 (7)	—	—	2 (20)	—
CARAPE	—	—	9 (2)	—	—	—	—	—	—
CARAQU	—	—	—	—	2 (1)	—	—	—	—
CARATH	—	—	—	—	2 (3)	—	—	—	—
CARAUR	—	—	—	—	2 (1)	—	—	—	—
CARBAC	—	—	—	4 (1)	—	—	—	—	—
CARBEB	—	—	—	—	3 (10)	—	—	—	—
CARBRE	2 (3)	—	—	—	—	—	—	—	—
CARCAN	—	—	5 (10)	—	—	—	—	—	—
CARCUS	—	—	—	—	3 (7)	—	—	—	—
CARDEW	—	—	5 (1)	—	—	—	—	—	—
CAREXX	—	—	5 (1)	—	2 (1)	—	—	2 (3)	—
CARFIL	2 (1)	—	—	—	—	9 (20)	6 (3)	2 (1)	—
CARGRA	—	—	—	4 (3)	—	—	—	—	—
CARHOO	—	—	—	—	2 (1)	—	—	—	—
CARLAN	—	—	9 (1)	—	8 (1)	—	—	4 (15)	—
CARLIM	—	—	—	—	2 (10)	—	—	—	—
CARMIC	—	17 (20)	5 (1)	—	2 (1)	—	—	—	—
CARNEB	—	—	—	—	3 (2)	—	—	—	—
CAROED	—	—	—	—	3 (2)	—	—	—	—
CARPAR	—	—	—	—	2 (1)	—	—	—	—
CARPRA	—	—	—	—	2 (20)	—	—	—	—
CARPRI	—	—	—	—	3 (2)	—	—	—	—
CARPRT	—	17 (1)	—	—	—	—	—	—	—
CARRET	—	—	—	—	2 (1)	—	—	—	—
CARROS	—	—	5 (3)	—	3 (2)	—	—	—	—
CARSPR	—	—	—	16 (36)	—	—	—	2 (1)	—
CARVUL	—	—	5 (1)	—	—	—	—	—	—
CINLAT	—	—	—	—	—	—	—	2 (1)	—
DACGLO	—	—	5 (3)	—	2 (10)	—	—	—	—
DANINT	—	50 (1)	—	—	—	—	—	—	—
DESCES	—	33 (1)	—	—	7 (4)	—	—	—	—
DESELO	—	—	5 (10)	—	—	—	—	—	—
DICACU	—	—	5 (10)	—	7 (8)	—	—	—	—
DISSPI	19 (14)	—	—	—	—	27 (22)	—	—	25 (3)
ELEPAL	—	—	—	—	2 (10)	—	—	2 (10)	—
ELYCAN	9 (6)	17 (1)	—	4 (1)	27 (2)	—	6 (3)	9 (13)	25 (1)
ELYCIN	2 (70)	—	—	—	10 (24)	18 (20)	—	5 (7)	—
ELYGLA	—	17 (10)	5 (1)	—	5 (1)	—	—	—	—
ELYMUS	2 (1)	—	—	—	—	—	—	2 (3)	—
ELYVIL	—	—	—	4 (40)	—	—	—	—	—
ELYVIR	—	—	5 (3)	20 (21)	—	—	—	2 (40)	—
FESIDA	—	50 (14)	—	—	2 (1)	—	—	2 (20)	—
FESOCC	2 (1)	—	—	—	—	—	—	—	—
FESRUB	—	—	—	—	2 (1)	—	—	—	—
GLYGRA	—	—	—	—	2 (1)	—	—	—	—
HORBRA	—	17 (20)	—	—	—	—	—	—	—
HORDEU	2 (1)	—	—	—	—	—	—	—	—
HORJUB	2 (1)	17 (3)	14 (5)	—	2 (1)	45 (17)	—	2 (10)	50 (2)

JUNART	—	—	5 (1)	—	2 (10)	—	—	—	—
JUNBAL	—	33 (1)	14 (22)	—	22 (12)	—	11 (2)	5 (8)	—
JUNCON	—	—	—	4 (3)	—	—	—	—	—
JUNCUS	—	17 (3)	—	—	—	—	—	—	—
JUNTEN	—	—	—	4 (1)	—	—	—	—	—
JUNTOR	—	—	—	—	—	—	—	2 (3)	—
KOECRI	5 (1)	17 (1)	—	—	—	—	11 (2)	2 (1)	—
MUHFIL	—	—	—	—	2 (1)	—	—	2 (1)	—
MUHRAC	9 (5)	17 (3)	—	8 (2)	19 (6)	—	—	9 (13)	—
ORYASP	—	—	5 (3)	—	—	—	—	—	—
ORYHYM	—	—	—	—	—	9 (1)	—	—	—
ORYMIC	—	—	—	24 (40)	—	—	—	2 (3)	—
PANCAP	2 (1)	17 (3)	—	—	—	—	—	—	25 (3)
PANVIR	—	—	—	—	—	—	6 (3)	—	—
PHAARU	—	—	5 (10)	—	7 (20)	—	—	2 (1)	25 (3)
PHLALP	—	—	—	—	2 (10)	—	—	—	—
PHLPRA	—	33 (22)	41 (6)	8 (17)	27 (20)	—	6 (3)	13 (9)	—
PHRAUS	—	—	—	—	—	—	—	2 (80)	—
POAARI	2 (20)	—	—	—	—	—	—	—	—
POABUL	5 (22)	—	—	—	—	—	—	—	—
POACOM	—	—	5 (10)	4 (30)	7 (4)	—	—	—	—
POAFEN	2 (3)	—	—	—	—	—	—	—	—
POAGLA	2 (1)	—	—	—	—	—	—	—	—
POAINT	5 (12)	—	—	—	—	—	—	—	—
POAJUN	—	—	—	—	—	9 (80)	—	—	—
POAPAL	5 (2)	17 (1)	27 (17)	4 (3)	22 (11)	—	—	4 (2)	—
POAPRA	35 (28)	67 (16)	50 (23)	40 (23)	49 (29)	45 (29)	94 (60)	60 (28)	—
POASAN	2 (20)	—	—	—	—	—	—	—	—
POAXXX	7 (7)	—	—	—	10 (8)	9 (20)	6 (1)	2 (20)	—
PUCNUT	2 (3)	—	—	—	—	9 (80)	—	—	—
SCHPUR	—	—	—	4 (3)	—	—	—	—	—
SCIACU	—	—	5 (1)	—	—	—	—	—	—
SCIAME	—	—	—	—	—	—	—	2 (3)	—
SCIPUN	—	—	—	4 (30)	—	—	—	2 (90)	25 (1)
SETVIR	2 (1)	17 (3)	—	—	2 (1)	—	—	—	—
SPAGRA	5 (1)	—	—	—	—	—	—	2 (3)	—
SPAPEC	7 (34)	—	—	—	—	—	—	—	25 (10)
SPOAIR	2 (3)	—	—	—	—	—	—	—	—
SPOCRY	7 (15)	—	—	—	—	—	—	—	—
STICOM	14 (9)	17 (1)	5 (40)	8 (12)	2 (1)	9 (3)	—	2 (1)	—
STIOCC	—	33 (2)	—	—	5 (1)	—	—	2 (3)	—
STIPAX	—	—	—	—	2 (1)	—	—	—	—
STIVIR	56 (11)	—	—	4 (1)	3 (2)	18 (3)	17 (3)	5 (1)	—
TRIWOL	—	—	—	—	2 (10)	—	—	—	—
Forbs									
ACHMIL	35 (5)	67 (1)	18 (5)	24 (4)	24 (4)	18 (10)	56 (12)	27 (3)	—
AGOGLA	2 (1)	—	—	—	2 (1)	—	—	—	—
AGRSTR	—	—	5 (3)	—	—	—	—	—	—
ALLCER	—	—	—	—	2 (1)	—	—	—	—
ALLGEY	—	17 (1)	—	—	—	—	—	—	—
ALLSCH	—	—	5 (3)	—	7 (4)	—	—	—	—
ALYALY	2 (1)	—	—	—	—	—	—	—	—
AMBPSE	—	—	—	—	3 (10)	—	—	—	—
AMBPSI	—	—	—	—	—	—	—	5 (9)	—
AMBTRI	—	—	—	—	—	—	—	2 (3)	—
ANAMAR	—	—	—	—	2 (1)	—	—	—	—
ANDOCC	—	17 (1)	—	—	—	—	—	—	—

ANECAN	—	—	—	—	—	—	17 (3)	—	—
ANECYL	—	—	—	8 (3)	—	—	—	2 (1)	—
ANGARG	—	17 (1)	5 (1)	—	5 (2)	—	—	—	—
ANTENN	—	—	—	—	—	—	6 (20)	—	—
ANTMIC	—	33 (1)	—	8 (1)	—	—	6 (3)	—	—
ANTPAL	—	—	—	—	—	—	—	2 (3)	—
APOAND	—	—	—	4 (40)	—	—	—	—	—
APOCAN	—	—	9 (10)	4 (3)	2 (3)	—	—	—	—
ARABIS	—	17 (1)	—	—	—	—	—	—	—
ARADRU	—	17 (1)	—	—	—	—	—	—	—
ARAGLA	—	—	—	—	2 (1)	—	—	—	—
ARCLAP	—	—	5 (1)	4 (1)	2 (20)	—	—	—	—
ARCMIN	—	—	—	12 (7)	—	—	6 (3)	—	—
ARNCHA	—	17 (1)	—	—	5 (8)	—	—	—	—
ARNFUL	—	—	—	—	2 (1)	—	—	—	—
ARNLAT	2 (1)	—	—	—	—	—	—	—	—
ARTCAM	—	—	—	—	2 (1)	—	—	—	—
ARTDRA	2 (1)	17 (3)	—	—	—	—	—	—	—
ARTLIN	—	—	5 (10)	—	7 (6)	—	—	—	—
ARTLUD	21 (10)	—	—	—	14 (1)	—	50 (7)	20 (7)	—
ASACAU	—	—	5 (1)	—	—	—	—	2 (1)	—
ASCSPE	2 (1)	17 (1)	5 (1)	—	8 (1)	—	—	4 (1)	—
ASCVER	—	—	—	—	3 (2)	—	—	—	—
ASPOFF	—	—	—	—	7 (1)	—	—	4 (1)	—
ASPPRO	—	—	—	—	2 (3)	—	—	—	—
ASTAGE	2 (1)	—	—	—	—	—	—	—	—
ASTAGR	—	—	—	4 (1)	—	—	—	2 (20)	—
ASTCHI	—	17 (1)	—	—	14 (4)	—	—	4 (3)	—
ASTCIL	—	—	5 (3)	—	—	—	—	—	—
ASTCON	—	—	5 (1)	—	—	—	—	—	—
ASTERI	2 (1)	—	—	—	—	—	—	—	—
ASTERX	2 (1)	—	—	—	7 (2)	9 (3)	—	—	—
ASTFAL	—	—	—	—	2 (1)	—	—	—	—
ASTFOL	—	33 (1)	—	—	3 (2)	—	6 (1)	—	—
ASTHES	—	—	—	—	2 (40)	—	—	—	—
ASTLAE	—	—	9 (5)	20 (1)	2 (3)	—	—	—	—
ASTMOD	—	—	5 (1)	—	—	—	—	2 (1)	—
ASTOBL	2 (1)	—	—	—	2 (1)	—	—	—	—
ASTOCC	—	17 (1)	—	—	8 (7)	—	—	4 (1)	—
ASTPAN	—	—	—	—	5 (1)	—	—	—	—
ASTRAG	—	—	—	—	2 (1)	—	—	2 (1)	—
BASHYS	5 (3)	—	—	—	—	—	—	—	—
CALSEP	2 (3)	—	—	4 (1)	3 (2)	—	—	2 (3)	—
CAMMIC	2 (1)	—	—	—	—	18 (3)	—	2 (1)	—
CAMROT	—	—	5 (1)	12 (1)	3 (1)	—	—	4 (1)	—
CARCAR	—	—	—	—	2 (3)	—	—	—	—
CARNUT	—	—	5 (1)	4 (1)	—	—	—	—	—
CASMIN	—	17 (1)	—	—	—	—	—	—	—
CENMAC	—	—	9 (15)	4 (1)	5 (5)	—	—	5 (10)	—
CERARV	—	17 (1)	—	—	2 (1)	—	—	—	—
CHEALB	5 (1)	—	—	8 (1)	3 (3)	9 (3)	11 (3)	5 (4)	—
CHECAP	—	—	—	—	—	—	6 (20)	—	—
CHEGLA	—	—	—	—	—	9 (1)	—	—	—
CHELEP	5 (1)	—	—	—	—	—	—	—	—
CHENOP	5 (2)	—	—	—	—	—	—	—	—
CHRLEU	—	—	—	—	—	—	—	2 (20)	—

CHRVIL	5 (1)	—	—	—	—	—	—	—	—
CICMAC	—	—	—	—	2 (3)	—	6 (1)	—	—
CIRARV	2 (3)	—	23 (4)	4 (1)	42 (8)	9 (20)	33 (14)	25 (9)	75 (9)
CIRCAN	—	—	—	—	3 (10)	—	—	—	—
CIRFLO	—	—	—	—	—	—	—	2 (3)	—
CIRSCA	—	33 (2)	—	—	2 (1)	—	—	—	—
CIRSIU	—	17 (1)	5 (1)	—	2 (1)	—	—	4 (1)	—
CIRUND	—	—	—	—	—	—	6 (3)	—	—
CIRVUL	2 (3)	—	5 (3)	—	—	—	—	—	—
COLLIN	—	17 (1)	—	—	2 (10)	—	—	—	—
CONARV	—	—	—	4 (1)	—	—	17 (3)	7 (1)	—
CONCAN	5 (2)	—	—	—	2 (1)	—	—	—	—
COPOCC	—	—	—	—	—	—	—	2 (1)	—
CORTIN	—	—	5 (1)	4 (50)	—	—	—	—	—
CORVIV	2 (1)	—	—	—	—	—	—	—	—
CRERUN	—	—	—	—	2 (1)	—	—	—	—
CYNOFF	5 (1)	—	—	4 (3)	8 (1)	—	6 (1)	2 (1)	—
DESPIN	—	17 (1)	—	—	—	9 (60)	—	—	—
DESSOP	2 (1)	—	—	4 (10)	—	—	—	2 (10)	—
DIAARM	—	—	—	—	—	—	—	2 (3)	—
DISTRA	—	—	—	16 (2)	—	—	—	—	—
ECHLOB	—	—	—	—	—	—	—	2 (1)	—
EPIANG	—	—	5 (1)	4 (1)	7 (6)	—	—	—	—
EPICIL	—	17 (1)	9 (1)	—	7 (1)	—	—	2 (1)	—
EPIGLA	—	—	5 (1)	—	—	—	—	—	—
EPILOB	—	—	5 (1)	—	—	—	—	—	—
EPIPAN	—	—	—	—	2 (1)	—	—	—	—
ERIGER	—	17 (1)	—	—	—	—	—	—	—
ERIOGO	—	—	—	—	—	—	—	2 (1)	—
ERISPE	—	—	—	—	2 (3)	—	—	—	—
ERISTR	2 (1)	—	—	—	—	—	—	—	—
ERIUMB	—	17 (1)	—	—	—	—	—	—	—
ERYCHE	—	—	—	—	2 (3)	—	—	—	—
EUPESU	2 (20)	17 (20)	5 (1)	—	2 (3)	—	—	2 (1)	—
EUPSPA	2 (1)	—	—	—	—	—	—	—	—
FILARV	—	—	—	4 (1)	—	—	—	—	—
FORBPE	—	—	5 (10)	—	—	—	—	—	—
FRAVES	—	—	9 (5)	8 (15)	—	—	—	2 (1)	—
FRAVIR	—	17 (40)	9 (1)	16 (2)	12 (12)	—	—	5 (2)	—
GAIARI	—	—	5 (20)	—	3 (2)	—	—	—	—
GALAPA	2 (1)	—	5 (3)	8 (3)	—	—	28 (20)	11 (1)	—
GALBOR	—	—	14 (7)	36 (12)	15 (7)	—	11 (12)	11 (11)	—
GALTRI	—	—	9 (1)	8 (1)	3 (1)	—	—	2 (1)	—
GAUCOC	12 (2)	—	—	—	—	—	—	—	—
GENAFF	—	17 (1)	—	—	—	—	—	—	—
GENAMA	—	—	—	4 (1)	—	—	—	—	—
GENTIA	—	17 (1)	—	—	—	—	—	—	—
GERANI	—	—	—	—	2 (20)	—	—	—	—
GERCAR	—	—	—	4 (3)	—	—	—	—	—
GERRIC	—	—	5 (1)	—	2 (10)	—	—	2 (1)	—
GERVIS	—	—	9 (1)	—	2 (1)	—	—	4 (1)	—
GEUMAC	—	33 (3)	14 (1)	—	14 (1)	—	—	4 (1)	—
GEUTRI	—	50 (8)	—	—	—	—	—	—	—
GLYLEP	14 (10)	17 (98)	5 (30)	4 (10)	19 (13)	—	33 (3)	16 (9)	—
GRISQU	9 (1)	—	—	—	2 (1)	9 (1)	—	—	50 (10)
HACDEF	—	—	—	12 (1)	—	—	11 (12)	2 (1)	—
HAPLAN	—	—	—	—	—	—	—	2 (20)	—

HEDHIS	5 (1)	—	—	—	—	—	—	—	—
HELAUT	—	—	—	—	3 (7)	—	—	—	—
HELNUT	—	—	—	—	5 (21)	—	—	2 (3)	—
HELPET	—	—	—	—	2 (1)	—	—	2 (1)	—
HELRIG	2 (1)	—	—	—	—	—	—	2 (1)	—
HERLAN	—	17 (1)	5 (10)	—	5 (4)	—	—	2 (1)	—
HEURIC	—	—	—	24 (2)	—	—	—	—	—
HUMLUP	—	—	5 (3)	—	2 (40)	—	—	2 (20)	—
HYPPER	—	—	—	4 (1)	—	—	—	2 (1)	—
IMPAUR	—	—	—	—	3 (2)	—	—	—	—
IRIMIS	—	—	—	—	5 (14)	—	—	—	—
KOCSCO	9 (1)	—	—	—	—	—	—	—	—
LACOBL	12 (5)	—	—	12 (2)	—	—	11 (3)	11 (11)	—
LACSER	—	—	9 (10)	—	7 (7)	9 (3)	—	2 (3)	—
LAPECH	2 (1)	—	—	—	—	—	—	—	—
LAPRED	2 (1)	—	—	—	—	—	—	—	—
LEPDEN	2 (1)	—	—	—	—	—	—	—	—
LEPIDI	2 (1)	—	—	—	—	—	—	—	—
LEPPER	7 (5)	—	—	—	—	—	—	—	—
LINPER	5 (2)	17 (1)	—	4 (1)	5 (1)	9 (1)	—	2 (3)	—
LINRIG	—	—	—	—	—	—	—	2 (1)	—
LINVUL	—	—	—	—	2 (1)	—	—	—	—
LITPER	—	—	—	—	5 (1)	—	—	—	—
LITRUD	—	—	—	—	2 (1)	—	—	—	—
LUPARG	—	—	—	—	—	—	6 (3)	—	—
LUPSER	—	—	—	—	2 (1)	—	—	—	—
LYGJUN	—	—	—	—	—	—	—	2 (3)	—
LYSCIL	—	—	9 (1)	—	3 (1)	—	—	—	—
MEDLUP	—	—	18 (2)	—	7 (5)	—	6 (1)	2 (3)	—
MEDSAT	2 (1)	—	14 (5)	—	3 (3)	—	—	2 (1)	—
MELALB	7 (4)	—	9 (7)	—	3 (2)	—	—	9 (10)	50 (3)
MELOFF	16 (1)	—	5 (3)	12 (4)	14 (1)	—	11 (3)	11 (24)	—
MENARV	—	—	5 (10)	—	15 (4)	—	—	—	—
MENNUD	2 (1)	—	—	—	—	—	—	—	—
MERCIL	—	17 (1)	—	—	—	—	—	—	—
MERTEN	—	—	—	—	—	—	—	2 (1)	—
MICROS	—	17 (1)	—	—	—	—	—	—	—
MONFIS	2 (1)	—	—	24 (3)	3 (1)	—	50 (9)	—	—
MONNUT	7 (2)	—	—	—	—	—	—	—	—
MYOARV	—	—	—	—	—	—	—	2 (3)	—
MYOSCO	—	—	—	—	2 (20)	—	—	—	—
NEPCAT	—	—	5 (1)	—	2 (1)	—	33 (6)	—	—
OENBIE	2 (1)	—	—	—	—	—	—	—	—
OENVIL	—	—	—	—	2 (3)	—	—	—	—
OPUFRA	5 (10)	17 (1)	—	—	—	—	—	—	—
OPUPOL	12 (5)	—	—	—	—	9 (20)	—	2 (1)	—
OSMCHI	—	—	5 (1)	—	2 (1)	—	—	—	—
OXASTR	—	—	—	16 (2)	—	—	—	—	—
OXYCAM	—	—	—	4 (1)	—	—	—	—	—
PARPEN	9 (2)	—	—	12 (3)	—	—	61 (30)	13 (7)	—
PENCON	—	—	—	—	3 (1)	—	—	—	—
PENPRO	—	17 (1)	—	—	—	—	—	—	—
PENSTE	—	—	—	—	2 (10)	—	—	—	—
PERGAI	—	17 (1)	5 (1)	—	—	—	—	—	—
PHYHET	—	—	—	—	2 (3)	—	—	—	—
PHYPAR	—	—	—	—	3 (2)	—	—	—	—

PLALAN	—	—	5 (10)	—	—	—	—	—	—
PLAMAJ	—	—	5 (3)	—	7 (3)	—	—	2 (20)	—
PLAPAT	2 (1)	—	—	—	—	—	—	—	—
PLAPRA	—	—	5 (20)	—	—	—	—	—	—
POLAMP	—	—	5 (1)	—	3 (1)	—	—	—	—
POLAVI	2 (1)	—	—	—	2 (1)	—	—	—	—
POLBIF	—	—	—	4 (3)	—	—	—	—	—
POLBIS	—	33 (1)	—	—	2 (1)	—	—	—	—
POLDOU	—	17 (1)	—	—	—	—	—	—	—
POLYGO	—	—	—	—	2 (1)	—	—	2 (3)	—
POTANS	—	—	5 (1)	—	10 (1)	—	—	2 (1)	—
POTGLA	—	—	—	—	2 (1)	—	—	—	—
POTGRA	—	67 (2)	9 (10)	4 (1)	15 (5)	—	6 (1)	4 (1)	—
PRUVUL	—	—	5 (1)	—	5 (4)	—	—	5 (30)	—
PSOARG	2 (1)	—	—	—	—	—	11 (3)	—	—
RANABO	—	—	—	8 (2)	—	—	—	—	—
RANREP	—	—	—	—	2 (10)	—	—	—	—
RATCOL	7 (1)	—	—	—	—	—	6 (3)	2 (1)	—
RORPAL	—	—	—	—	2 (1)	—	—	—	—
RUBPUB	—	—	—	—	3 (2)	—	—	—	—
RUMACE	—	—	—	—	2 (1)	—	—	—	—
RUMCRI	—	—	5 (1)	—	7 (3)	—	—	4 (1)	25 (3)
RUMEXX	—	—	—	—	—	—	—	2 (1)	—
RUMSAL	—	—	—	—	3 (2)	—	—	—	—
SALIBE	2 (20)	—	—	—	2 (1)	—	—	—	—
SANMAR	—	—	5 (1)	8 (3)	—	—	17 (3)	—	—
SAXORE	—	17 (1)	—	—	—	—	—	—	—
SCUGAL	—	—	—	—	2 (1)	—	—	—	—
SENECI	—	—	—	—	2 (1)	—	—	—	—
SENHYD	—	—	5 (10)	—	2 (3)	—	—	2 (20)	—
SENINT	—	17 (20)	—	—	3 (2)	—	—	—	—
SENPAU	—	—	—	—	2 (1)	—	—	—	—
SENPSE	—	—	5 (1)	—	7 (8)	—	—	—	—
SENSER	—	—	—	—	—	—	—	2 (3)	—
SENTRI	—	—	5 (1)	—	2 (1)	—	—	—	—
SILDOU	—	—	5 (1)	—	3 (2)	—	—	—	—
SISALT	5 (1)	—	—	—	5 (2)	—	—	4 (2)	—
SISIDA	—	—	5 (1)	—	—	—	—	—	—
SISLOE	5 (1)	—	—	4 (1)	3 (1)	—	—	4 (1)	—
SMIHER	—	—	—	16 (1)	—	—	—	—	—
SMIRAC	—	—	9 (1)	4 (1)	3 (2)	—	6 (3)	—	—
SMISTE	5 (1)	—	27 (2)	44 (9)	10 (1)	—	11 (3)	13 (1)	—
SOLCAN	2 (1)	—	9 (1)	8 (3)	20 (13)	—	—	7 (16)	—
SOLGIG	2 (1)	—	5 (10)	—	7 (5)	—	6 (30)	—	—
SOLIDA	—	—	—	—	—	—	6 (1)	—	25 (3)
SOLMIS	2 (3)	—	—	—	2 (1)	—	—	2 (1)	—
SOLMOL	2 (3)	—	—	—	—	—	—	—	—
SOLOCC	—	—	—	—	3 (20)	—	—	—	—
SOLRIG	2 (1)	—	—	4 (1)	—	—	6 (3)	—	—
SOLROS	—	—	—	4 (3)	2 (1)	—	—	—	—
SONARV	—	—	—	—	2 (80)	—	—	2 (20)	—
SONASP	—	—	—	—	—	—	—	4 (2)	—
SPHCOC	9 (2)	—	—	—	—	—	—	—	—
STAPAL	—	—	—	—	2 (1)	—	—	—	—
STELON	—	17 (1)	—	—	3 (7)	—	—	—	—
TANVUL	—	—	—	—	—	—	—	2 (3)	—
TARCER	—	—	—	—	2 (1)	—	—	—	—

TAROFF	19 (3)	67 (12)	18 (10)	40 (2)	15 (3)	9 (20)	28 (6)	16 (1)	—
THAALP	—	—	—	—	2 (1)	—	—	—	—
THADAS	2 (1)	—	—	8 (3)	—	—	—	2 (1)	—
THAFEN	—	—	—	—	2 (3)	—	—	—	—
THALIC	—	17 (1)	—	4 (1)	2 (1)	—	—	—	—
THAOCC	—	—	5 (1)	4 (1)	5 (4)	—	—	2 (1)	—
THAVEN	—	—	—	8 (1)	—	—	—	4 (1)	—
THEPAN	—	17 (1)	—	—	—	—	—	—	—
THERHO	—	—	—	4 (3)	—	—	—	2 (1)	—
THLARV	9 (5)	—	—	—	2 (1)	—	—	4 (2)	—
TRADUB	9 (2)	—	5 (1)	8 (2)	3 (1)	27 (2)	—	7 (1)	—
TRIAGR	—	—	5 (1)	—	—	—	6 (1)	2 (1)	—
TRIFOL	2 (1)	—	—	—	—	—	—	—	—
TRILON	—	—	—	—	3 (5)	—	—	—	—
TRIMAR	—	—	—	—	2 (1)	—	—	—	—
TRIPRA	—	—	—	4 (1)	2 (10)	—	—	4 (3)	—
TRIREP	—	17 (1)	5 (1)	—	5 (1)	—	—	2 (10)	—
TYPLAT	—	—	—	—	2 (3)	—	—	—	—
URTDIO	—	—	18 (4)	32 (4)	7 (1)	—	28 (3)	15 (11)	—
VACPYR	—	—	—	—	—	—	—	2 (1)	—
VERBLA	—	—	—	—	—	—	—	2 (1)	—
VEROFF	—	—	—	—	—	—	—	2 (3)	—
VERTHA	—	—	5 (1)	—	3 (1)	—	—	4 (1)	—
VICAME	21 (3)	—	—	4 (1)	3 (1)	—	17 (2)	5 (1)	—
VIOADU	—	—	—	8 (1)	—	—	—	—	—
VIOCAN	—	—	5 (3)	—	3 (3)	—	—	—	—
VIOLAX	—	—	—	—	3 (2)	—	6 (3)	—	—
VIONUT	—	—	—	4 (3)	—	—	—	7 (1)	—
VIOLAX	—	—	—	16 (1)	—	—	—	—	—
XANSTR	2 (1)	17 (20)	—	—	—	—	—	—	75 (8)
ZIZAUR	—	—	—	—	—	—	—	2 (1)	—
Ferns and Allies									
CYSFRA	—	—	—	4 (3)	—	—	—	—	—
EQUARV	—	—	—	—	5 (1)	—	—	2 (1)	—
EQUFLU	—	—	5 (1)	—	—	—	—	—	—
EQUHYE	—	—	—	—	3 (1)	—	—	2 (20)	—
EQULAE	—	17 (1)	—	—	10 (1)	—	6 (3)	5 (15)	—
EQUPAL	—	—	—	—	2 (1)	—	—	—	—
EQUPRA	—	—	5 (1)	—	2 (1)	—	—	2 (30)	—
EQUSYL	—	—	—	—	—	—	6 (1)	—	—
EQUVAR	—	—	—	—	3 (2)	—	—	—	—
POLYPO	—	—	—	20 (2)	—	—	—	—	—
PTEAQU	—	—	—	—	—	—	—	2 (3)	—

Appendix 21. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	CARAQU	CARAQU	CARLAS	CARLIM	CARNEB	CARROS	CARROS	CARROS	CARSCO
Phase	CARAQU H.T.	DESCES H.T.	H.T.	H.T.	C.T.	CARAQU H.T.	CARROS H.T.	DESCES H.T.	H.T.
No. Of Stands	39	29	32	15	7	45	142	46	20
Trees									
ABILAS	—	3 (10)	—	—	—	—	—	—	—
PICEAX	3 (1)	3 (1)	—	—	—	4 (2)	—	2 (1)	—
PINCON	—	—	—	—	—	—	1 (1)	—	5 (1)
POPTRE	—	—	—	—	—	—	—	2 (1)	—
Shrubs									
BERREP	—	—	—	—	—	—	—	2 (1)	—
BETGLA	8 (1)	7 (2)	—	27 (2)	—	4 (1)	—	—	—
CORSTO	—	—	—	—	—	2 (1)	—	—	—
GAUHUM	—	—	—	—	—	—	—	—	5 (1)
KALMIC	—	—	—	—	—	2 (1)	1 (1)	—	10 (1)
LEDGLA	—	3 (1)	—	—	—	—	—	—	5 (10)
LONINV	3 (3)	3 (1)	—	—	14 (3)	2 (1)	1 (1)	—	—
LONUTA	—	—	—	—	—	2 (1)	—	—	5 (1)
PHYEMP	—	—	—	—	—	—	—	—	5 (10)
POTFRU	15 (1)	14 (2)	6 (3)	20 (2)	—	7 (1)	1 (1)	4 (1)	—
RHAALN	—	—	—	—	—	—	—	2 (1)	—
RIBESX	—	—	—	—	—	—	1 (3)	—	—
RIBLAC	—	—	—	—	—	2 (1)	—	—	—
ROSACI	—	—	3 (3)	—	—	—	—	—	—
ROSAXX	3 (1)	—	—	—	—	—	—	—	—
ROSWOO	3 (1)	—	—	—	—	4 (7)	2 (1)	—	—
RUBPAR	—	—	—	—	—	—	—	2 (1)	—
SALBEB	3 (3)	3 (3)	3 (1)	—	—	4 (2)	2 (1)	4 (2)	—
SALBOO	5 (2)	3 (1)	—	—	—	7 (1)	2 (1)	2 (1)	—
SALCAN	5 (3)	7 (3)	6 (2)	20 (2)	—	7 (1)	1 (1)	—	—
SALDRU	3 (1)	3 (1)	—	7 (1)	—	4 (2)	1 (1)	4 (2)	—
SALEXI	—	7 (1)	3 (3)	—	—	—	1 (1)	2 (3)	—
SALGEY	10 (2)	3 (1)	—	—	—	7 (1)	2 (1)	7 (3)	—
SALIXX	—	—	—	—	—	—	—	2 (3)	—
SALLAS	—	7 (12)	—	—	—	—	—	—	—
SALLUT	3 (1)	—	3 (3)	—	—	7 (2)	1 (1)	2 (3)	—
SALPLA	10 (1)	10 (1)	3 (1)	7 (1)	—	18 (2)	2 (1)	—	10 (1)
SALPSE	—	—	—	—	—	—	—	—	5 (1)
SALWOL	5 (1)	7 (3)	—	—	—	—	1 (3)	2 (1)	5 (1)
SOLDUL	—	—	—	—	—	—	—	2 (1)	—
VACMEM	—	3 (1)	—	—	—	—	—	—	—
VACSCO	—	—	—	—	—	—	—	—	10 (1)
Graminoids									
AGRCAN	—	3 (1)	—	—	—	7 (1)	1 (1)	2 (1)	—
AGRDAS	—	—	—	—	—	—	1 (1)	—	—
AGRDIE	—	3 (20)	—	—	—	—	—	—	—
AGREXA	—	—	—	—	—	—	1 (1)	4 (2)	—
AGRHUM	3 (1)	—	—	—	—	—	—	—	15 (14)
AGROPY	—	—	—	—	—	—	1 (2)	2 (1)	—

AGROST	—	—	—	—	—	2 (1)	1 (1)	—	—
AGRREP	—	—	—	—	—	—	—	2 (1)	—
AGRSCA	—	3 (1)	—	—	—	7 (5)	3 (2)	13 (16)	25 (2)
AGRSMI	—	—	—	—	—	—	—	—	5 (1)
AGRSPI	—	—	—	—	—	—	—	4 (10)	—
AGRSTO	—	3 (1)	16 (13)	—	14 (10)	4 (2)	—	9 (14)	—
AGRTHU	—	3 (3)	—	—	—	2 (10)	—	—	25 (18)
ALOAEQ	—	7 (5)	—	—	—	—	2 (1)	4 (10)	—
ALOALP	—	10 (1)	—	—	14 (3)	7 (5)	1 (1)	9 (13)	10 (20)
ALOPRA	—	3 (1)	—	—	—	—	—	—	—
BECSYZ	—	7 (10)	—	—	—	2 (1)	4 (1)	9 (15)	—
BROCIL	8 (1)	—	3 (1)	—	—	11 (1)	3 (1)	7 (5)	5 (3)
BROINE	—	—	3 (10)	—	—	—	—	—	—
CALAMA	—	—	—	—	—	—	—	2 (60)	—
CALCAN	—	10 (5)	6 (1)	—	—	16 (9)	3 (1)	20 (27)	5 (20)
CALSTR	13 (2)	28 (16)	25 (7)	7 (3)	14 (1)	38 (10)	6 (1)	15 (7)	5 (1)
CARAMP	—	3 (1)	—	—	—	—	1 (20)	—	—
CARAPE	5 (94)	—	—	—	—	—	—	—	—
CARAQU	92 (58)	83 (49)	6 (12)	27 (8)	—	100 (32)	11 (2)	2 (3)	5 (1)
CARATH	—	—	3 (10)	—	—	2 (40)	12 (69)	20 (39)	—
CARATO	—	—	—	—	—	2 (1)	—	2 (1)	—
CARAUR	—	—	3 (1)	—	—	—	—	2 (1)	—
CARBEB	—	—	—	—	—	—	—	2 (20)	—
CARBRU	—	—	—	—	—	—	—	2 (10)	—
CARBUX	—	—	13 (33)	13 (5)	—	2 (20)	—	2 (30)	—
CARCAN	3 (3)	3 (1)	—	—	—	4 (15)	2 (20)	2 (10)	5 (1)
CARCAP	—	—	—	—	—	2 (1)	1 (1)	—	—
CARCRA	3 (3)	—	—	—	—	—	—	—	—
CARCUS	—	—	—	—	—	2 (3)	—	4 (10)	—
CARDIA	—	—	3 (1)	—	—	—	1 (3)	—	—
CARDIS	—	—	—	—	—	—	—	2 (1)	—
CARELE	—	—	—	—	—	—	—	—	5 (1)
CAREXX	—	7 (2)	—	—	—	—	1 (1)	2 (1)	—
CARFLA	—	3 (10)	3 (3)	—	—	—	—	—	—
CARHAY	—	3 (10)	—	—	—	—	—	—	—
CARHOO	—	—	—	—	—	—	—	2 (20)	—
CARIDA	3 (3)	—	—	—	—	—	—	—	—
CARILL	3 (1)	—	—	—	—	—	—	—	30 (18)
CARINT	—	—	9 (11)	7 (60)	—	—	1 (1)	7 (7)	—
CARLAN	3 (1)	—	53 (40)	7 (1)	—	7 (1)	2 (8)	9 (13)	—
CARLAS	3 (3)	—	44 (45)	13 (35)	—	—	2 (13)	—	—
CARLEN	3 (80)	10 (47)	—	—	—	—	1 (3)	2 (1)	—
CARLEP	3 (3)	—	—	—	—	—	1 (3)	—	—
CARLIM	5 (15)	—	9 (7)	100 (41)	—	—	1 (30)	2 (1)	—
CARLIV	—	3 (10)	6 (30)	20 (33)	—	2 (1)	—	—	—
CARLUZ	—	—	—	—	—	—	—	—	25 (14)
CARMIC	—	—	—	—	—	2 (1)	3 (10)	7 (7)	20 (2)
CARNEB	3 (40)	3 (1)	6 (40)	—	100 (76)	2 (3)	4 (19)	4 (2)	—
CARNIG	—	—	—	—	—	—	—	—	10 (20)
CAROED	—	3 (3)	6 (2)	13 (1)	—	—	—	—	—
CARPAC	—	3 (10)	—	—	—	—	1 (20)	—	10 (2)
CARPAU	—	—	3 (60)	—	—	—	—	—	—
CARPHA	—	—	—	—	—	—	—	—	5 (50)
CARPRA	3 (1)	7 (5)	6 (10)	—	14 (3)	—	1 (10)	2 (10)	—
CARPRT	—	—	—	—	—	2 (1)	1 (20)	—	—
CARROS	33 (9)	24 (10)	25 (6)	27 (11)	14 (1)	100 (45)	72 (63)	78 (42)	10 (15)
CARSAA	3 (30)	—	—	—	—	—	—	—	—

CARSAR	—	—	3 (30)	—	—	—	—	—	—
CARSCI	—	—	—	7 (3)	—	—	—	—	—
CARSCO	3 (1)	—	3 (20)	—	—	2 (1)	1 (10)	7 (4)	100 (33)
CARSIM	15 (27)	14 (15)	6 (1)	20 (8)	—	9 (13)	1 (20)	2 (1)	—
CARSTI	—	—	—	—	14 (1)	—	—	4 (5)	—
CARUNI	—	3 (1)	—	—	—	—	—	—	—
CARVES	10 (15)	—	6 (3)	—	—	11 (21)	28 (69)	20 (50)	—
CARVUL	—	—	—	—	—	—	—	2 (1)	—
DANINT	—	—	—	—	—	—	—	—	25 (6)
DESCES	28 (1)	59 (22)	22 (7)	7 (1)	—	49 (5)	7 (2)	33 (15)	90 (12)
DULARU	—	3 (30)	—	7 (1)	—	—	—	—	—
ELEACI	—	—	—	—	—	—	1 (3)	4 (20)	—
ELEOCH	—	—	—	—	—	—	1 (1)	—	—
ELEPAL	5 (40)	14 (4)	6 (20)	—	—	—	9 (9)	24 (13)	5 (1)
ELEPAU	5 (85)	3 (10)	3 (20)	20 (20)	—	2 (60)	2 (17)	—	50 (15)
ELYGLA	—	3 (20)	—	—	—	—	—	—	—
ERICHA	—	—	—	13 (1)	—	2 (10)	1 (20)	4 (5)	—
ERIPOL	—	—	3 (10)	—	—	—	1 (3)	—	—
ERIVIR	—	—	—	13 (2)	—	—	—	—	—
FESIDA	—	—	3 (1)	—	—	—	—	—	—
FESPRA	—	—	—	—	—	—	—	2 (10)	—
GLYELA	—	—	—	—	—	—	—	—	5 (1)
GLYGRA	—	—	3 (3)	—	—	4 (10)	5 (1)	15 (19)	—
GLYSTR	3 (1)	7 (10)	—	—	14 (1)	2 (1)	1 (1)	9 (1)	—
HIEODO	—	—	—	—	—	2 (10)	—	—	—
HORBRA	—	10 (5)	—	—	—	—	1 (3)	7 (2)	5 (1)
HORJUB	3 (1)	3 (3)	6 (1)	—	—	2 (3)	2 (1)	15 (8)	—
JUNALP	—	—	—	7 (1)	—	—	1 (3)	—	—
JUNART	—	—	—	—	—	—	1 (1)	7 (1)	—
JUNBAL	10 (2)	38 (14)	31 (19)	27 (12)	—	16 (11)	6 (3)	22 (27)	20 (6)
JUNBUF	—	—	—	—	—	—	1 (1)	—	—
JUNCUS	—	—	—	—	—	—	—	2 (3)	—
JUNDRU	—	—	—	—	—	—	—	—	15 (7)
JUNENS	—	3 (1)	3 (10)	—	—	—	—	4 (1)	10 (1)
JUNHAL	—	—	—	—	—	—	1 (3)	—	—
JUNLON	—	3 (1)	3 (10)	—	—	—	—	2 (1)	10 (1)
JUNMER	—	—	—	—	—	—	—	—	25 (12)
JUNNEV	—	—	3 (40)	—	—	—	—	—	—
JUNNOD	3 (1)	—	—	7 (1)	—	—	1 (60)	—	—
JUNREG	3 (10)	—	—	—	—	—	—	—	—
JUNTEN	—	—	—	—	—	—	—	9 (2)	—
JUNTRA	—	—	—	—	—	2 (1)	—	2 (60)	—
LUZCAM	—	—	—	—	—	—	—	—	20 (3)
LUZPAR	—	3 (1)	—	—	—	2 (1)	—	—	5 (1)
MUHAND	—	—	6 (1)	—	—	—	—	—	—
MUHFIL	3 (10)	3 (1)	6 (2)	—	—	2 (20)	—	2 (1)	—
MUHGLO	—	—	—	7 (3)	—	—	—	—	—
PHAAQU	—	—	—	—	—	—	1 (3)	—	—
PHAARU	—	—	6 (15)	—	14 (1)	—	4 (1)	11 (15)	—
PHLALP	5 (1)	14 (1)	—	—	—	—	—	2 (10)	50 (8)
PHLPRA	3 (1)	7 (15)	16 (16)	—	—	4 (15)	3 (1)	4 (12)	10 (1)
POACUS	—	3 (1)	—	—	—	2 (1)	—	2 (1)	—
POAGLA	—	—	—	—	—	—	—	—	5 (1)
POAGRA	—	—	—	—	—	—	—	—	10 (2)
POALEP	—	—	—	—	—	—	—	—	10 (2)
POAPAL	8 (2)	17 (37)	9 (14)	—	29 (2)	18 (6)	6 (4)	28 (30)	—

POAPRA	5 (1)	41 (6)	16 (13)	—	14 (3)	11 (2)	2 (2)	17 (8)	—
POAXXX	—	—	—	—	—	2 (1)	—	2 (20)	—
POLMON	—	3 (1)	—	—	—	—	—	—	—
PUCNUT	—	—	—	—	—	—	—	2 (90)	—
SCIACU	3 (3)	—	13 (5)	20 (53)	—	—	6 (13)	2 (1)	—
SCICYP	—	—	—	—	—	—	—	2 (10)	—
SCIMAR	—	—	—	—	—	—	1 (1)	—	—
SCIMIC	—	—	—	—	—	2 (20)	—	4 (2)	—
SCIPAL	—	—	3 (1)	—	—	—	1 (1)	—	—
SCIPUN	—	—	3 (40)	—	—	—	1 (50)	—	—
SCIVAL	—	—	—	—	—	—	1 (3)	—	—
SCOFES	—	—	—	—	—	—	1 (80)	—	—
SPAPEC	—	—	—	—	—	—	1 (10)	—	—
STIOCC	3 (1)	—	6 (10)	—	—	—	1 (3)	—	—
STIRIC	—	—	3 (3)	—	—	—	—	—	—
TRIWOL	8 (1)	7 (10)	3 (1)	—	—	4 (1)	—	4 (15)	20 (2)
Forbs									
ACHMIL	5 (1)	10 (8)	9 (1)	—	14 (1)	2 (1)	—	7 (7)	5 (1)
AGOGLA	3 (1)	—	—	—	—	—	—	—	5 (1)
AGOSER	—	—	—	—	—	—	—	2 (3)	—
ALITRI	—	—	—	—	—	—	1 (1)	4 (1)	—
ALLIUM	—	—	—	—	—	—	—	—	5 (1)
ALLSCH	3 (1)	—	9 (1)	13 (2)	—	—	1 (1)	2 (1)	—
ANEMUL	—	—	3 (1)	—	—	—	—	—	—
ANGARG	3 (1)	3 (1)	3 (1)	—	—	—	1 (1)	2 (1)	—
ANGELI	—	—	—	—	—	—	1 (1)	—	—
ANTANA	—	—	3 (1)	7 (1)	—	—	—	—	5 (10)
ANTCOR	—	3 (1)	—	—	—	—	—	—	5 (1)
ANTENN	—	—	3 (1)	—	—	—	—	—	—
ANTMIC	—	3 (3)	3 (1)	—	—	—	—	4 (2)	—
ANTUMB	3 (3)	—	—	—	—	2 (30)	—	2 (20)	15 (10)
APOCAN	—	—	—	—	—	—	—	2 (3)	—
AREMAC	—	3 (1)	—	—	—	—	—	—	—
ARNAMP	—	—	—	—	—	—	—	—	5 (1)
ARNCHA	8 (1)	7 (10)	3 (3)	—	—	9 (3)	1 (2)	—	—
ARNLON	—	—	—	—	—	—	—	2 (3)	—
ARNMOL	—	—	—	—	—	—	—	—	5 (1)
ARNRYD	—	—	—	—	—	—	1 (1)	2 (1)	—
ARTLUD	—	—	—	—	—	—	—	2 (1)	—
ASCSPE	—	—	—	—	—	—	—	2 (1)	—
ASTCAN	—	—	3 (3)	—	—	—	1 (1)	—	—
ASTCHI	8 (14)	3 (3)	6 (3)	—	—	7 (1)	1 (3)	9 (1)	—
ASTEAT	—	—	—	—	14 (3)	—	—	—	—
ASTERX	—	7 (12)	3 (3)	—	—	4 (1)	1 (1)	—	—
ASTFOL	3 (20)	7 (2)	9 (1)	—	—	4 (1)	—	2 (30)	20 (20)
ASTJUN	—	3 (1)	—	7 (1)	—	—	1 (1)	—	—
ASTLAE	—	—	3 (10)	—	—	—	—	2 (3)	—
ASTOCC	10 (4)	24 (4)	9 (11)	—	—	9 (5)	2 (1)	17 (9)	55 (8)
ASTSIB	—	3 (3)	—	—	—	—	—	—	—
ASTSUB	—	—	—	—	—	—	—	2 (1)	—
BIDCER	—	—	—	—	—	—	1 (3)	—	—
CALLEP	5 (7)	—	—	—	—	—	1 (10)	—	50 (29)
CAMQUA	—	—	—	—	—	—	—	—	5 (1)
CARBRW	—	—	—	—	—	2 (1)	—	—	—
CARDUU	—	—	—	—	—	—	—	2 (20)	—
CARPES	—	—	—	—	—	2 (1)	1 (2)	—	—
CASSUL	—	3 (1)	—	—	—	—	—	—	—

CENMAC	—	3 (1)	—	—	—	—	—	—	—
CHRLEU	—	3 (1)	—	—	—	—	—	2 (1)	—
CICMAC	3 (1)	—	3 (40)	—	—	—	4 (1)	9 (8)	—
CIRARV	3 (60)	—	6 (3)	—	14 (3)	7 (1)	1 (2)	15 (3)	—
CIRCAN	—	—	—	—	—	—	1 (3)	—	—
CIRSCA	3 (1)	—	6 (3)	—	—	2 (1)	—	2 (1)	5 (1)
COLLIN	—	—	—	—	—	2 (1)	—	—	—
DESPIN	—	—	—	—	—	4 (1)	—	—	—
DODECA	—	—	3 (1)	7 (1)	—	—	—	—	10 (2)
DODJEF	—	3 (1)	—	—	—	—	—	—	40 (23)
DODPUL	3 (1)	—	—	—	—	—	—	—	5 (3)
DRASTE	—	—	—	—	—	2 (1)	1 (1)	—	—
DROANG	—	—	3 (1)	—	—	—	—	—	—
DROLIN	—	—	6 (1)	7 (10)	—	—	—	—	—
ELONUT	—	—	—	—	—	—	1 (3)	—	—
EPIANG	—	3 (1)	—	—	—	9 (1)	2 (1)	—	—
EPICIL	18 (1)	3 (1)	13 (1)	—	29 (2)	38 (3)	19 (5)	30 (4)	25 (1)
EPIGLA	—	3 (1)	—	—	—	2 (1)	1 (1)	4 (1)	5 (10)
EPILOB	—	10 (1)	—	—	—	2 (1)	—	—	—
EPILON	—	—	—	—	—	2 (1)	—	—	—
EPIPAL	5 (2)	—	—	—	—	2 (1)	—	2 (1)	—
EPIPER	—	—	—	—	—	—	—	—	—
ERIPER	—	3 (1)	—	—	—	—	—	—	5 (1)
ERYCHE	3 (1)	3 (1)	—	7 (10)	—	2 (3)	—	—	—
FRAVES	—	3 (3)	—	—	—	—	—	—	—
FRAVIR	—	3 (1)	3 (1)	—	—	4 (1)	1 (2)	7 (10)	5 (3)
GALAPA	—	—	3 (1)	—	—	—	2 (1)	—	—
GALBOR	—	—	6 (1)	13 (2)	—	2 (1)	1 (1)	2 (1)	—
GALIUM	—	3 (1)	3 (1)	—	—	—	—	—	—
GALTRF	5 (1)	10 (1)	3 (1)	—	—	22 (2)	10 (3)	17 (4)	10 (1)
GALTRI	—	7 (1)	—	—	—	2 (1)	1 (1)	2 (1)	—
GALVER	—	—	—	—	—	—	—	2 (10)	—
GAUPAR	—	—	—	—	—	—	—	—	5 (1)
GENAFF	—	3 (1)	3 (1)	—	—	—	—	2 (1)	5 (3)
GENCAL	3 (10)	—	—	—	—	—	—	—	35 (13)
GENDET	—	—	9 (1)	—	—	—	1 (1)	2 (1)	—
GENTIA	—	3 (1)	—	—	—	—	—	—	—
GERANI	—	—	3 (1)	—	—	—	—	—	—
GERRIC	—	—	—	—	—	2 (1)	—	—	—
GERVIS	—	—	—	—	—	2 (1)	1 (1)	—	—
GEUALE	—	—	—	—	—	—	—	2 (1)	—
GEUMAC	21 (1)	31 (2)	6 (1)	—	29 (10)	24 (1)	8 (1)	22 (2)	10 (2)
GEURIV	—	—	—	—	—	—	1 (3)	2 (20)	—
GEUTRI	—	—	—	—	14 (20)	—	—	—	—
HABDIL	—	—	—	—	—	—	1 (1)	2 (1)	5 (3)
HABENA	—	—	3 (1)	—	—	—	—	—	—
HABHYP	—	3 (1)	—	7 (1)	—	—	—	—	5 (1)
HAPLAN	—	3 (1)	—	—	—	—	—	—	—
HELAUT	—	—	—	—	—	—	—	11 (1)	—
HELNUT	—	—	6 (10)	—	—	—	1 (3)	2 (1)	—
HERLAN	3 (3)	—	—	—	—	4 (2)	—	2 (1)	—
HIPVUL	—	—	—	—	—	—	4 (6)	—	—
HYPPER	—	—	—	—	—	—	—	2 (1)	—
IRIPSE	—	—	—	—	—	—	—	2 (3)	—
LACSER	—	—	—	—	—	—	—	2 (1)	—
LEMMIN	—	—	—	—	—	—	1 (5)	2 (3)	—

LEPVIR	—	—	—	—	—	—	1 (1)	—	—
LIGCAN	—	—	—	—	14 (1)	—	—	—	—
LIGTEN	3 (10)	—	—	—	—	2 (10)	1 (1)	2 (60)	40 (16)
LINPER	—	—	6 (2)	—	—	—	—	—	—
LYSCIL	—	3 (10)	—	—	—	—	1 (10)	7 (1)	—
LYSTHY	—	—	—	7 (1)	—	—	—	—	—
MEDLUP	—	—	—	—	—	—	—	2 (3)	—
MELOFF	—	—	3 (1)	—	—	—	—	—	—
MENARV	5 (12)	28 (5)	9 (5)	—	14 (40)	9 (4)	11 (8)	35 (6)	—
MENTHA	3 (3)	—	—	—	—	—	—	—	—
MENTRI	8 (2)	3 (20)	9 (8)	40 (13)	—	2 (10)	1 (3)	—	—
MERCIL	3 (1)	—	—	—	—	2 (3)	—	—	5 (1)
MICNIG	—	—	—	—	—	—	—	—	10 (1)
MIMGUT	—	—	—	—	—	2 (1)	—	7 (4)	—
MITBRE	—	3 (1)	—	—	—	—	—	—	—
MITELL	—	3 (3)	—	—	—	—	—	—	—
MYOLAX	—	—	—	—	—	—	1 (1)	7 (1)	—
MYOSCO	—	—	—	—	—	—	—	2 (20)	—
NASOFF	—	—	—	—	—	—	—	4 (1)	—
PARFIM	—	3 (10)	—	—	—	—	—	—	10 (15)
PARPAL	—	3 (1)	3 (1)	—	—	—	—	—	—
PEDGRO	5 (7)	7 (2)	3 (1)	—	—	2 (1)	1 (1)	7 (5)	50 (8)
PEDICU	—	—	—	—	—	—	1 (1)	—	—
PENRYD	—	7 (1)	—	—	—	4 (1)	—	—	—
PENPRO	—	—	—	—	—	—	1 (1)	2 (20)	—
PENRYD	3 (1)	—	—	—	—	—	—	2 (3)	—
PERGAI	—	—	3 (1)	—	—	2 (1)	—	—	5 (10)
PETSAG	—	—	—	—	—	4 (5)	—	2 (20)	—
PHYPAR	—	—	3 (1)	—	—	—	—	—	—
PLAERI	—	3 (1)	—	—	—	—	—	—	—
PLALAN	—	—	—	—	—	—	—	2 (1)	—
PLAMAJ	—	—	—	—	—	—	—	4 (2)	—
POLAMP	5 (3)	10 (1)	3 (1)	—	—	2 (1)	13 (12)	13 (7)	—
POLAUS	—	—	3 (1)	—	—	—	—	—	—
POLBIS	—	3 (1)	—	—	—	—	—	2 (1)	15 (2)
POLHYD	—	—	3 (3)	—	—	2 (10)	2 (1)	2 (1)	—
POLLAP	—	—	—	—	—	—	1 (3)	—	—
POLOCC	3 (1)	7 (1)	—	—	14 (1)	2 (1)	—	4 (15)	—
POLPER	—	—	—	—	—	—	—	2 (1)	—
POLPUL	—	3 (1)	—	—	—	—	—	—	—
POLPUN	—	—	—	—	—	—	—	4 (10)	—
POTANS	—	3 (20)	22 (12)	—	—	—	3 (2)	11 (7)	—
POTDIV	—	3 (1)	—	—	—	—	—	2 (3)	10 (1)
POTENT	3 (3)	—	—	—	—	—	—	2 (3)	—
POTFLA	—	—	—	—	—	—	—	2 (1)	—
POTGRA	8 (5)	28 (1)	9 (7)	—	—	7 (7)	5 (9)	7 (7)	—
POTGRM	—	—	3 (1)	—	—	—	1 (3)	—	—
POTPAL	—	3 (3)	13 (15)	13 (60)	—	7 (7)	8 (25)	4 (30)	—
POTPEC	—	—	—	—	—	—	1 (3)	—	—
POTRIV	—	—	—	—	—	—	1 (3)	—	—
PRUVUL	—	3 (1)	3 (1)	—	—	—	—	2 (1)	—
RANACR	—	3 (1)	—	—	—	—	—	—	—
RANALI	—	—	—	—	—	—	—	2 (10)	—
RANCYM	—	—	6 (10)	—	—	—	—	2 (3)	—
RANFLA	—	—	—	—	—	—	2 (28)	—	—
RANGME	—	—	—	—	—	—	1 (22)	2 (40)	—
RANMAC	—	—	3 (1)	—	—	—	1 (1)	—	—

RANNAT	3 (3)	—	—	—	—	2 (20)	—	—	—
RANREP	—	—	—	—	—	—	—	4 (1)	—
RANSCE	—	—	—	—	—	—	1 (1)	—	—
RANUNC	—	—	—	—	—	—	1 (1)	—	—
RORCUR	—	—	—	—	—	—	—	2 (20)	—
RORCUV	—	—	—	—	—	—	1 (1)	—	—
RORIPP	—	—	—	—	—	—	—	2 (10)	—
RORPAL	—	7 (5)	—	—	—	2 (1)	4 (1)	7 (1)	—
RORSYL	—	—	—	—	—	—	—	2 (10)	—
RUMCRI	8 (1)	10 (7)	3 (1)	—	14 (1)	—	3 (1)	13 (1)	—
RUMEXX	—	—	—	—	—	—	1 (1)	2 (1)	—
RUMMAR	—	—	—	—	—	—	1 (3)	2 (1)	—
RUMOCC	3 (1)	—	—	—	—	4 (2)	1 (1)	—	—
RUMSAL	—	7 (1)	—	—	—	2 (1)	—	2 (1)	—
SAGCUN	—	—	—	—	—	—	—	2 (3)	—
SAGLAT	—	—	—	—	—	—	1 (3)	—	—
SCHPAL	—	—	—	7 (10)	—	—	—	—	—
SCUGAL	—	—	6 (2)	—	—	4 (10)	—	4 (5)	—
SENCYM	5 (1)	3 (1)	—	—	—	—	1 (1)	—	45 (9)
SENFOE	—	—	—	—	—	2 (1)	1 (1)	2 (3)	—
SENHYD	5 (20)	10 (1)	3 (3)	—	—	18 (2)	4 (3)	2 (3)	—
SENINT	—	21 (9)	—	—	—	4 (2)	1 (1)	11 (9)	25 (9)
SENPSE	5 (3)	—	—	—	—	4 (1)	—	—	5 (1)
SENSER	—	—	—	—	—	—	1 (1)	—	—
SENSPH	—	—	—	—	—	—	—	—	10 (10)
SENTRI	—	3 (1)	—	—	—	2 (1)	—	2 (1)	30 (2)
SISALT	—	—	—	—	—	—	—	2 (1)	—
SISIDA	—	—	—	—	—	—	—	2 (1)	—
SIUSUA	—	3 (1)	—	—	14 (3)	4 (5)	6 (3)	7 (4)	—
SMIRAC	—	—	—	—	—	—	—	2 (1)	—
SMISTE	3 (1)	—	9 (1)	—	—	4 (1)	1 (1)	—	—
SPIROM	—	3 (1)	—	—	—	—	—	—	—
SOLCAN	5 (2)	—	6 (5)	—	—	13 (5)	3 (6)	—	—
SOLOCC	—	—	—	—	—	—	—	11 (2)	—
SONARV	—	—	—	—	—	—	—	2 (1)	—
SPAEME	—	—	—	—	—	—	—	2 (20)	—
SPIROM	3 (1)	—	—	—	—	2 (1)	—	2 (1)	25 (4)
STAPAL	—	—	—	—	—	—	1 (1)	2 (1)	—
STECAL	—	—	—	—	—	—	—	2 (3)	—
STELOG	—	—	—	—	—	—	—	—	5 (1)
STELON	3 (1)	14 (1)	—	—	—	7 (1)	1 (1)	4 (1)	—
STERUN	—	—	—	—	—	—	—	2 (1)	—
STEUMB	3 (3)	—	—	—	—	—	—	—	—
SWEPER	3 (10)	3 (10)	—	—	—	—	1 (1)	2 (1)	15 (7)
TARCER	—	3 (1)	—	—	—	—	—	—	—
TAROFF	15 (1)	14 (1)	9 (1)	—	14 (20)	7 (1)	4 (1)	11 (10)	5 (1)
THAFEN	5 (1)	3 (1)	—	—	—	4 (1)	—	—	—
THALIC	—	—	—	—	—	2 (1)	—	—	—
THASPA	—	3 (1)	—	—	—	—	—	—	—
THEPAN	—	—	—	—	—	—	1 (1)	—	—
THLARV	—	—	—	—	—	4 (1)	1 (3)	—	—
TOFGLU	3 (20)	—	—	—	—	—	—	—	25 (20)
TRIAGR	—	3 (1)	—	—	—	—	—	—	—
TRIHYB	—	—	—	—	—	—	—	—	5 (1)
TRILON	—	—	—	—	—	—	—	4 (5)	10 (1)
TRIMAR	5 (2)	3 (3)	13 (4)	20 (1)	14 (1)	2 (3)	1 (1)	4 (1)	—

TRIPAL	5 (1)	3 (1)	—	7 (1)	—	—	—	—	—
TRIPRA	—	3 (1)	—	—	—	—	1 (1)	—	—
TRIREP	—	3 (1)	—	—	—	2 (1)	1 (1)	2 (1)	—
TROLAX	—	—	—	—	—	—	—	—	20 (13)
TYPLAT	3 (1)	—	3 (1)	—	—	2 (3)	3 (21)	7 (14)	—
URTDIO	3 (40)	3 (10)	—	—	—	—	1 (1)	—	—
UTRMIN	—	—	—	—	—	—	1 (15)	—	—
VALEDU	3 (1)	3 (1)	—	—	—	4 (1)	1 (1)	—	—
VERAME	—	—	3 (1)	—	—	—	1 (1)	7 (4)	—
VERANA	—	—	—	—	—	—	—	2 (1)	—
VERBLA	—	—	—	—	—	—	—	2 (3)	—
VERCAT	—	—	—	—	—	4 (1)	1 (1)	—	—
VERCUS	—	—	—	—	—	—	—	—	5 (1)
VERONI	—	—	—	—	—	—	1 (1)	—	—
VERSCU	—	—	—	—	—	2 (1)	1 (2)	2 (1)	—
VERWOR	—	—	—	—	—	—	—	—	20 (1)
VIOLAX	8 (1)	10 (4)	3 (1)	—	—	11 (1)	1 (1)	4 (10)	25 (20)
VIONEP	—	—	—	7 (1)	—	—	—	—	—
VIOPAL	—	—	—	—	—	—	—	4 (10)	—
ZIGELE	—	—	—	7 (1)	—	—	—	—	—
Ferns and Allies									
EQUARV	—	3 (1)	3 (40)	—	29 (49)	11 (1)	5 (23)	11 (4)	10 (20)
EQUFLU	3 (20)	—	3 (10)	—	—	2 (20)	7 (19)	11 (6)	—
EQUHYE	—	—	—	—	—	2 (1)	—	4 (1)	—
EQULAE	—	7 (1)	16 (1)	—	—	4 (1)	4 (1)	2 (1)	—
EQUPRA	—	3 (1)	—	—	—	2 (1)	—	2 (1)	—
EQUVAR	—	3 (40)	3 (40)	—	—	—	1 (10)	—	—
LYCOPO	—	3 (10)	—	—	—	—	—	—	—

Appendix 22. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	CARSIM H.T.	AGRSMI H.T.	AGRSTO C.T.	BROINE C.T.	CALCAN H.T.	DESCES H.T.	DISSPI H.T.	ELEPAL H.T.	ELEPAU H.T.
No. Of Stands	18	32	1	2	39	35	21	57	18
Trees									
ABILAS	—	—	—	—	10 (1)	—	—	—	—
JUNSCO	—	9 (1)	—	—	—	—	—	—	—
PICEAX	—	—	—	—	10 (2)	3 (1)	—	—	—
PINCON	—	—	—	—	5 (1)	—	—	—	—
POPDEL	—	3 (10)	—	—	—	—	—	—	—
POPTRE	—	—	100 (1)	—	—	—	—	—	—
POPTRI	—	—	—	—	—	—	—	2 (1)	—
Shrubs									
ALNINC	—	—	—	—	5 (1)	—	—	—	—
ARCUVA	6 (1)	—	—	—	—	—	—	—	—
ARTCAN	—	34 (3)	—	—	—	—	—	—	—
ARTFRI	—	16 (1)	—	—	—	—	—	—	—
ARTTRI	—	13 (4)	—	—	—	—	5 (1)	—	—
BETGLA	28 (1)	—	—	—	—	—	—	2 (3)	11 (3)
CERLAN	—	6 (3)	—	—	—	—	—	—	—
CHRVIS	—	3 (1)	—	—	—	—	10 (1)	—	—
CLEMAT	—	3 (3)	—	—	—	—	—	—	—
CORCAN	—	—	—	—	3 (1)	—	—	—	—
CORSTO	—	—	—	—	3 (1)	—	—	—	—
CRACOL	—	3 (1)	—	—	—	—	—	—	—
GUTSAR	—	3 (1)	—	—	—	—	—	—	—
JUNCOM	—	—	—	—	3 (1)	—	—	—	—
KALMIC	—	—	—	—	—	—	—	—	11 (2)
LONINV	—	—	—	—	5 (1)	—	—	—	—
POTFRU	50 (1)	—	—	—	3 (1)	17 (2)	—	2 (3)	11 (1)
RHUARO	—	3 (3)	—	—	—	—	—	—	—
RIBESX	—	—	—	—	3 (1)	—	—	—	—
RIBSET	—	—	—	—	3 (1)	—	—	—	—
ROSAXX	—	—	—	—	—	—	—	2 (10)	—
ROSWOO	—	16 (2)	—	—	3 (3)	—	—	2 (1)	—
RUBIDA	—	—	—	—	3 (10)	—	—	—	—
SALBEB	—	—	—	—	3 (3)	3 (1)	—	2 (3)	—
SALBOO	—	—	—	—	5 (2)	3 (1)	—	—	—
SALBRA	6 (1)	—	—	—	—	—	—	—	—
SALCAN	39 (1)	—	—	—	—	—	—	2 (1)	11 (2)
SALDRU	6 (1)	3 (1)	—	—	5 (1)	—	—	—	—
SALEXI	—	3 (1)	—	—	—	3 (1)	—	4 (2)	—
SALGEY	17 (1)	—	—	—	3 (1)	3 (1)	—	—	—
SALLUT	11 (2)	—	—	—	—	3 (1)	—	4 (3)	—
SALPLA	28 (2)	—	—	—	—	3 (1)	—	—	6 (1)
SALPSE	—	—	—	—	3 (1)	—	—	—	—
SALSER	—	—	—	—	—	—	—	—	6 (1)
SALWOL	28 (1)	—	—	—	3 (1)	9 (2)	—	—	—
SARVER	—	3 (1)	—	—	—	—	10 (1)	—	—
SPIDEN	—	—	—	—	3 (1)	—	—	—	—
SYMOCC	—	31 (4)	—	—	—	—	—	—	—

SYMPHO	—	—	—	—	—	—	—	2 (3)	—
TAMCHI	—	6 (2)	—	—	—	—	—	—	—
VACOCC	—	—	—	—	—	—	—	—	6 (10)
Graminoids									
AGRCAN	6 (1)	3 (1)	—	—	—	17 (1)	—	—	—
AGRCRI	—	6 (5)	—	—	—	—	—	—	—
AGREXA	—	—	—	—	3 (20)	3 (1)	—	—	6 (1)
AGRHUM	—	—	—	—	—	3 (10)	—	—	—
AGRIDA	—	—	—	—	5 (1)	9 (1)	—	—	—
AGRINT	—	—	—	—	—	—	5 (10)	—	—
AGROPY	—	3 (3)	—	—	3 (1)	—	—	—	—
AGRREP	—	13 (11)	—	—	—	3 (20)	5 (10)	—	—
AGRSCA	6 (1)	—	—	—	13 (8)	17 (5)	—	2 (30)	11 (2)
AGRSCR	6 (20)	—	—	—	—	—	—	—	—
AGRSMI	—	100 (59)	100 (3)	—	—	3 (3)	5 (20)	4 (40)	—
AGRSPI	—	6 (1)	—	—	—	—	—	—	—
AGRSTO	6 (1)	16 (38)	100 (50)	—	3 (1)	—	—	9 (19)	17 (27)
AGRTHU	—	—	—	—	3 (1)	—	—	—	—
ALOALP	6 (3)	—	—	—	13 (9)	9 (4)	—	—	6 (3)
ALOAEQ	—	—	—	—	—	—	—	7 (18)	—
ALOCAR	—	6 (20)	—	—	—	—	—	—	—
ALOGEN	—	—	—	—	—	3 (10)	—	2 (3)	—
ALOPEC	—	—	—	—	3 (1)	3 (3)	—	—	—
ALOPRA	—	—	—	—	—	3 (1)	—	—	—
BECSYZ	—	—	—	—	—	—	—	19 (6)	—
BOUCUR	—	3 (1)	—	—	—	—	—	—	—
BOUGRA	—	6 (7)	—	—	—	—	—	—	—
BROCAR	—	—	—	—	—	3 (1)	—	—	—
BROCIL	—	—	—	—	13 (1)	6 (2)	—	—	—
BROINE	—	19 (10)	—	100 (40)	—	—	—	2 (1)	—
BROJAP	—	9 (1)	—	—	—	—	—	—	—
BUCDAC	—	3 (1)	—	—	—	—	—	—	—
CALCAN	—	—	—	—	54 (54)	3 (1)	—	—	6 (10)
CALLON	—	3 (1)	—	—	—	—	—	—	—
CALRUB	—	6 (27)	—	—	—	—	—	—	—
CALSTR	22 (1)	—	—	—	46 (55)	11 (1)	—	—	—
CARAQU	67 (13)	—	—	—	13 (11)	14 (9)	—	2 (1)	44 (9)
CARATH	—	—	—	—	8 (5)	3 (10)	—	2 (3)	—
CARATO	—	—	—	—	—	3 (20)	—	2 (60)	—
CARAUR	11 (2)	—	—	—	—	6 (5)	—	—	—
CARBRE	—	3 (1)	—	—	—	—	—	—	—
CARBRU	—	—	—	—	3 (10)	—	—	—	—
CARBUX	17 (5)	—	—	—	3 (3)	3 (1)	—	—	17 (8)
CARCAN	—	—	—	—	5 (2)	—	—	—	6 (1)
CARCAP	—	—	—	—	3 (3)	—	—	—	—
CARCON	—	—	—	—	—	3 (3)	—	—	—
CARCUS	—	—	100 (1)	—	—	—	—	—	—
CARDIA	6 (3)	—	—	—	—	—	—	—	—
CAREXX	—	—	—	—	—	3 (1)	—	—	—
CARFIL	—	3 (3)	—	—	—	—	—	—	—
CARHAY	—	—	—	—	3 (3)	—	—	—	—
CARHOO	—	—	—	—	3 (1)	—	—	—	—
CARILL	—	—	—	—	3 (3)	3 (3)	—	—	6 (60)
CARINT	6 (1)	—	—	—	3 (1)	—	—	—	—
CARLAN	11 (1)	—	—	—	3 (1)	6 (1)	—	—	—
CARLAS	6 (3)	—	—	—	3 (10)	—	—	—	—
CARLEN	—	—	—	—	8 (4)	—	—	2 (1)	—

CARLEP	—	—	—	—	—	—	—	2 (1)	—
CARLIM	6 (10)	—	—	—	10 (4)	3 (10)	—	—	11 (7)
CARLIV	17 (20)	—	—	—	—	—	—	2 (1)	11 (12)
CARLUZ	—	—	—	—	—	3 (10)	—	—	—
CARMIC	—	—	—	—	13 (7)	23 (2)	—	—	—
CARMUL	—	—	—	—	3 (1)	3 (10)	—	—	—
CARNEB	11 (3)	—	100 (20)	—	5 (15)	—	—	—	—
CARNOR	—	—	—	—	3 (3)	—	—	—	—
CAROED	17 (27)	—	—	—	—	—	—	2 (1)	6 (3)
CARPAC	—	—	—	—	3 (3)	11 (18)	—	—	6 (1)
CARPAU	6 (1)	—	—	—	—	—	—	—	6 (1)
CARPRA	—	—	—	—	—	11 (10)	—	—	—
CARPRT	—	—	—	50 (20)	—	3 (3)	—	2 (3)	—
CARROS	33 (11)	3 (1)	—	—	21 (4)	23 (3)	—	11 (7)	22 (8)
CARRUP	—	3 (3)	—	—	—	3 (3)	—	—	—
CARSCO	—	—	—	—	8 (7)	14 (2)	—	—	6 (20)
CARSCI	11 (1)	—	—	—	—	—	—	2 (1)	—
CARSIM	100 (57)	—	—	—	3 (1)	—	—	2 (1)	6 (1)
CARSTR	—	—	—	—	3 (10)	—	—	—	—
CARUNI	—	—	—	—	—	—	—	5 (33)	—
CARVES	—	3 (3)	—	—	5 (5)	11 (11)	—	9 (3)	—
DACGLO	—	6 (1)	—	—	—	—	5 (3)	—	—
DANCAL	—	—	—	—	—	3 (1)	—	—	—
DANINT	—	—	—	—	—	17 (12)	—	—	—
DESCES	67 (3)	3 (3)	—	—	28 (12)	100 (31)	—	12 (2)	33 (5)
DICACU	—	3 (3)	—	—	—	—	—	—	—
DISSPI	—	3 (10)	—	—	—	—	100 (58)	—	—
ECHCRU	—	3 (1)	—	—	—	—	—	—	—
ELEACI	—	—	—	—	—	—	—	26 (47)	—
ELEOCH	—	—	—	—	—	3 (1)	—	—	—
ELEPAL	—	—	—	—	—	—	—	84 (61)	—
ELEPAU	28 (12)	—	—	—	—	9 (5)	—	—	83 (45)
ELEROS	—	—	—	—	3 (98)	—	—	—	17 (92)
ELYCAN	—	9 (7)	—	—	—	—	—	—	—
ELYGLA	—	—	—	—	13 (7)	—	—	—	—
ERICHA	—	—	—	—	—	—	—	—	6 (10)
ERIPOL	17 (10)	—	—	—	—	—	—	—	—
FESIDA	—	3 (10)	—	—	—	3 (1)	—	—	—
FESOVI	—	—	—	—	—	3 (1)	—	—	—
FESPRA	6 (1)	6 (3)	100 (20)	—	—	—	5 (70)	—	—
FESTUC	—	—	—	—	—	3 (20)	—	—	—
GLYBOR	—	—	—	—	—	—	—	5 (5)	—
GLYCER	—	—	—	—	—	—	—	2 (1)	—
GLYELA	—	—	—	—	5 (10)	—	—	—	—
GLYGRA	—	—	—	—	—	—	—	7 (1)	—
GLYSTR	—	—	100 (1)	—	—	—	—	4 (20)	—
HIEODO	6 (1)	—	—	—	3 (1)	—	—	—	—
HORBRA	—	—	—	—	3 (3)	14 (13)	—	—	—
HORJUB	—	9 (1)	—	—	5 (12)	9 (3)	38 (16)	25 (11)	—
JUNALP	17 (1)	—	—	—	—	—	—	—	—
JUNART	—	3 (1)	100 (1)	—	—	3 (10)	—	2 (1)	—
JUNBAL	39 (21)	16 (5)	100 (20)	—	13 (23)	37 (28)	—	5 (18)	11 (32)
JUNCUS	—	—	—	—	3 (1)	—	—	2 (3)	—
JUNENS	—	—	—	—	3 (10)	—	—	—	—
JUNDRU	—	—	—	—	—	11 (4)	—	—	—
JUNHAL	—	—	—	—	3 (10)	—	—	—	—

JUNINT	—	—	—	—	—	—	—	2 (1)	—
JUNLON	—	—	—	—	—	—	—	2 (3)	—
JUNMER	—	—	—	—	3 (1)	—	—	—	—
JUNTEN	—	6 (3)	100 (10)	—	3 (1)	—	—	—	—
JUNTOR	—	—	—	—	—	—	—	—	6 (1)
JUNTRA	—	—	—	—	—	—	—	2 (60)	—
JUNTWE	—	—	—	—	3 (1)	—	—	—	—
KOECRI	—	—	—	—	—	6 (1)	—	—	—
LUZCAM	—	—	—	—	—	11 (3)	—	—	—
LUZPAR	—	—	—	—	5 (3)	—	—	—	—
LUZSPI	—	—	—	—	—	3 (1)	—	—	—
MELSUB	—	—	—	—	5 (1)	—	—	—	—
MUHAND	6 (1)	—	—	—	—	—	—	—	—
MUHASP	—	—	—	—	—	—	—	—	6 (1)
MUHFIL	28 (3)	—	—	—	3 (3)	11 (2)	—	—	—
MUHGLO	11 (2)	—	—	—	—	—	—	2 (3)	11 (2)
MUHRIC	6 (3)	—	—	—	—	—	—	—	—
PANVIR	—	3 (10)	—	—	—	—	—	—	—
PHAARU	—	—	—	—	—	3 (10)	—	7 (2)	—
PHLALP	6 (1)	—	—	—	10 (6)	34 (7)	—	—	11 (1)
PHLPRA	11 (1)	9 (1)	100 (10)	—	13 (5)	23 (13)	—	7 (1)	6 (3)
POAALP	—	—	—	—	—	3 (1)	—	—	—
POAARI	—	—	—	—	—	—	5 (1)	—	—
POABUL	—	3 (3)	—	—	—	—	—	—	—
POACOM	—	—	—	—	—	—	—	5 (11)	—
POACUS	—	—	—	—	—	—	—	2 (1)	—
POAGLA	—	3 (10)	—	—	—	—	—	—	—
POAGRA	—	—	—	—	—	6 (1)	—	—	—
POAINT	—	3 (1)	100 (10)	—	—	—	—	—	—
POALEP	—	—	—	—	—	3 (1)	—	—	—
POANEV	—	—	—	—	—	—	5 (10)	—	—
POAPAL	6 (1)	6 (1)	—	—	13 (20)	3 (1)	—	7 (20)	—
POAPRA	22 (1)	19 (14)	100 (10)	50 (1)	13 (5)	37 (13)	—	4 (10)	6 (1)
POAXXX	—	3 (20)	—	—	3 (1)	—	—	—	—
POLMON	—	—	—	—	—	—	—	—	11 (2)
PUCNUT	—	—	—	—	—	—	76 (31)	2 (60)	—
SCIACU	6 (3)	—	—	—	—	—	—	9 (1)	28 (2)
SCIAME	—	—	—	—	3 (3)	—	—	—	6 (3)
SCIMAR	—	3 (1)	—	—	—	—	—	2 (3)	—
SCIMIC	—	—	—	—	5 (1)	—	—	—	—
SCINEV	—	—	—	—	—	—	5 (40)	—	—
SCIPUN	—	6 (2)	—	—	—	—	5 (1)	—	—
SETVIR	—	3 (1)	—	—	—	—	—	—	—
SITHYS	—	—	—	—	—	—	5 (3)	—	—
SPAGRA	—	—	—	—	—	—	10 (20)	—	6 (1)
SPAPEC	—	9 (1)	—	—	3 (20)	—	—	—	—
STICOM	—	6 (2)	—	—	—	—	—	—	—
STIVIR	—	22 (6)	—	—	—	—	5 (1)	—	—
TRICAN	—	—	—	—	3 (20)	—	—	—	—
TRISPI	—	—	—	—	3 (1)	6 (1)	—	—	—
TRIWOL	—	—	—	—	15 (7)	11 (2)	—	—	—
Forbs									
ACHMIL	—	19 (2)	—	—	10 (1)	29 (4)	—	—	—
ACOCOL	—	—	—	—	3 (1)	—	—	2 (1)	—
ACTRUB	—	—	—	—	3 (1)	—	—	2 (1)	—
AGOGLA	—	—	—	—	—	3 (1)	—	—	—
AGOSER	—	—	—	—	—	3 (1)	—	—	—

AGRIMO	—	—	—	—	3 (1)	—	—	—	—
ALLGEY	—	—	—	—	3 (10)	3 (1)	—	—	—
ALLSCH	17 (1)	—	—	—	5 (3)	6 (5)	—	2 (10)	11 (1)
ALYALY	—	3 (10)	—	—	—	—	—	—	—
AMARAN	—	—	—	—	—	—	5 (3)	—	—
ANAMAR	—	—	—	—	3 (1)	—	—	—	—
ANGARG	—	—	—	—	8 (14)	—	—	—	—
ANTALP	—	—	—	—	—	3 (1)	—	—	—
ANTANA	11 (2)	—	—	—	—	3 (1)	—	—	—
ANTCOR	—	—	—	—	5 (10)	9 (8)	—	—	11 (5)
ANTMIC	6 (3)	—	—	—	5 (1)	6 (10)	—	—	—
ANTUMB	—	—	—	—	3 (1)	6 (15)	—	—	—
AQUILE	—	—	—	—	5 (2)	—	—	—	—
ARENUT	—	—	100 (1)	—	—	—	—	—	—
ARNCHA	—	—	—	—	5 (10)	9 (14)	—	—	—
ARNDIV	—	—	—	—	3 (20)	—	—	—	—
ARNICA	—	—	—	—	3 (20)	—	—	—	—
ARNMOL	—	—	—	—	5 (7)	3 (10)	—	—	—
ARNRYD	—	—	—	—	—	6 (1)	—	2 (1)	—
ARTDRA	—	3 (3)	—	—	3 (1)	—	—	—	—
ARTEAT	—	—	—	—	13 (3)	—	—	—	—
ARTLUD	—	13 (7)	—	—	—	—	—	—	—
ASTCHI	6 (1)	—	—	—	—	3 (40)	—	—	—
ASTEAT	—	—	—	—	—	3 (10)	—	—	17 (1)
ASTERX	—	—	—	—	3 (3)	6 (12)	5 (1)	2 (3)	—
ASTFOL	11 (1)	—	—	—	13 (7)	11 (18)	—	—	—
ASTJUN	17 (2)	—	—	—	—	—	—	2 (1)	11 (1)
ASTLAE	—	—	—	—	—	3 (20)	—	2 (3)	—
ASTMIS	—	—	—	—	3 (1)	—	—	—	—
ASTMOD	—	—	—	—	3 (1)	—	—	—	—
ASTOCC	6 (1)	—	—	—	21 (9)	51 (8)	—	—	17 (4)
ASTRAG	—	—	—	—	—	3 (1)	—	—	—
ASTSUB	—	—	—	—	8 (1)	—	—	—	—
CALHER	—	—	—	—	—	—	—	2 (1)	—
CALLEP	—	—	—	—	3 (1)	6 (30)	—	—	11 (5)
CAMQUA	—	—	—	—	5 (10)	3 (10)	—	—	—
CAPBUR	—	—	—	—	—	—	—	2 (1)	—
CARDUU	—	—	—	—	—	—	—	2 (20)	—
CENMAC	—	3 (1)	—	—	—	—	—	—	—
CERARV	—	—	—	—	3 (1)	—	—	—	—
CHEALB	—	—	—	—	—	—	5 (10)	—	—
CHELEP	—	3 (20)	—	—	—	—	—	—	—
CHENOP	—	—	—	—	—	—	5 (1)	2 (80)	—
CHEWAT	—	—	—	—	—	—	5 (1)	—	—
CHRLEU	—	—	—	—	3 (1)	—	—	—	—
CIRALP	—	—	—	—	3 (1)	—	—	—	—
CIRARV	—	19 (18)	—	—	8 (1)	6 (2)	—	4 (12)	—
CIRCAN	—	—	—	—	—	—	—	—	6 (1)
CIRHOO	—	—	—	—	—	3 (10)	—	—	—
CIRSCA	—	—	—	—	—	17 (3)	—	—	—
CIRVUL	—	9 (10)	—	—	—	—	—	2 (10)	—
CLEHIR	—	—	—	—	3 (20)	—	—	—	—
CONCAN	—	6 (12)	—	—	—	—	—	—	—
CORAUR	—	—	—	—	—	—	—	2 (3)	—
CORTIN	—	3 (3)	—	—	—	—	—	—	—
CORVIV	—	3 (1)	—	—	—	—	—	—	—

CRERUN	—	—	—	—	3 (1)	3 (1)	—	—	—
DALEAX	—	3 (1)	—	—	—	—	—	—	—
DELDEP	—	—	—	—	—	3 (1)	—	—	—
DESSOP	—	3 (1)	—	—	3 (1)	—	—	—	—
DODECA	6 (1)	—	—	—	3 (10)	20 (1)	—	—	—
DODJEF	—	—	—	—	3 (1)	—	—	—	6 (30)
DODPUL	11 (2)	—	—	—	8 (5)	—	—	2 (1)	6 (1)
ELONUT	—	—	—	—	—	—	—	2 (30)	—
EPIALP	—	—	—	—	3 (1)	—	—	—	—
EPIANG	—	—	—	—	5 (2)	—	—	—	6 (1)
EPICIL	28 (2)	3 (1)	—	—	33 (2)	17 (1)	—	5 (1)	6 (1)
EPIGLA	—	—	—	—	—	—	—	2 (1)	—
EPILOB	—	—	—	—	3 (1)	—	—	2 (3)	—
EPIPAN	—	3 (1)	—	—	—	—	—	—	—
ERIGER	6 (1)	—	—	—	—	—	—	—	—
ERILON	—	—	—	—	—	3 (1)	—	—	—
ERIPER	—	—	—	—	—	3 (1)	—	—	—
ERYCHE	—	—	—	—	—	3 (1)	—	—	—
ERYGRA	—	—	—	—	3 (3)	—	—	—	—
EUPESU	—	6 (1)	—	—	—	—	—	—	—
FRAVES	—	3 (1)	—	—	3 (1)	—	—	2 (1)	—
FRAVIR	—	—	—	—	10 (3)	11 (16)	—	—	—
GALAPA	—	3 (1)	—	—	5 (1)	—	—	—	—
GALBOR	6 (3)	—	—	—	—	9 (2)	—	—	6 (3)
GALIUM	—	—	—	—	5 (1)	—	—	—	—
GALTRF	11 (1)	—	—	—	3 (10)	6 (1)	—	2 (10)	—
GALTRI	—	—	—	—	10 (1)	—	—	—	—
GAUCOC	—	3 (1)	—	—	—	—	—	—	—
GENAFF	—	—	—	—	5 (1)	9 (1)	—	—	—
GENCAL	—	—	—	—	—	3 (10)	—	—	6 (10)
GENDET	11 (1)	—	—	—	—	3 (3)	—	—	—
GENTIA	11 (1)	—	—	—	—	—	—	—	6 (1)
GERRIC	—	—	—	—	13 (5)	—	—	—	—
GERVIS	—	—	—	—	3 (1)	—	—	—	—
GEUMAC	—	—	—	—	21 (2)	26 (5)	—	—	—
GEUMXX	—	—	—	—	3 (3)	—	—	—	—
GLYLEP	—	31 (16)	—	—	—	—	10 (12)	—	—
GRISQU	—	6 (2)	—	—	—	—	19 (2)	—	—
HABDIL	—	—	—	—	3 (3)	—	—	—	—
HABHYP	11 (1)	—	—	—	—	3 (1)	—	2 (1)	6 (1)
HABSAC	—	—	—	—	3 (1)	—	—	—	—
HAPLOP	—	—	—	—	—	—	5 (3)	—	—
HELAUT	—	3 (1)	—	—	—	3 (3)	—	2 (1)	—
HELNUT	6 (1)	—	—	—	3 (1)	—	—	—	11 (1)
HELPET	—	3 (1)	—	—	—	—	—	—	—
HELTUB	—	—	—	—	3 (60)	—	—	—	—
HERLAN	—	—	—	—	13 (13)	—	—	—	—
HIEGRA	—	—	—	—	3 (1)	—	—	—	—
HIERAC	—	—	—	—	—	3 (1)	—	—	—
HIPVUL	—	—	—	—	—	—	—	7 (10)	—
HYPPER	—	—	—	—	—	—	—	2 (1)	—
IRIMIS	—	—	—	—	—	3 (1)	—	—	—
LACOBL	—	9 (1)	—	—	—	—	—	—	—
LACSER	—	6 (20)	—	—	3 (3)	—	—	2 (20)	—
LIGCAN	—	—	—	—	3 (3)	—	—	—	—
LIGTEN	—	—	—	—	5 (25)	14 (11)	—	—	6 (20)
LIGUST	—	—	—	—	3 (30)	—	—	—	—

LINPER	—	3 (1)	—	—	—	—	—	—	—
LUPARG	—	—	—	—	5 (1)	—	—	—	—
LUPLEP	—	3 (1)	—	—	—	—	—	—	—
LUPSER	—	—	100 (3)	—	—	—	—	—	—
MEDICA	—	3 (50)	—	—	—	—	—	—	—
MEDLUP	—	6 (3)	—	—	—	—	—	—	—
MEDSAT	—	9 (10)	—	—	—	—	—	—	—
MELALB	—	9 (8)	—	—	—	—	—	2 (20)	—
MELOFF	—	13 (2)	—	—	—	—	—	—	—
MENARV	6 (1)	—	—	—	15 (6)	9 (1)	—	21 (3)	—
MENTRI	11 (5)	—	—	—	—	—	—	—	6 (1)
MERCIL	—	—	—	—	10 (1)	—	—	—	—
MICNIG	—	—	—	—	—	9 (10)	—	—	—
MICROS	—	—	—	—	—	3 (1)	—	—	—
MIMLEW	—	—	—	—	3 (1)	—	—	—	—
MIMPRI	—	—	—	—	—	—	—	—	6 (1)
MITELL	—	—	—	—	3 (1)	—	—	—	—
MITNUD	—	—	—	—	3 (1)	—	—	—	—
MONNUT	—	3 (1)	—	—		—	5 (1)	—	—
MYOLAX	—	—	—	—	—	—	—	2 (1)	—
MYOSCO	—	—	—	—	—	—	—	4 (5)	—
MYRSPI	—	—	—	—	—	—	—	4 (10)	—
NASOFF	—	—	—	—	—	—	—	2 (1)	—
NUPLUT	—	—	—	—	—	—	—	2 (1)	—
OENBRE	—	—	—	—	—	3 (1)	—	4 (2)	—
OPUPOL	—	13 (1)	—	—	—	—	—	—	—
ORTLUT	—	—	—	—	—	3 (1)	—	—	—
OSMCHI	—	3 (3)	—	—	—	—	—	—	—
PARFIM	—	—	—	—	13 (3)	—	—	—	—
PARNAS	11 (1)	—	—	—	—	—	—	—	6 (1)
PARPAL	11 (1)	—	—	—	—	—	—	—	11 (1)
PARPAR	6 (1)	—	—	—	—	—	—	—	—
PARPEN	—	3 (20)	—	—	—	—	—	—	—
PEDBRA	—	—	—	—	—	3 (1)	—	—	—
PEDGRO	11 (1)	—	—	—	18 (9)	26 (3)	—	—	17 (1)
PEDICU	—	—	—	—	3 (1)	6 (1)	—	—	—
PENPRO	—	—	—	—	—	6 (1)	—	—	—
PENRYD	—	—	—	—	3 (1)	6 (1)	—	—	—
PENSTE	—	—	—	—	—	3 (3)	—	—	—
PERGAI	—	—	—	—	—	3 (1)	—	2 (1)	—
PETSAG	—	—	—	—	—	6 (10)	—	—	—
PHYPAR	—	3 (1)	—	—	—	—	—	—	—
PLAMAJ	—	6 (2)	100 (3)	—	—	—	—	7 (5)	—
PLAPAT	—	3 (3)	—	—	—	—	—	—	—
PLASCO	—	3 (40)	—	—	—	—	—	—	—
POLAMP	—	—	—	—	5 (1)	—	—	9 (1)	—
POLAVI	—	—	—	—	—	—	—	2 (1)	—
POLBIS	—	—	—	—	3 (10)	26 (2)	—	—	—
POLHYD	—	6 (3)	—	—	—	—	—	2 (1)	—
POLLAP	—	—	—	—	—	—	—	2 (20)	—
POLRAM	—	6 (12)	—	—	—	—	—	—	—
POLVIV	6 (1)	—	—	—	—	—	—	—	—
POLYGO	—	3 (3)	—	—	—	—	—	—	—
POTANS	11 (1)	3 (1)	—	—	—	3 (3)	—	4 (20)	—
POTDIV	—	—	—	—	8 (1)	17 (5)	—	—	—
POTGRA	6 (3)	—	—	—	5 (1)	34 (2)	—	7 (4)	—

POTGRM	—	—	—	—	—	—	—	2 (20)	—
POTPAL	—	—	—	—	5 (15)	—	—	2 (3)	6 (1)
POTPAR	—	—	—	—	—	3 (1)	—	—	—
POTPEC	—	—	—	—	—	—	—	4 (10)	—
POTPUS	—	—	—	—	—	—	—	2 (10)	—
POTRIC	—	—	—	—	—	—	—	2 (1)	—
POTRIV	—	—	—	—	3 (1)	—	—	2 (3)	—
PRUVUL	—	3 (3)	100 (1)	—	—	3 (3)	—	2 (20)	—
PSOARG	—	3 (3)	—	—	—	—	—	—	—
RANAQU	—	—	—	—	—	—	—	4 (20)	—
RANCYM	6 (1)	—	—	—	—	—	—	—	—
RANFLA	—	—	—	—	—	—	—	5 (17)	—
RANREP	—	—	—	—	—	—	—	2 (1)	—
RANSCE	—	—	—	—	—	—	—	4 (1)	—
RANUNC	—	—	—	—	—	—	—	2 (3)	6 (1)
RANUNI	—	—	—	—	—	3 (1)	—	—	—
RATCOL	—	3 (1)	—	—	—	—	—	—	—
RORCAL	—	—	—	—	—	—	—	2 (1)	—
RORPAL	—	—	—	—	—	—	—	2 (3)	—
RORSYL	—	—	—	—	—	—	—	2 (30)	—
RUBPUB	—	—	—	—	3 (1)	—	—	—	—
RUMCRI	—	9 (1)	—	—	3 (1)	3 (3)	—	14 (14)	—
RUMEXX	—	3 (1)	—	—	—	—	—	—	—
RUMMAR	—	—	—	—	—	—	—	2 (10)	—
RUMOCC	6 (1)	—	—	—	—	—	—	—	—
RUMSAL	—	—	—	—	—	3 (3)	—	9 (2)	—
SALRUB	—	—	—	—	—	—	14 (3)	—	—
SAGCUN	—	—	—	—	—	—	—	7 (15)	—
SAGLAT	—	—	—	—	—	—	—	2 (1)	—
SAXFLA	—	—	—	—	—	3 (1)	—	—	—
SCUGAL	—	—	—	—	3 (3)	—	—	—	—
SEDSTE	—	—	—	—	—	3 (1)	—	—	—
SENCYM	—	—	—	—	3 (1)	6 (5)	—	—	28 (5)
SENECI	—	—	—	—	3 (1)	3 (1)	—	—	—
SENFOE	—	—	—	—	5 (12)	—	—	—	—
SENHYD	6 (3)	—	—	—	—	3 (3)	—	7 (26)	—
SENINT	—	—	—	—	10 (16)	29 (16)	—	—	—
SENPSE	—	—	—	—	5 (20)	—	—	—	—
SENSPH	—	—	—	—	3 (30)	—	—	—	—
SENTRI	—	—	—	—	28 (13)	3 (3)	—	—	—
SIBPRO	—	—	—	—	3 (10)	—	—	—	—
SISIDA	6 (1)	—	—	—	—	—	—	—	—
SISYRI	6 (1)	—	—	—	—	3 (1)	—	—	—
SIUSUA	—	—	—	—	—	—	—	2 (1)	—
SMISTE	—	—	—	—	5 (10)	—	—	—	—
SOLCAN	—	3 (1)	—	—	3 (3)	6 (10)	—	—	—
SOLMUL	—	—	—	—	—	3 (1)	—	—	—
SOLOCC	—	—	—	—	—	—	—	2 (1)	—
SONARV	—	—	—	—	—	—	—	2 (20)	—
SPAANG	—	—	—	—	—	—	—	2 (10)	—
SPAEME	—	—	—	—	—	—	—	7 (30)	—
SPHCOC	—	9 (1)	—	—	—	—	—	—	—
SPIROM	17 (1)	—	—	—	—	—	—	—	22 (1)
STAPAL	—	—	—	—	—	—	—	4 (1)	—
STELLA	—	—	—	—	8 (1)	—	—	—	—
STELON	6 (1)	—	—	—	5 (2)	11 (1)	—	—	—
STEOCC	—	—	—	—	3 (1)	—	—	—	—

SUADEP	—	—	—	—	—	—	29 (18)	—	—
SUAMOQ	—	—	—	—	—	—	5 (1)	—	—
SWEPER	6 (1)	—	—	—	—	3 (1)	—	—	11 (1)
TARAXA	—	3 (3)	—	—	—	—	—	—	—
TARCER	—	—	—	—	5 (1)	—	—	—	—
TAROFF	6 (1)	19 (1)	100 (20)	—	15 (1)	29 (5)	—	—	—
THAFEN	—	—	—	—	3 (1)	—	—	—	—
THALIC	6 (1)	—	—	—	—	3 (1)	—	—	—
THAOCC	—	—	—	—	3 (1)	—	—	—	—
THAVEN	6 (1)	—	—	—	5 (1)	—	—	—	—
THLARV	—	16 (9)	—	—	—	—	—	2 (3)	—
TRACAR	—	—	—	—	3 (1)	—	—	—	—
TRADUB	—	13 (1)	—	50 (1)	—	—	—	—	—
TRICON	—	—	—	—	—	—	5 (3)	—	—
TRIFOL	—	9 (12)	—	—	—	—	—	—	—
TRIHYB	—	—	—	—	—	3 (1)	—	2 (20)	6 (1)
TRILON	—	—	—	—	—	14 (1)	—	—	—
TRIMAR	39 (9)	—	—	—	—	3 (1)	10 (3)	4 (2)	33 (7)
TRIPAL	6 (1)	—	—	—	—	—	—	—	11 (1)
TRIPRA	—	3 (3)	100 (1)	—	—	—	—	—	6 (3)
TRIREP	—	3 (3)	100 (1)	50 (1)	3 (1)	3 (1)	—	2 (40)	11 (1)
TROLAX	—	—	—	—	3 (3)	3 (3)	—	—	—
TYPLAT	—	—	—	—	—	—	—	—	6 (1)
URTDIO	—	—	—	—	3 (1)	—	—	—	6 (1)
UTRICU	6 (1)	—	—	—	—	—	—	2 (10)	—
VALACU	—	—	—	—	3 (10)	—	—	—	—
VALEDU	11 (1)	—	—	—	—	11 (2)	—	—	—
VALOCC	—	—	—	—	3 (10)	—	—	—	—
VALSIT	—	—	—	—	3 (3)	—	—	—	—
VERANA	—	—	—	—	—	—	—	2 (1)	—
VERCUS	—	—	—	—	—	6 (1)	—	—	—
VERPER	—	—	—	—	—	—	—	2 (1)	—
VERSCU	—	—	—	—	3 (1)	—	—	—	—
VERSER	—	—	—	—	3 (1)	—	—	—	—
VERWOR	—	—	—	—	—	6 (1)	—	—	6 (1)
VERVIR	—	—	—	—	8 (2)	—	—	—	—
VERWOR	—	—	—	—	5 (1)	—	—	—	—
VICAME	—	19 (8)	—	—	—	—	—	—	—
VIOCAN	—	—	—	—	3 (1)	—	—	—	—
VIOLAX	11 (10)	—	—	—	26 (5)	6 (10)	—	—	6 (1)
VIOMAC	—	—	—	—	—	3 (1)	—	—	—
VIONEP	17 (1)	—	—	—	—	—	—	2 (1)	6 (1)
VIOORB	—	—	—	—	3 (1)	—	—	—	—
XANSTR	—	19 (7)	—	—	—	—	—	—	—
XERTEN	—	—	—	—	3 (1)	—	—	—	—
Ferns and Allies									
ATHFIL	—	—	—	—	3 (1)	—	—	—	—
BOTMUL	—	—	—	—	5 (2)	—	—	—	—
EQUARV	—	3 (3)	—	—	10 (4)	—	—	7 (8)	6 (1)
EQUFLU	—	—	—	—	—	—	—	7 (4)	—
EQUHYE	—	3 (1)	100 (20)	—	—	—	—	4 (25)	—
EQUISE	—	—	—	—	3 (1)	—	—	—	—
EQULAE	6 (1)	—	—	100 (7)	—	9 (1)	—	2 (3)	—
EQUPRA	—	—	—	—	10 (6)	—	—	—	—
EQUVAR	—	—	—	—	—	6 (50)	—	2 (3)	—
POLLON	—	—	—	—	3 (1)	—	—	—	—

Appendix 23. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	EQUFLU H.T.	GLYBOR H.T.	GLYLEP C.T.	HORJUB C.T.	JUNBAL C.T.	PHAARU H.T.	PHRAUS H.T.	POAPAL C.T.	POAPRA C.T.
No. Of Stands	16	9	3	11	9	26	5	4	12
Trees									
POPTRI	—	—	—	—	—	4 (1)	—	50 (5)	—
Shrubs									
ARTCAN	—	—	33 (1)	—	—	—	—	—	—
ARTFRI	—	—	—	9 (1)	—	—	—	—	—
ARTTRI	—	—	—	9 (1)	—	—	—	—	—
CHRVIS	—	—	—	9 (1)	—	—	—	—	—
CLEMAT	—	—	33 (3)	—	—	—	—	—	—
ROSNUT	—	—	—	—	—	4 (1)	—	—	—
ROSWOO	—	—	33 (1)	—	—	—	—	—	—
RUBIDA	—	—	—	—	—	4 (1)	—	—	—
SALEXI	—	—	—	—	—	12 (1)	—	—	—
SARVER	—	—	—	9 (1)	—	—	—	—	—
SOLDUL	—	—	—	—	—	4 (1)	—	—	—
SYMALB	—	—	—	—	—	4 (1)	—	—	—
SYMOCC	—	—	33 (3)	—	—	—	—	—	—
Graminoids									
AGRCAN	—	—	—	9 (3)	—	—	—	25 (3)	33 (2)
AGRDAS	—	—	—	—	22 (3)	—	—	—	—
AGRREP	—	—	—	—	11 (10)	4 (10)	—	50 (10)	17 (12)
AGRSCA	—	—	—	—	—	4 (1)	—	—	—
AGRSMI	—	—	67 (40)	—	—	—	—	—	—
AGRSPI	—	—	—	—	22 (7)	—	—	—	8 (3)
AGRSTO	—	—	—	9 (1)	22 (22)	15 (6)	—	25 (3)	25 (17)
ALOAEQ	—	22 (10)	—	—	—	—	—	—	—
ALOGEN	—	11 (1)	—	9 (3)	—	—	—	—	—
BECSYZ	—	—	—	—	11 (3)	8 (2)	—	—	—
BROCAR	—	—	—	—	—	—	—	—	8 (1)
BROINE	—	—	67 (45)	—	—	4 (20)	—	—	25 (18)
CALSTR	—	—	—	—	—	—	—	—	8 (1)
CARATH	—	—	—	—	—	—	—	25 (1)	8 (1)
CARBEB	—	—	—	—	—	8 (1)	—	—	—
CARCUS	—	—	—	—	—	—	—	—	8 (1)
CARDOU	—	—	—	—	11 (1)	—	—	25 (10)	—
CARLAE	—	—	—	—	—	—	20 (20)	—	—
CARLAN	—	—	—	—	22 (5)	—	—	—	—
CARMIC	—	—	—	—	—	—	—	—	8 (1)
CARNEB	—	—	—	—	—	—	—	—	8 (3)
CARPRA	—	—	—	—	11 (20)	—	—	—	8 (1)
CARPRT	—	—	—	—	—	—	—	—	8 (1)
CARROS	13 (2)	11 (1)	—	—	—	—	—	25 (3)	—
CARSIM	—	—	—	—	11 (3)	—	—	—	8 (1)
CARSTI	—	—	—	—	—	4 (1)	—	—	—
CARVES	6 (1)	11 (10)	—	—	—	15 (5)	—	—	—
CATAQU	—	—	—	9 (1)	—	—	—	—	—
DACGLO	—	—	—	—	—	—	—	—	8 (1)
DANCAL	—	—	—	—	—	—	—	—	8 (1)

DESCES	—	—	—	—	11 (1)	—	—	25 (3)	17 (3)
DISSPI	—	—	—	9 (20)	—	—	—	—	—
ECHCRU	—	—	—	—	—	4 (3)	—	—	—
ELEACI	6 (20)	22 (30)	—	—	—	—	—	—	—
ELEPAL	13 (7)	44 (30)	—	—	—	12 (11)	—	—	—
ELYCAN	—	—	33 (10)	—	—	—	—	—	—
GLYBOR	—	100 (48)	—	—	—	—	—	—	—
GLYELA	—	11 (20)	—	—	—	—	—	—	—
GLYGRA	19 (1)	11 (3)	—	—	—	—	—	—	—
HORBRA	—	—	—	—	11 (1)	—	—	—	—
HORJUB	—	—	—	100 (65)	44 (22)	4 (20)	—	25 (3)	8 (3)
JUNBAL	—	—	—	—	100 (70)	—	—	—	58 (30)
KOECRI	—	—	—	—	11 (1)	—	—	—	8 (1)
MUHASP	—	—	—	—	11 (1)	—	—	—	—
MUHFIL	—	—	—	—	11 (10)	—	—	—	—
PHAARU	6 (3)	—	—	—	11 (3)	100 (80)	—	25 (10)	—
PHLPRA	—	—	—	9 (3)	—	4 (1)	—	25 (1)	58 (8)
PHRAUS	—	—	—	—	—	—	100 (87)	—	—
POACOM	—	—	—	—	11 (10)	4 (20)	—	—	—
POAPAL	—	—	—	—	11 (3)	15 (13)	—	100 (53)	8 (20)
POAPRA	—	—	—	18 (12)	—	12 (5)	—	50 (20)	100 (66)
POLMON	—	—	—	—	11 (1)	—	—	—	—
PUCCUS	—	—	—	9 (3)	—	—	—	—	—
PUCNUT	—	—	—	18 (15)	—	—	—	—	—
SCIACU	—	—	—	—	—	4 (1)	—	—	—
SCIAME	—	—	—	—	11 (3)	—	—	—	—
SCIMAR	—	—	—	—	—	4 (1)	—	—	—
STIVIR	—	—	33 (3)	9 (1)	—	—	—	—	—
TRIWOL	—	—	—	—	—	—	—	—	17 (2)
Forbs									
ACHMIL	—	—	—	9 (1)	—	—	—	—	33 (6)
ACOCAL	—	—	—	—	—	4 (1)	—	—	—
AGOGLA	—	—	—	—	—	—	—	—	8 (3)
ALIGRA	—	—	—	—	—	4 (1)	—	—	—
ALLGEY	—	—	—	—	—	—	—	—	8 (1)
AMBPSI	—	—	—	—	—	4 (3)	—	—	—
APOCAN	—	—	—	—	—	15 (1)	—	—	—
ARNCHA	—	—	—	—	—	—	—	—	8 (20)
ASCLEP	—	—	33 (1)	—	—	—	—	—	—
ASTABO	—	—	—	9 (3)	—	—	—	—	—
ASTCHI	—	—	—	—	—	—	—	—	8 (1)
ASTERI	—	—	—	9 (1)	—	—	—	—	—
ASTERX	—	—	—	—	—	—	—	—	8 (3)
ASTHES	—	—	—	—	—	—	—	—	8 (3)
ASTMIS	—	—	—	—	—	—	—	—	8 (10)
ASTOCC	—	—	—	—	11 (10)	—	—	—	33 (1)
ASTPAN	—	—	—	—	—	—	—	—	8 (20)
BIDBEC	—	—	—	—	—	4 (3)	—	—	—
CENMAC	—	—	—	—	11 (1)	12 (1)	—	25 (1)	—
CERARV	—	—	—	—	—	—	—	—	8 (1)
CHEALB	—	—	—	9 (1)	—	4 (1)	—	—	—
CHENOP	—	—	—	18 (10)	—	—	—	—	—
CICMAC	13 (10)	—	—	—	—	—	—	—	—
CIRARV	—	—	—	—	11 (3)	8 (5)	20 (20)	25 (1)	33 (11)
CIRCAN	—	—	—	—	—	—	—	—	8 (40)
CIRSCA	—	—	—	—	11 (3)	—	—	—	25 (1)
CIRSIU	—	—	—	—	—	4 (1)	—	25 (3)	—

CIRVUL	—	—	—	—	11 (3)	—	—	—	8 (1)
CRERUN	—	—	—	—	—	—	—	—	8 (1)
DESPIN	—	—	—	9 (20)	—	—	—	—	—
DODECA	—	—	—	—	11 (3)	—	—	—	—
ELOCAN	6 (20)	—	—	—	—	—	—	—	—
EPICIL	—	11 (1)	—	—	11 (3)	4 (1)	—	—	8 (1)
EPIGLA	—	—	—	—	11 (20)	—	—	—	—
EPIPAL	—	—	—	—	—	4 (1)	—	—	—
ERIACR	—	—	—	—	11 (1)	—	—	—	—
EUPESU	—	—	—	—	—	4 (1)	—	25 (1)	—
FRAVIR	—	—	—	—	—	—	—	—	8 (1)
GALBOR	—	—	—	—	—	—	—	—	17 (1)
GALTRF	6 (10)	—	—	—	—	—	—	—	—
GERRIC	—	—	—	—	—	—	—	—	17 (1)
GERVIS	—	—	—	—	—	—	—	—	8 (3)
GEUMAC	—	—	—	—	—	—	—	25 (3)	—
GLYLEP	—	—	100 (57)	—	—	—	20 (20)	—	—
GRISQU	—	—	33 (1)	18 (2)	—	—	—	—	—
HELAUT	—	—	—	—	—	8 (1)	—	—	—
IRIMIS	—	—	—	—	11 (1)	—	—	—	33 (5)
LACSER	—	—	—	9 (3)	11 (10)	8 (10)	—	—	—
LEPDEN	—	—	—	—	—	4 (1)	—	25 (1)	—
LEPVIR	—	—	—	9 (1)	—	—	—	—	—
LINPER	—	—	—	—	—	—	—	—	8 (1)
LYSCIL	—	—	—	—	—	4 (1)	—	—	—
MEDLUP	—	—	—	—	—	—	—	—	8 (10)
MELALB	—	—	—	—	—	—	20 (20)	—	—
MENARV	6 (1)	—	—	—	22 (10)	23 (7)	—	—	8 (1)
MONNUT	—	—	—	9 (1)	—	—	—	—	—
MYOLAX	6 (1)	—	—	—	—	4 (1)	—	—	—
MYOSCO	—	—	—	—	—	4 (1)	—	—	—
NASOFF	—	11 (10)	—	—	—	—	—	—	—
NUPLUT	—	11 (3)	—	—	—	—	—	—	—
PHYPAR	6 (1)	—	—	—	—	—	—	—	—
PLAMAJ	—	—	—	—	—	—	—	—	8 (20)
POLAMP	6 (10)	—	—	—	—	4 (10)	—	25 (1)	8 (1)
POLLAP	—	—	—	—	—	8 (22)	—	—	—
POLRAM	—	—	—	9 (60)	—	—	—	—	—
POLYGO	—	—	—	—	—	4 (80)	—	—	—
POTANS	—	—	—	—	11 (10)	4 (1)	—	—	42 (7)
POTGRA	6 (10)	—	—	—	—	—	—	—	50 (4)
POTGRM	—	11 (3)	—	—	—	—	—	—	—
POTPAL	19 (7)	—	—	—	—	—	—	—	—
POTPAR	—	—	—	9 (60)	—	—	—	—	—
POTREC	—	—	—	—	—	4 (1)	—	—	—
RANAQU	—	11 (20)	—	—	—	—	—	—	—
RANCYM	—	—	—	—	11 (3)	—	—	—	—
RANFLA	—	44 (38)	—	—	—	—	—	—	—
RANNAT	—	—	—	9 (3)	—	—	—	—	—
RANSUB	6 (10)	—	—	—	—	—	—	—	—
RORCUR	—	11 (20)	—	—	—	—	—	—	—
RORPAL	—	—	—	—	—	8 (1)	—	—	—
RUMCRI	—	—	33 (3)	18 (2)	—	12 (7)	20 (20)	25 (1)	8 (1)
RUMEXX	—	—	33 (1)	—	—	4 (1)	—	—	—
RUMOCC	—	—	—	—	—	—	—	—	8 (1)
SAGCUN	—	—	—	—	—	4 (3)	—	—	—

SAGLAT	6 (3)	—	—	—	—	—	—	—	—
SALIBE	—	—	—	9 (20)	—	—	—	—	—
SALRUB	—	—	—	9 (3)	—	—	—	—	—
SCUGAL	—	—	—	—	—	8 (2)	—	—	—
SENHYD	—	—	—	—	11 (40)	—	—	25 (1)	8 (3)
SENINT	—	—	—	—	—	—	—	—	17 (20)
SENPAU	—	—	—	—	11 (1)	—	—	—	—
SISIDA	—	—	—	—	11 (1)	—	—	—	—
SMISTE	—	—	—	—	—	—	—	—	8 (1)
SOLCAN	—	—	—	—	—	—	—	—	25 (1)
SOLOCC	—	—	—	—	11 (50)	8 (2)	—	—	—
SPAEME	—	11 (20)	—	—	—	—	—	—	—
STAPAL	6 (1)	—	—	—	—	—	—	—	—
STELON	—	—	—	—	—	—	—	—	8 (1)
TANVUL	—	—	—	—	—	4 (10)	—	25 (10)	—
TARERI	—	—	—	—	—	—	—	—	8 (3)
TAROFF	—	—	33 (1)	—	—	—	—	—	42 (13)
THAFEN	—	—	—	—	—	—	—	—	8 (20)
THLARV	—	—	33 (3)	—	—	—	—	—	—
TRADUB	—	—	—	—	—	—	—	—	8 (1)
TRILON	—	—	—	—	—	—	—	—	8 (1)
TRIMAR	—	—	—	—	22 (7)	—	—	—	—
TRIPRA	—	—	—	—	—	—	—	—	8 (1)
TRIREP	—	—	—	—	—	—	—	—	17 (2)
VALERI	—	—	—	—	—	—	—	—	8 (1)
VERAME	—	—	—	—	—	8 (12)	—	—	—
VERANA	—	—	—	—	—	4 (3)	—	—	—
VERBRA	—	—	—	9 (3)	—	—	—	—	—
VERTHA	—	—	—	—	—	4 (3)	—	—	—
VICAME	—	—	33 (3)	—	—	—	—	—	8 (3)
VIOLAX	—	—	—	—	—	—	—	—	8 (40)
XANSTR	—	—	67 (2)	—	—	4 (80)	—	—	—
Ferns and Allies									
EQUARV	—	—	—	—	—	8 (10)	—	—	—
EQUFLU	100 (71)	—	—	—	—	8 (7)	—	—	—
EQUHYE	—	—	—	—	—	4 (1)	—	—	8 (1)
EQULAE	—	—	—	—	—	—	—	—	33 (1)
EQUPAL	—	—	—	—	—	4 (1)	—	—	—
PTEAQU	—	—	—	—	—	4 (10)	—	—	—

Appendix 24. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	POLAMP C.T.	SALRUB C.T.	SCIACU H.T.	SCIMAR H.T.	SCIPUN H.T.	SENTRI C.T.	SPAPEC H.T.	TYPLAT H.T.
No. Of Stands	5	4	58	5	18	7	19	82
Trees								
ABILAS	—	—	—	—	—	29 (1)	—	—
PICEAX	—	—	—	—	—	29 (1)	—	—
POPDEL	—	—	—	—	6 (1)	—	—	1 (3)
POPTRI	—	—	—	—	—	14 (1)	—	—
SALAMY	—	—	—	—	6 (1)	—	—	—
THUPLI	—	—	—	—	—	14 (1)	—	—
TSUHET	—	—	—	—	—	14 (3)	—	—
Shrubs								
BERREP	—	—	—	—	—	—	—	2 (1)
BETGLA	—	—	2 (3)	—	—	—	—	—
CORSTO	—	—	—	—	6 (1)	—	—	1 (3)
LONINV	—	—	—	—	—	29 (2)	—	—
POTFRU	—	—	3 (2)	—	—	—	—	2 (1)
PRUVIR	—	—	—	—	6 (1)	—	—	—
RIBESX	—	—	—	—	6 (3)	—	—	—
ROSWOO	—	—	—	—	6 (1)	—	5 (3)	—
RUBPAR	—	—	—	—	—	14 (1)	—	—
SALCAN	—	—	—	—	—	—	—	1 (3)
SALEXI	—	—	2 (1)	—	6 (3)	—	—	2 (3)
SALLAS	—	—	—	—	—	—	—	1 (3)
SALLUT	—	—	2 (1)	—	—	—	—	—
SALPLA	—	—	2 (1)	—	—	—	—	—
SOLDUL	—	—	—	—	—	—	—	1 (1)
SYMOCC	—	—	—	—	17 (4)	—	—	—
TAMCHI	—	—	—	—	—	—	5 (1)	—
VACGLO	—	—	—	—	—	14 (3)	—	—
Graminoids								
AGRHUM	—	—	—	—	—	14 (3)	—	—
AGROPY	—	—	—	—	11 (12)	—	—	—
AGROST	—	—	—	—	6 (20)	14 (1)	—	—
AGRREP	—	—	2 (40)	—	6 (40)	—	16 (2)	—
AGRSCA	—	—	—	—	—	—	5 (40)	—
AGRSMI	—	—	—	—	22 (4)	—	5 (20)	—
AGRSTO	—	—	2 (1)	—	—	14 (3)	—	—
ALOAEQ	—	—	—	—	—	—	—	1 (1)
BECSYZ	20 (20)	—	2 (1)	—	—	—	—	1 (3)
BROCAR	—	—	—	—	—	14 (3)	—	—
CALSTR	—	—	—	—	6 (3)	14 (1)	5 (3)	1 (1)
CARAEN	—	—	—	—	—	14 (1)	—	—
CARAQU	—	—	3 (2)	—	6 (3)	—	—	—
CARBUX	—	—	2 (20)	—	—	—	—	—
CARCAP	—	—	—	—	—	14 (20)	—	—
CARCUS	—	—	—	—	—	—	—	1 (1)
CAREXX	—	—	2 (1)	—	6 (1)	—	5 (3)	1 (1)
CARLAN	—	—	3 (10)	—	—	—	—	1 (1)
CARLIM	—	—	5 (10)	—	—	14 (1)	—	—

CARLIV	—	—	5 (2)	—	—	—	—	—
CARMIC	—	—	—	—	—	14 (1)	—	—
CARNEB	—	—	2 (3)	—	6 (3)	—	—	1 (3)
CARPRA	—	—	—	—	—	—	5 (80)	—
CARROS	—	—	5 (9)	—	11 (17)	—	—	4 (21)
CARSIM	—	—	3 (2)	—	—	—	—	—
CARSTI	—	—	—	—	—	—	—	2 (2)
CARVES	—	—	2 (1)	—	—	—	—	—
CINLAT	—	—	—	—	—	14 (1)	—	—
DISSPI	—	—	—	—	—	—	5 (1)	—
DULARU	—	—	2 (80)	—	—	—	—	—
ELEACI	—	—	2 (80)	—	6 (1)	—	—	—
ELEPAL	—	—	7 (15)	40 (12)	39 (37)	—	5 (20)	5 (5)
ELEPAU	—	—	7 (18)	—	—	—	—	—
ELEROS	—	—	2 (20)	—	—	—	—	—
ELYCAN	—	—	—	—	—	—	11 (1)	—
ELYGLA	—	—	—	—	—	43 (1)	—	—
FESPRA	—	—	—	—	—	—	—	1 (10)
GLYGRA	—	—	—	—	—	—	—	2 (2)
GLYSTR	—	—	—	—	—	14 (20)	—	1 (1)
HORJUB	20 (3)	50 (3)	3 (27)	20 (20)	39 (10)	—	26 (5)	1 (20)
JUNART	—	—	—	—	—	—	—	1 (1)
JUNBAL	—	—	5 (9)	—	22 (13)	—	5 (1)	—
JUNBUF	—	—	2 (10)	—	—	—	—	—
JUNNOD	—	—	—	—	6 (98)	—	—	—
JUNTOR	—	—	2 (3)	—	—	—	—	—
LUZHIT	—	—	—	—	—	14 (3)	—	—
LUZULA	—	—	—	—	—	14 (1)	—	—
MUHGLO	—	—	2 (1)	—	—	—	—	—
MUHRIC	—	—	—	—	—	—	5 (1)	—
PHAAQU	—	—	—	—	6 (3)	—	—	—
PHAARU	—	—	—	—	—	—	—	2 (15)
PHLALP	—	—	—	—	—	14 (1)	—	—
POAGLA	—	—	—	—	—	—	5 (1)	—
POAPAL	—	—	—	—	6 (3)	14 (1)	—	—
POAPRA	—	—	—	—	6 (20)	—	5 (1)	1 (10)
POLMON	—	—	2 (1)	—	6 (1)	—	—	—
PUCNUT	—	50 (3)	—	—	—	—	11 (40)	—
SCIACU	—	—	86 (65)	—	6 (10)	—	5 (20)	7 (11)
SCIAME	—	—	3 (65)	20 (60)	17 (53)	—	5 (70)	—
SCIMAR	—	—	—	100 (85)	17 (1)	—	—	—
SCIPUN	—	—	—	—	83 (71)	—	5 (3)	1 (50)
SCIRPU	20 (1)	—	—	—	—	—	—	—
SCIVAL	—	—	14 (73)	—	11 (2)	—	—	6 (31)
SITHYS	—	—	—	—	—	—	5 (3)	—
SPAGRA	—	—	—	—	—	—	42 (65)	—
SPAPEC	—	—	—	—	17 (11)	—	58 (79)	—
TRICAN	—	—	—	—	—	14 (10)	—	—
Forbs								
ALITRI	—	—	—	—	—	—	—	1 (1)
ALLSCH	—	—	2 (1)	—	—	—	—	—
AMBPSI	—	—	—	—	—	—	5 (3)	—
ANAMAR	—	—	—	—	—	14 (1)	—	—
ANEPAR	—	—	2 (1)	—	—	—	—	—
ANGDAW	—	—	—	—	—	29 (10)	—	—
ANGARG	—	—	—	—	—	14 (1)	—	—
APOAND	—	—	—	—	—	—	5 (20)	—

APOCAN	—	—	—	—	—	—	—	2 (3)
AQUFLA	—	—	—	—	—	43 (1)	—	—
ARCMIN	—	—	—	—	—	—	5 (1)	—
ARNAMP	—	—	—	—	—	14 (3)	—	—
ARNDIV	—	—	—	—	—	14 (3)	—	—
ARNLAT	—	—	—	—	—	29 (20)	—	—
ARNMOL	—	—	—	—	—	14 (3)	—	—
ARTLUD	—	—	—	—	—	—	5 (3)	—
ASCSPE	—	—	—	—	—	—	5 (20)	1 (3)
ASTBRA	—	—	2 (1)	—	—	—	—	—
ASTCHI	—	—	2 (1)	—	—	—	—	—
ASTERI	—	—	—	—	—	—	5 (20)	—
ASTFAL	—	—	—	—	6 (20)	—	5 (10)	—
ASTJUN	—	—	2 (1)	—	—	—	—	—
ASTOCC	—	—	—	—	—	14 (3)	5 (1)	—
ASTSIB	—	—	—	—	—	14 (3)	—	—
BASHYS	—	—	—	20 (1)	—	—	—	—
BUTUMB	—	—	—	—	—	—	—	2 (1)
CAMPAR	—	—	—	—	—	14 (1)	—	—
CARBRW	—	—	—	—	—	—	—	1 (20)
CASMIN	—	—	—	—	—	29 (3)	—	—
CERDEM	—	—	2 (1)	—	—	—	—	—
CERVUL	—	—	—	—	—	14 (1)	—	—
CHEALB	—	—	2 (1)	—	—	—	5 (3)	—
CHELEP	—	25 (3)	—	—	—	—	—	—
CHENOP	—	—	—	—	6 (1)	—	—	—
CICMAC	—	—	2 (1)	—	—	—	—	1 (20)
CIRALP	—	—	—	—	—	29 (10)	—	—
CIRARV	—	—	3 (1)	—	6 (1)	—	—	2 (2)
CIRVUL	—	—	3 (30)	—	—	—	—	—
DELNUT	—	—	—	—	—	14 (10)	—	—
DISTRA	—	—	—	—	—	14 (1)	—	—
DODPUL	—	—	2 (1)	—	—	14 (1)	—	—
ELOCAN	—	—	2 (30)	—	—	—	—	—
EPIALP	—	—	—	—	—	29 (1)	—	—
EPIANG	—	—	—	—	—	14 (1)	—	—
EPICIL	—	—	7 (1)	—	6 (20)	43 (1)	5 (3)	4 (15)
EPIGLA	—	—	—	—	—	—	—	1 (1)
EPIPAL	—	—	—	—	—	14 (1)	—	1 (1)
ERIACR	—	—	2 (1)	—	—	—	—	—
ERIGLA	—	—	2 (3)	—	—	—	—	—
ERYGRA	—	—	—	—	—	14 (1)	—	—
FLOPRO	—	—	—	—	—	—	—	1 (10)
FRAVIR	—	—	—	—	—	14 (1)	—	—
GALAPA	—	—	—	—	—	—	—	1 (1)
GALBOR	—	—	2 (1)	—	—	—	—	—
GALTRF	—	—	—	—	—	—	—	1 (1)
GALTRI	—	—	2 (10)	—	—	29 (5)	—	1 (1)
GENDET	—	—	2 (1)	—	—	—	—	—
GEUMAC	—	—	—	—	—	29 (1)	—	2 (2)
GLYLEP	—	—	—	20 (3)	17 (5)	—	26 (17)	—
GRISQU	—	—	—	—	6 (3)	—	—	—
HABSAC	—	—	—	—	—	14 (1)	—	—
HEDYSA	—	—	—	—	—	—	5 (1)	—
HELAUT	—	—	—	—	—	—	—	1 (1)
HELMAX	—	—	—	—	—	—	11 (50)	—

HELNUT	—	—	3 (1)	—	—	—	—	1 (1)
HERLAN	—	—	—	—	—	29 (2)	—	—
HIPVUL	—	—	—	—	—	—	—	2 (1)
HYPPER	—	—	—	—	—	—	—	1 (1)
IMPAUR	—	—	—	—	—	—	—	1 (1)
KOCSCO	—	—	2 (3)	—	—	—	—	—
LACSER	—	—	—	—	—	—	5 (1)	—
LEMMIN	—	—	5 (1)	—	—	—	—	9 (10)
LYCASP	—	—	2 (3)	—	—	—	—	—
LYSCIL	—	—	—	—	—	—	—	1 (1)
MELOFF	—	—	—	—	6 (3)	—	—	—
MENARV	—	—	12 (6)	—	17 (9)	—	11 (32)	9 (15)
MENTRI	—	—	5 (11)	—	—	—	—	1 (20)
MERCIL	—	—	—	—	—	14 (40)	—	—
MIMGUT	—	—	—	—	—	14 (60)	—	—
MIMMOS	—	—	—	—	—	14 (3)	—	—
MITELL	—	—	—	—	—	14 (1)	—	—
MYOLAX	—	—	—	—	—	—	—	4 (1)
MYRSPI	—	—	7 (15)	—	—	—	—	1 (1)
NAJFLE	—	—	3 (2)	—	—	—	—	—
NASOFF	—	—	—	—	—	14 (1)	—	1 (1)
NUPLUT	—	—	2 (30)	—	—	—	—	—
OSMCHI	—	—	—	—	—	29 (2)	—	—
PARFIM	—	—	—	—	—	43 (7)	—	—
PLAMAJ	—	—	—	—	—	14 (1)	—	—
POLAMP	100 (91)	—	9 (18)	—	—	—	—	7 (18)
POLPUN	—	—	3 (1)	—	—	—	—	1 (1)
POLRAM	—	25 (1)	2 (3)	—	—	—	—	—
POLYGO	—	—	2 (1)	—	—	—	—	—
POTAMO	—	—	3 (20)	—	—	—	—	1 (20)
POTANS	—	—	2 (1)	—	—	—	5 (1)	—
POTCRI	—	—	2 (3)	—	—	—	—	—
POTENT	—	—	2 (1)	—	—	—	—	—
POTFIL	—	—	2 (40)	—	—	—	—	—
POTFRI	—	—	2 (1)	—	—	—	—	—
POTGRA	—	—	7 (3)	—	—	—	—	—
POTGRM	—	—	2 (3)	—	—	—	—	—
POTNAT	—	—	2 (20)	—	—	—	—	—
POTPAL	—	—	2 (1)	—	—	—	—	5 (11)
POTPEC	—	—	3 (7)	—	—	—	—	—
POTPUS	—	—	—	—	—	—	—	1 (1)
POTRIC	—	—	5 (7)	—	—	—	—	—
POTZOS	—	—	2 (20)	—	—	—	—	—
PYRUNI	—	—	—	—	—	14 (3)	—	—
RANABO	—	—	—	—	6 (3)	—	—	—
RANAQU	—	—	2 (3)	—	—	—	—	2 (1)
RANFLA	—	—	—	—	—	—	—	1 (1)
RANMAC	—	—	—	—	—	—	—	1 (1)
RANUNC	—	—	—	—	6 (1)	—	—	—
RORPAL	—	—	—	—	—	—	—	2 (3)
RUMCRI	20 (3)	—	3 (5)	—	17 (1)	—	—	—
RUMMAR	—	—	2 (3)	—	—	—	—	—
RUMSAL	—	—	—	—	6 (1)	—	5 (3)	—
SAGLAT	—	—	3 (40)	—	—	—	—	1 (40)
SALRUB	—	100 (70)	—	—	—	—	—	—
SAXARG	—	—	—	—	—	14 (10)	—	—
SAXLYA	—	—	—	—	—	14 (20)	—	—

SCUGAL	—	—	—	—	—	—	—	2 (10)
SENTRI	—	—	—	—	—	100 (22)	—	—
SIUSUA	—	—	—	—	—	—	—	1 (20)
SMIRAC	—	—	—	—	—	14 (1)	—	—
SOLCAN	—	—	—	—	—	—	5 (20)	—
SOLGIG	—	—	—	—	—	—	—	1 (3)
SOLIDA	—	—	—	—	—	—	5 (1)	—
SOLOCC	—	—	—	—	—	—	—	1 (3)
SONARV	—	—	—	—	—	—	5 (1)	2 (2)
SONASP	—	—	—	—	6 (1)	—	5 (1)	—
SPAANG	—	—	—	—	—	—	—	1 (20)
SPIPOL	—	—	—	—	—	—	—	1 (1)
STEOCC	—	—	—	—	—	29 (2)	—	—
STRAMP	—	—	—	—	—	29 (1)	—	—
SUADEP	—	25 (20)	—	—	—	—	—	—
THAOCC	—	—	—	—	—	43 (5)	—	—
TIATRI	—	—	—	—	—	29 (10)	—	—
TRIMAR	—	—	12 (7)	—	—	—	—	1 (1)
TRIPAL	—	—	2 (1)	—	—	—	—	—
TROLAX	—	—	—	—	—	43 (2)	—	—
TYPANG	—	—	—	—	—	—	—	16 (91)
TYPLAT	—	—	7 (1)	—	11 (2)	—	—	84 (83)
URTDIO	—	—	5 (1)	—	—	—	—	—
URTICU	—	—	2 (20)	—	—	—	—	1 (3)
UTRVUL	—	—	3 (20)	—	—	—	—	1 (20)
VALACU	—	—	—	—	—	14 (1)	—	—
VALERI	—	—	—	—	—	14 (3)	—	—
VERAME	—	—	—	—	—	14 (3)	—	1 (3)
VERBLA	—	—	—	—	—	—	—	1 (3)
VERSTR	—	—	—	—	—	—	—	1 (20)
VERVIR	—	—	—	—	—	29 (5)	—	—
VIOGLA	—	—	—	—	—	14 (1)	—	—
VIOLAX	—	—	—	—	—	14 (1)	—	—
VIONEP	—	—	2 (1)	—	—	—	—	—
XANSTR	—	—	2 (30)	—	17 (12)	—	5 (1)	—
ZANPAL	—	—	2 (80)	—	—	—	—	—
ZIGELE	—	—	—	—	—	29 (1)	—	—
Ferns and Allies								
ATHFIL	—	—	—	—	—	14 (30)	—	—
EQUFLU	—	—	3 (7)	—	—	—	—	—
EQULAE	—	—	—	—	—	—	5 (3)	—
EQUPRA	—	—	—	—	—	14 (3)	—	—
GYMDRY	—	—	—	—	—	14 (10)	—	—
POLLON	—	—	—	—	—	14 (1)	—	—

GLOSSARY

Abandoned Meander Channel. A former stream channel that was cut off from the rest of the river and typically lacks year-long standing water.

Aerobic. Condition in which molecular oxygen is present in the environment.

Albic Soil Horizon. A mineral soil horizon of virtually clean sand and silt particles: clays and free iron oxides have been removed most commonly by leaching, leaving the soil horizon a whitish appearance.

Alfisols. A soil order composed of soils having significantly more clay in the B horizon than in the A horizon and high base status.

Alkaline. Water or soil with a pH greater than 7.4.

Alluvial Soil. Sediments (clay, silt, sand, gravel, cobbles, and boulders) deposited by running water, ordinarily occurring on floodplains and at the base of ridges and slopes.

Alluvial Terrace. Deposits of alluvial soil that mark former floodplains. Typically, a floodplain may have several sets of alluvial terraces at different elevations and of different ages (the higher the elevation, the older the age).

Alluvium. An accumulation of sediments deposited by streams or rivers.

Anaerobic. Condition in which molecular oxygen is absent from the environment. This commonly occurs in wetlands where soils experience prolonged saturation by water.

Andisols. Are dark mineral soils developed in volcanic ash, pumice, cinders, other volcanic ejecta or volcaniclastic materials.

Aqualfs. Soils with aquic conditions and having clay accumulating in the B horizon; wet Alfisols.

Aquatic Bed (Cowardin and others 1979). A ***class*** of wetland and deepwater habitat dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

Aquents. Soils with aquic conditions and lacking distinct soil horizons in the subsoil; wet Entisols.

Aquepts. Soils with aquic conditions and showing little soil development in the B horizon; wet Inceptisols.

Aquic Conditions. These soils experience continuous or periodic saturation and reduction. The presence of these conditions is indicated by redoximorphic features.

Aquic Moisture Regime (obsolete). A moisture condition associated with a seasonal reducing environment that is virtually free of dissolved oxygen because the soil is saturated by ground water or by water of the capillary fringe, as in soils in Aquic suborders and Aquic subgroups.

Argillic Soil Horizon. A soil horizon that shows evidence of movement or accumulation of silicate clays, and possesses a higher clay content than an overlying horizon.

Available Water Capacity. The ability of a soil to hold water in a form available to plants, expressed in inches of water per inch

of soil depth. Classes are (Youngblood and others 1985a):

Low	0 - 0.12
Moderate	0.13 - 0.17
High	> 0.17

Backwater Area. Seasonal or permanent water bodies found in the lowest parts of floodplains, typically circular or oval in shape.

Bars (Alluvial). Sediment accumulations along waterways deposited by moving water. Examples include: 1) point bars - bars that are formed on the inside of a meander channel, 2) side bars - bars that are formed along the edges of relatively straight sections of a river, 3) mid-channel bars - these are found within the channel and generally become more noticeable during low flow periods, and 4) delta bars - formed immediately downstream of the confluences of a tributary and the main river.

Beaver Dams. Dams built by beavers that span the stream channel. In general, water is still flowing through the riparian system.

Bog (Mitsch and Gosselink 1986). A sphagnum moss-dominated community whose only water source is rainwater. They are extremely low in nutrients, form acidic peats, and are a northern phenomenon generally associated with low temperatures and short growing seasons.

Browse. Shrubby and woody forage consumed by wildlife.

Calcic Soil Horizon. A subsurface soil horizon with an accumulation of carbonates.

Cambic Soil Horizon. An altered soil horizon that does not have the dark color, organic matter content, or structure of a histic, mollic, or umbric epipedon. Cambic horizons possess the following characteristics: 1) texture is very fine sand, loamy very fine sand, or finer, 2) soil structure or absence of rock structure in at least 1/2 of the horizon (by volume), 3) the alteration of soil color by the loss of carbonates or aquic conditions.

Canopy Coverage. The percentage of ground covered by the gross outline of an individual plant's foliage, or collectively covered by all individuals of a species within a stand or a sample plot.

Capillary Fringe. A zone immediately above the water table in which water is drawn upward from the water table by capillary action.

Carr. Wetland on organic soil with greater than 25 percent cover of shrubs; typically carrs are dominated by willows (*Salix* species).

Climax Community. Refers to the final or steady state plant community which is self-perpetuating and in dynamic equilibrium with its environment.

Colluvium. A deposit of unconsolidated geologic materials and soil accumulated at the base of slopes as a result of gravity.

Community (Plant Community). An assembly of plants living together, reflecting no particular ecological status.

Community Type. An aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. A unit of vegetation within a classification. ***For the purposes of this document, a community type represents seral vegetation, and is never considered to be climax.***

Constancy. The percentage of sampled sites occupied by a given species

Disclimax. Where recurring disturbances, such as grazing (e.g., zootic disclimax) or periodic burning (e.g., fire disclimax), exert the predominant influence in maintaining the structure and composition of the steady-state vegetation. Disclimaxes, such as the zootic climax or fire climax, are not the basis for recognizing habitat types.

Diversity. The kind and amount of species in a community per unit area.

Drained. A condition in which ground or surface water has been removed by artificial means.

Dominance Type (equivalent to cover type). An aggregation of all stands (individual plant communities), grouped and named simply by the species with the greatest canopy coverage in the overstory or upper layer. In this classification, canopy cover of dominant species is greater than 25 percent.

Emergent Plant. A rooted herbaceous plant species that has parts extending above a water surface.

Emergent Wetland (Cowardin and others 1979). A *class* of wetland habitat characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens

Entisols. A soil order including soils of slight or recent development; common along rivers and floodplains.

Ephemeral Stream. A stream or stretch of a stream that flows only in direct response to precipitation. It receives no water from springs and no long-continued supply from melting snow or other surface source. Its stream channel is at all times above the water table. These streams do not normally flow for 30 consecutive days.

Epipedon. Diagnostic soil horizons formed at the soil surface (e.g., argillic horizon).

Facultative Species. Plant species that can occur both in wetlands and uplands. There are three subcategories of facultative species: 1) facultative wetland plants, 2) facultative plants, and 3) facultative upland plants.

Facultative Plants (FAC). A plant species that is equally likely to occur in wetlands or nonwetlands (estimated probability 34-66 percent).

Facultative Upland Plants (FACU). A plant species that usually occurs in nonwetlands (estimated probability 67-99 percent), but occasionally found in wetlands (estimated probability 1-33 percent).

Facultative Wetland Plants (FACW). A plant species that usually occurs in wetlands (estimated probability 67-99 percent), but occasionally found in nonwetlands.

Fen (Mitsch and Gosselink 1986). A non-acidic peat-forming wetland that receives nutrients form sources other than precipitation, usually through groundwater movement.

Fibric Materials. Plant materials that show very little signs of decomposition. Plant fiber content before rubbing between fingers is at least 3/4 of the soil volume.

Fibrists. Organic soils (peats) in which plant remains show very little decomposition and retain original shape; more than 2/3 of the fibers remain after rubbing the materials between the fingers.

Flooded. A condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks and runoff from adjacent or surrounding slopes, or any combination of sources.

Floodplain. An alluvial plain caused by the overbank deposition of alluvial material. Typically appearing as flat expanses of land bordering a stream or river. Most floodplains are accompanied by a series of alluvial terraces of varying levels.

Fluvial. Pertaining to or produced by the action of moving water.

Forb. A herbaceous plant, usually broadleaved, that is not a graminoid.

Forested Wetland (Cowardin and others 1979). A *class* of wetland habitat characterized by woody vegetation that is 6 m (20 ft) tall or taller.

Forested Wetlands. Occur near springs and seeps and in areas with naturally high water tables, such as river floodplains. Two general types of forested wetlands occur in Montana: those dominated by coniferous tree species, and those dominated by deciduous angiosperm tree species.

Frequently Flooded. A class of flood frequency in which flooding is common during most years (more than a 50 percent chance of flooding in any year, or more than 50 times in 100 years).

Gallery Forest. A strip of forest confined to a stream margin or floodplain in an otherwise unforested landscape.

Gleization. A process in saturated or nearly saturated soils which involves the reduction of iron. This process tends to give gray colors (low chroma) to those parts of the soil from which the iron has been reduced or removed and rust colors (high chroma) to those where the iron has oxidized and accumulated.

Gleyed Soil (obsolete). A soil condition resulting from prolonged soil saturation, which is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks) among other colors. Gleying occurs under reducing soil conditions resulting from soil saturation, by which iron is reduced predominantly to the ferrous state. See also redox depletions.

Graminoid. Grass or grass-like plant, such as species of the Poaceae (grasses), Cyperaceae (sedges), and Juncaceae (rushes).

Ground Water. Water occupying the interconnected pore spaces in the soil or geologic material below the water table, this water has a positive pressure.

Growing Season. The portion of the year when soil temperatures are above biologic zero (41° F) as defined by *Soil Taxonomy*; the following growing season months are assumed for each of the soil temperature regimes: 1) thermic (February-October), 2) mesic (March-October), 3) frigid (May-September), 4) cryic (June-August), and 5) pergelic (July-August).

Habitat Type. The land area that supports, or has the potential of supporting, the same primary climax vegetation. A habitat type classification is a vegetation based ecological site classification. It is based on the potential of the site to produce a specific plant community (plant association). It has been used to classify grasslands, shrublands, woodlands, and forests throughout western United States.

Herbaceous. Nonwoody vegetation, such as graminoids and forbs.

Histic Epipedon. A 20 to 40 cm (8-16 in) soil layer at or near the surface that is saturated for 30 consecutive days or more during the growing season in most years and contains a minimum of 20 percent organic matter when no clay is present or a

minimum of 30 percent of organic matter when 60 percent or more clay is present; generally a thin horizon of peat or muck if the soil has not been plowed.

Histosols. A soil order composed of organic soils (peats and mucks) with generally greater than 50 percent organic matter in the upper 80 cm (32 in) or that are of any thickness if overlying rock.

Horizon. A distinct layer of soil, more or less parallel with soil surface, having similar properties such as color, texture, and permeability; the soil profile is subdivided into the following major horizons: 1) A horizon, a surface horizon characterized by an accumulation of organic material, 2) E-horizon, most commonly a surface horizon, characterized by leaching of organic material, iron, and clay, 3) B horizon, a subsurface horizon characterized by relative accumulation of organic matter, iron, clay, or aluminum, 4) C horizon, undisturbed, unaltered parent material.

***Hydric Soil (USDA SCS 1990).** A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile.

Hydrology. The science dealing with the properties, distribution, and circulation of water.

Hydrophyte. Any macrophytic plant that grows in water or on a substrate that is at least potentially deficient in oxygen as a result of excessive water content; plants typically found in wetland and other aquatic habitats.

Hydrophytic Vegetation. Plant life growing in water or on a substrate that is at least potentially deficient in oxygen as a result of excessive water content.

Inceptisols. A soil order composed of soils of intermediate development; morphological characteristics are generally too weak to meet requirements of other soil orders.

Incidental Type. Refers to a habitat type or community type that rarely occurs or occupies only a small area of a wetland zone.

Intermittent Stream. A stream or reach of stream which flows only at certain times of the year when it receives water from springs or from some surface source (e.g., melting snow). They are usually divided with respect to the source of their water into spring-fed or surface-fed intermittent streams. These streams generally flow continuously during periods of at least one month or more during the year.

Inundation. A condition in which water temporarily or permanently covers a land surface.

Irrigation Canal. Included all types of canals associated with irrigation systems.

Lacustrine System (Cowardin and others 1979). Any wetland or deepwater habitat with the following characteristics: 1) situated in a topographic depression or dammed river channel, 2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage, and 3) total area exceeds 8 ha (20 acres).

Lake. A natural topographic depression collecting a body of water covering at least 20 acres with surface water.

Lentic Wetland. See still water wetland.

Long Duration (flooding). A duration class in which inundation for a single event ranges from 7 days to 1 month.

Lotic Wetland. See riparian wetland.

Major Type. Refers to a habitat type or community type that occupies an extensive area within a wetland zone.

Marsh. A frequently or continually inundated wetland on often developing in shallow ponds, depressions, and river margins. Marshes are dominated by herbaceous plants, such as grasses (e.g., *Phragmites*), sedges, cattails (e.g., *Typha*), and bulrushes (e.g., *Scirpus*). Waters are usually neutral to basic.

Mineral Soil. Soils composed of predominantly mineral materials (sands, silts, and clays) instead of organic materials. The soil contains less than 20 percent organic matter.

Minor Type. Refers to a habitat type or community type that seldom occupies large areas but may be common within a wetland zone.

Mollic Epipedon. A surface layer that consists of mineral soil materials and have the following properties: 1) soil structure that is not both massive and hard or very hard when dry. 2) Munsell color value less than 3 moist and 5 dry, and chroma less than 3. 3) base saturation of at least 50 percent. 4) at least 1 percent organic matter throughout the horizon, 5) typically moist for at least 3 months in most years, and 6) at least 18 cm (7 in) thick.

Mollisols. A soil order including soils with a thick dark brown to black surface horizon (mollic epipedon), has a high base saturation, and a well-developed structure. Typically associated with grassland soils.

Monotypic Stands. Stands composed primarily of a single species.

Montane. That region between the subalpine zone and the grassland zone or more broadly, mountain slopes below the alpine zone.

Mottling (obsolete). Spots or blotches of different color or shades of color interspersed within the dominant color in a soil layer, usually resulting from the presence of periodic reducing soil conditions. See also redox concentrations.

Natric Horizon. A special kind of argillic horizon. Natric horizons have all the properties of argillic horizons but, in addition, are 15 percent or more sodium saturated. Their formation is favored where leaching results in the accumulation of sodium on the cation-exchange complex.

Nonhydric Soils. A soil that has developed under predominantly unsaturated soil conditions.

Nonpersistent Vegetation. Plants that break down readily after the growing season; no evidence of previous year`s growth at the beginning of the next grow season.

Nonwetland. Any area that has sufficiently dry conditions that hydrophytic vegetation, hydric soils, and/or wetland hydrology are lacking; it includes upland as well as former wetlands that are effectively drained.

Obligate Wetland Plant. Refers to a plant species that occurs almost always (estimated probability greater than 99 percent) under natural conditions in wetlands.

Organic Soil. Soils composed of primarily organic rather than mineral material. Equivalent to **Histosols** and includes peats and mucks.

Overbank Flooding. Any situation in which inundation occurs as a result of the water level of a river or stream rising above bank level.

Overflow Channel. An abandoned channel in a floodplain that may carry water during periods of high stream or river flows.

Oxbow Lake. A meander channel of a stream or river that is formed by breaching of a meander loop during flood stage. The ends of the cut-off meander are blocked by bank sediments.

Palustrine System (Cowardin and others 1979). Any nontidal wetland of a class dominated by trees, shrubs, persistent emergents, or emergent mosses or lichens

Parent Material. The unconsolidated and undeveloped mineral or organic matter from which the solum (soil) is developed.

Peraquic Moisture Regime. A soil condition in which reducing conditions always occur due to the presence of ground water at or near the soil surface.

Perennial Stream. A stream or reach of a stream that flows continuously. They are generally fed in part by springs; surface water elevations are commonly lower than water table elevations in adjacent soils.

Permanently Flooded. A water regime condition where standing water covers the land surface throughout the year (but may be absent during extreme droughts).

Permeability. The quality of the soil that enables water to move downward through the profile, measured as the number of cm (in) per hour that water moves downward through the saturated soil.

Phase. A subdivision of a habitat type or representing a characteristic variation in climax vegetation and environmental conditions.

Pioneer Species. Species that colonize bare areas (e.g., gravel bars) where there is little or no competition from other species.

Plant Association. Used to group together all those stands of climax vegetation which occur in environments so similar that there is much floristic similarity throughout all layers of the vegetation.

Playa. A periodically flooded wetland basin; common in parts of southwest Montana.

Pond. Bodies of water encircled by wetland vegetation. Wave action is minimal, allowing emergent vegetation to establish.

Ponded. A condition in which free water covers the soil surface, for example, in a closed depression; the water is removed only by percolation, evaporated, or transpiration.

Pooled Channel Stream. An intermittent stream with significant surface pool area and without flowing surface water. The water sources for the pools are springs within the channel.

Poorly Drained. Water is removed from the soil so slowly that the soil is saturated periodically during the growing season or remains wet for long periods (greater than 7 days).

Pothole. A depressional wetland community caused by glaciation and is common to portions of the Northern Great Plains. The body of water is less than 20 acres in size.

Primary Succession. Occurs on a bare surface not previously occupied by plants, such as a recently deposited alluvial bar.

Redox Concentrations. A redoximorphic feature characterized by zones in the soil of apparent accumulation of iron and manganese oxides. These may form as nodules, concretions, soft bodies, or pore linings and vary in shape, size, and color.

Redox Depletions. A redoximorphic feature characterized by zones in the soil of low chroma (less than 3) where iron and manganese oxides alone have been removed, or where both iron/manganese oxides and clay have been removed.

Redoximorphic Features. Soil features associated with wetness and are formed as a result of the reduction and oxidation of iron and manganese compounds in the soil following saturation with water and desaturation, respectively.

Reduced Matrix. A redoximorphic feature characterized by a soil matrix having low chroma (less than 3) in situ, but increases in hue or chroma when exposed (within 30 minutes) to air.

Reservoir. An artificial (dammed) water body with at least 20 acres covered by surface water.

Riparian Plant Association. A plant community representing the latest successional stage attainable on a specific, hydrologically influenced surface (equivalent potential natural community type).

Riparian Wetlands (Lotic Wetlands). Riparian wetlands are wetlands associated with running water systems found along rivers, streams, and drainageways. Such wetlands contain a defined channel and floodplain. The channel is an open conduit which periodically, or continuously, carries flowing water, dissolved and suspended material. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the riparian wetland.

Riparian or Wetland Ecosystem. The ecosystem located between aquatic and terrestrial environments. Identified by hydric soil characteristics and riparian or wetland plant species that requires or tolerates free water conditions of varying duration.

Riparian or Wetland Species. Plant species occurring within the riparian or wetland zone. Obligate riparian or wetland species require the environmental conditions associated with the riparian or wetland zone. Facultative riparian or wetland species are tolerant of these environmental conditions, but also occur in uplands.

Riparian Zone. A geographically delineated portion of the riparian ecosystem; equivalent to riparian area.

River. Rivers are usually larger than streams. They flow year around, in years of normal precipitation and when significant amounts of water are not being diverted out of them.

Riverbank. That portion of the channel bank cross-section that controls the lateral movement of water.

Riverine System (Cowardin and others 1979). Any wetland or deepwater habitat contained within a channel, with exception of wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens.

Salic Horizon. A mineral soil horizon 15 cm (6 in) or more thick enriched with secondary soluble salts.

Saline. Soil or water containing sufficient soluble salts to interfere with the growth of most plants.

Saturated. A soil condition in which all voids (pore spaces) between soil particles are filled with water.

Secondary Succession. The process of changing biotic communities that occurs following disturbances to a site that has previously been occupied by living organisms.

Seep. Groundwater discharge areas. In general, seeps have less flow than a spring.

Seral. Refers to vegetation that has not theoretically attained a steady state with its environment, and current populations of some species are being replaced by other species; a community or species that is replaced by another community or species as succession progresses.

Series. Refers to a group of habitat types having the same climax species.

Scrub-Shrub Wetland (Cowardin and others 1979). A *class* of wetland habitat which includes areas dominated by woody vegetation less than 6 m (20 ft) tall. It may include true shrubs, young trees, or trees or shrubs that are small or stunted because of environmental conditions.

Shrub. A multi-stemmed woody plant generally shorter than 4.8 m (16 ft).

Small Mountain Lake. A natural topographic depression collecting a body of water covering less than 20 acres with surface water.

Soil Series. A subdivision of a soil family and consists of soils that are similar in all major soil profile characteristics and arrangements.

Solum. The upper and most weathered part of the soil profile; the A and B horizons.

Somewhat Poorly Drained. Water is removed slowly enough that the soil is wet for significant periods during the growing season.

Spring. Groundwater discharge areas. In general, springs are considered to have more flow than seeps.

Stable Community. The condition of little or no perceived change in plant communities that are in relative equilibrium with existing environmental conditions; describes persistent but not necessarily climax stages in plant succession.

Stand. A plant community that is relatively uniform in composition, structure, and habitat conditions; a sample unit.

Stream. A natural waterway; defined as first to third order.

Streambank. That portion of the channel bank cross-section that controls the lateral movement of water.

Stream Order. A classification of streams according to the number of tributaries. Order 1 streams have no tributaries; a stream of order 2 or higher has 2 or more tributaries of the next lower order.

Still Water Wetlands (Lentic Wetlands). These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (e.g., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

Stockpond. An artificial (dammed) body of water of less than 20 acres covered by surface water.

Subterranean Stream. A stream that flows underground for part of the stream reach.

Succession. The change or sequence of plant, animal, and microbial communities that successively occupy an area over a period of time. Primary succession begins on a bare surface not previously occupied by living organisms, such as a recently deposited gravel bar. Secondary succession occurs following disturbances on sites that previously supported living organisms.

Swale. A depression or topographical low area.

Sward. An expanse of grass or grass-like plants.

Tree. Aa single-stemmed woody plant generally taller than 4.8 m (16 ft).

Unconsolidated Bottom (Cowardin and others 1979). A ***class*** of wetland or deepwater habitat with at least 25 percent cover of particles smaller than stones, and a vegetative cover less than 30 percent.

Unconsolidated Shore (Cowardin and others 1979). A ***class*** of wetland habitat having three characteristics: 1) unconsolidated substrates with less than 75 percent areal cover of stones, boulders, or bedrock, 2) less than 30 percent areal cover of vegetation other than pioneering plants, and 3) any of the following water regimes: irregularly exposed, regularly flooded, seasonally flooded, irregularly flooded, temporarily flooded, intermittently flooded, saturated, or artificially flooded.

Uplands. Any area that does not qualify as a wetland because the associated hydrologic regime is not sufficiently wet to elicit development of vegetation, soils, and/or hydrologic characteristics associated with wetlands. Such areas occurring in floodplains are more appropriately termed nonwetlands.

Very Long Duration (flooding). A duration class in which inundation for a single event is greater than 1 month.

Very Poorly Drained. Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season.

Water Mark. A line on vegetation or other upright structures that represents the maximum height reached during a flood, ponding or inundation event.

Water Regime (nontidal) (Cowardin and others 1979). Includes the following types: 1) permanently flooded - water covers the land surface throughout the year in all years. Vegetation is composed of obligate hydrophytes. 2) intermittently exposed - surface water is present throughout the year except in years of extreme drought. 3) semipermanently flooded - surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface. 4) seasonally flooded - surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the soil surface. 5) Saturated - the substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present. 6) temporarily flooded - surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Plants that grow both in uplands and wetlands are characteristic of the temporarily flooded regime. 7) intermittently flooded - the substrate is usually exposed, but surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation. The dominant plant communities under this regime may change as soil moisture conditions change. Some areas exhibiting this regime may not fall within the wetland definition because they do not have hydric soils or support hydrophytic plants.

Water Table. The upper surface of the zone of saturation within the soil or geologic material.

Wet Meadow. A herbaceous wetland on mineral soil. Generally, wet meadows occur in seasonally flooded basins and flats. Soils

are usually dry for part of the growing season.

Wetlands. Areas that under normal circumstances have hydrophytic vegetation, hydric soils, and wetland hydrology. It includes landscape units such as bogs, fens, carrs, marshes, and lowlands covered with shallow, and sometimes ephemeral or intermittent waters. Wetlands are also potholes, sloughs, wet meadows, riparian zones, overflow areas, and shallow lakes and ponds having submerged and emergent vegetation. Permanent waters of streams and water deeper than 3 m (approximately 10 ft) in lakes and reservoirs are not considered wetlands.

***Wetland Hydrology.** Permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the soil.

Wetland Status. Refers to to plant species that have exhibited an ability to develop to maturity and reproduce in an environment where all or portions of the soil within the root zone become, periodically or continuously, saturated or inundated during the growing season. The ability to grow and reproduce in wetlands is due to morphological and/or physiological adaptations and/or reproductive strategies of the plant (Reed 1988). Categories are as follows:

OBL (Obligate Wetland). Refers to species that almost always occur (estimated probability greater than 99 percent) under natural conditions in wetlands.

FACW (Facultative Wetland). Refers to species that usually occur in wetlands (estimated probability 67-99 percent), but is occasionally found in nonwetlands.

FAC (Facultative). Refers to species that are equally likely to occur in wetlands or nonwetlands (estimated probability 34-66 percent).

FACU (Facultative Upland). Refers to species that usually occur in nonwetlands (estimated probability 67-99 percent), but are occasionally found in wetlands (estimated probability 1-33 percent).

This asterisk (*) notes those terms and definitions that are currently the most widely used but not necessarily the most widely accepted. There is considerable debate with particular regard to the requirement of anaerobic or reduced conditions to meet hydric soils criteria. There are riparian or wetland types in Montana that are dominated by hydrophytic vegetation and are saturated throughout the growing season, yet never experience any biological oxygen deficiency. These sites are commonly found in western Montana along high to medium gradient streams with coarse textured soils.

Juncus balticus Community Type
(Baltic Rush Community Type)

JUNBAL (JUBA)
Number Of Stands Sampled = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Juncus balticus* (Baltic rush) community type is a major type of low to mid elevation riparian or wetland environments throughout Montana. Sites range from 975 to 2,105 m (3,200 to 6,900 ft). This type occurs near seeps, in meadows, and on alluvial terraces. Surface topography is usually level or sometimes undulating.

FLORISTIC CHARACTERISTICS

The *Juncus balticus* (Baltic rush) community type represents a grazing disclimax. *Juncus balticus* (Baltic rush) dominates the aspect of this type. Common associates of this disturbance-caused type may include *Hordeum jubatum* (foxtail barley).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Hordeum jubatum (foxtail barley)	22	0-60	44
Juncus balticus (Baltic rush)	70	30-98	100

SUCCESSIONAL INFORMATION

The *Juncus balticus* (Baltic rush) community type represents a grazing disclimax. This community type occurs over a wide range of environmental conditions. It usually increases on sites formally held by the *Deschampsia cespitosa* (tufted hairgrass) and the *Calamagrostis canadensis* (bluejoint reedgrass) habitat types. It is considered an increaser due to its high tolerance to grazing. Utilization of *Juncus balticus* (Baltic rush) may be partially responsible for the numerous invader species often associated with it. In other situations, *Juncus balticus* (Baltic rush) appears to have increased with disturbance, replacing other riparian or wetland graminoids.

The presence of nearly pure stands of *Juncus balticus* (Baltic rush) usually indicates wetter phases of this type and sites which have been heavily grazed in the past. *Deschampsia cespitosa* (tufted hairgrass) occurs on intermediate sites, while *Poa pratensis* (Kentucky bluegrass) indicates drier conditions and previous site disturbance.

SOILS

Soils are Mollisols (Aquolls and Borolls), or rarely Entisols. Soil texture ranges from silt to sandy loam. Water tables are often at or near the soil surface in early summer, but may drop below 50 cm (20 in) by late August. Soil reaction ranges from neutral to mildly alkaline (pH 7.0 to 8.0).

ADJACENT COMMUNITIES

A variety of types occupy adjacent wetter sites, including the *Salix geyeriana* (Geyer willow), *Typha latifolia* (common cattail), *Scirpus acutus* (hardstem bulrush), *Carex aquatilis* (water sedge), and *Carex rostrata* (beaked sedge) habitat

types. The *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type is common on adjacent sites with similar or slightly drier moisture regimes.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of this community type are productive but forage value is relatively low. Hermann (1975) reported grazing use when plants were young and tender. As it matures, it is commonly avoided. Heavy grazing generally results in an increase of unpalatable forbs.

Poa pratensis (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

In addition, *Agrostis stolonifera* (redtop) is tolerant of close use due to its somewhat prostrate growth form, rhizomatous growth habit, and lower palatability than associated species.

Wildlife

This type provides early season forage for wildlife, especially in stands with a large grass component.

Fisheries

Juncus balticus (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes, and one established, rapidly spreads. These soil holding characteristics may make it valuable for stabilizing streambanks.

Fire

Limited information on the effects of fire on *Juncus balticus* (Baltic rush) suggests that is not harmed by cool fires. In addition, associated species such as *Poa pratensis* (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can severely damage stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

The fine textured soils associated with this community type are subject to soil compaction and damage when moist, resulting in lower productivity and compositional changes that favor *Juncus balticus* (Baltic rush).

The strong rhizomes of *Juncus balticus* (Baltic rush) effectively stabilize of streambanks, especially where soils are coarse and otherwise unstable. Except for *Juncus balticus* (Baltic rush), the associated graminoids of this type provide limited streambank protection.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Other studies of the region have identified similar *Juncus balticus* (Baltic rush) communities, including Norton (1981), Mattson (1984), Youngblood and others (1985), Chadde and others (1988); and Padgett and others (1989).

Phalaris arundinacea Habitat Type
(Reed Canarygrass Habitat Type)

PHAARU (PHAR3)
Number Of Stands Sampled = 26

LOCATION AND ASSOCIATED LANDFORMS

The *Phalaris arundinacea* (reed canarygrass) habitat type is a minor type in central and eastern Montana, and a major type in western Montana. It occurs at low to mid elevations, ranging from 640 to 1,251 m (2,100 to 4,100 ft). The type is located along streams, rivers, oxbows, lake and pond margins, ditches, irrigation channel, and in wet meadows. Although a native species, *Phalaris arundinacea* (reed canarygrass) has been widely distributed as a forage, and readily escapes from pastures into riparian or wetland areas, displacing more desirable species.

FLORISTIC CHARACTERISTICS

Stands are clearly dominated by the tall *Phalaris arundinacea* (reed canarygrass). *Phalaris arundinacea* (reed canarygrass) is highly competitive with other riparian or wetland plants because of the heavy sod formed by its rhizome. Because of this, it tends to form dense, highly productive monotypic stands that spread radially (Apfelbaum and Sams 1987). Due to its location, pioneer species may be present in varying amounts.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy

Shrubs			
Rubus idaeus (red raspberry)	1	0-1	7
Salix exigua (sandbar willow)	1	0-3	20
Symphoricarpos albus (common snowberry)	1	0-1	7
Graminoids			
Agrostis stolonifera (redtop)	1	0-1	7
Beckmannia syzigachne (American sloughgrass)	1	0-1	7
Carex stipata (sawbeak sedge)	1	0-1	7
Carex vesicaria (inflated sedge)	1	0-1	20
Eleocharis palustris (common spikesedge)	3	0-3	7
Phalaris arundinacea (reed canarygrass)	96	90-98	100
Poa palustris (fowl bluegrass)	3	0-3	7
Poa pratensis (Kentucky bluegrass)	3	0-3	7
Scirpus maritimus (alkali bulrush)	1	0-1	7
Forbs			
Apocynum cannabinum (hemp dogbane)	1	0-3	27
Helenium autumnale (sneezeweed)	1	0-1	7
Mentha arvensis (field mint)	6	0-10	27
Myosotis scorpioides (common forget-me-not)	1	0-1	7
Potentilla anserina (common silverweed)	1	0-1	7
Scutellaria galericulata (marsh skullcap)	1	0-1	7
Solidago occidentalis (western goldenrod)	3	0-3	7
Ferns and Allies			
Equisetum arvense (field horsetail)	20	0-20	7
Equisetum hyemale (common scouring-rush)	1	0-1	7

SUCCESSIONAL INFORMATION

Phalaris arundinacea (reed canarygrass) has a strong tolerance to grazing except in the early growth stages. However, if stands are severely impacted, introduced species such as *Phleum pratense* (common timothy), *Poa pratensis* (Kentucky bluegrass), or *Agrostis stolonifera* (redtop) may invade and dominate the site.

SOILS

Soils are typically variable ranging from Entisols (Fluvents) to Mollisols. Soils are commonly fine textured with soil reactions ranging widely from slightly acid to moderately alkaline (pH 6.5 to 8.0) (USDA Soil Conservation Service 1968). Stands are commonly poorly drained. Water tables may be above the soil surface for several months in spring, and soils often remain saturated throughout the growing season. *Phalaris arundinacea* (reed canary grass) tolerates prolonged periods of flooding. In fact, it is one of the most flood tolerant of the cultivated grasses, yet also withstands short summer droughts (Apfelbaum and Sams 1987).

ADJACENT COMMUNITIES

Adjacent wetter sites may include open water or the *Carex rostrata* (beaked sedge), *Typha latifolia* (common cattail), *Scirpus acutus* (hardstem bulrush), *Eleocharis palustris* (common spikesedge) and *Equisetum fluviatile* (water horsetail) habitat types. Adjacent drier sites include a variety of habitat types including: *Carex rostrata* (beaked sedge), *Phleum pratense* (common timothy), *Spiraea douglasii* (Douglas's spiraea), *Carex diandra* (lesser-panicled sedge), *Populus trichocarpa* (black cottonwood), *Alnus incana* (mountain alder), and *Crataegus douglasii* (black hawthorn).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production from the *Phalaris arundinacea* (reed canarygrass) habitat type is high. However, the palatability of the coarse *Phalaris arundinacea* (reed canarygrass) is only low to moderate. It is most palatable when actively growing, and becomes less palatable in fall and winter. *Phalaris arundinacea* (reed canarygrass) has a strong tolerance to grazing except in the early growth stages. Alkaloidal content and increasing fiber content with advancing maturity cause a gradual decline in palatability during the growing season. Grazing should begin when this species is about 30 cm (12 in) tall and soils have dried enough to minimize trampling damage (USDA Soil Conservation Service 1968). It is suggested that livestock operators graze it using an intense stocking and short rotation plan that leaves at least a 2-3 cm (5-8 in) stubble. Management may include mowing stands once a year and fencing to force cattle to consume *Phalaris arundinacea* (reed canarygrass). To maintain dense stands, plants should not be grazed to less than 10 cm (4 in) in height (Alberta Agriculture 1981).

This type is also suitable for hay production. However, harvest must usually be delayed until late in the season when soils are dry and plants mature. Nutritive quality at this time is low, especially where *Phalaris arundinacea* (reed canarygrass) completely dominates the stand.

Wildlife

In many locations, the *Phalaris arundinacea* (reed canarygrass) habitat type is inundated long enough to provide limited nesting habitat for waterfowl and cover for muskrats. Stands of this habitat type are also use by big game for forage and cover.

Fisheries

This habitat type may provide valuable spawning areas for many species of fish. It may also provide hiding cover.

Fire

High water tables during the growing season makes burning difficult. However, burning during the nongrowing season may be feasible. A fire management strategy of a two to three year burn rotation has shown limited success in controlling the spread of *Phalaris arundinacea* (reed canarygrass).

Soil Management and Rehabilitation Opportunities

These sites are generally so wet as to preclude most development activities. Even sites that dry out near the end of the growing season are highly susceptible to compaction problems due to fine textured soils.

Once established, *Phalaris arundinacea* (reed canarygrass) spreads rapidly and is extremely difficult to eliminate (Apfelbaum and Sams 1987). The resilient nature of this rhizomatous grass makes it an effective stabilizer of streambanks and ditches. ***However, its future use in revegetating degraded sites should be severely restricted.*** *Phalaris arundinacea* (reed canarygrass) is becoming a threat to wetland areas dominated by other native species. The effectiveness of control measures, such as burning and herbicide spraying, has not been determined. Chemical methods usually provide poor long term control and are not always acceptable. The proximity of water tables creates a high potential for water contamination. Even when chemical and mechanical control treatments are used, new seedlings can rapidly reestablish themselves from seeds in the soil.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to

saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

Similar communities have not been described elsewhere.

Phragmites australis Habitat Type
(Common Reed Habitat Type)

PHRAUS (PHAU7)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Phragmites australis* (common reed) habitat type is an incidental type at lower elevations throughout central and eastern Montana. It occurs in swales, marshes, pond and lake margins, oxbow lakes, backwater areas, and banks of rivers and streams. Sites are classified as seasonally flooded. Sites range in elevation from 640 to 1,173 m (2,100 to 3,850 ft).

FLORISTIC CHARACTERISTICS

Phragmites australis (common reed) is a strongly rhizomatous perennial that generally forms tall (2-3 m [6.5-10 ft in height]), dense, monotypic stands. Some stands my be quite extensive in size.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Phragmites australis (common reed)	98	98-98	100

SUCCESSIONAL INFORMATION

The sites are generally so wet as to preclude most forms of disturbance. *Phragmites australis* (common reed) is a strongly rhizomatous perennial that tends to out compete all but the most aggressive disturbance-caused herbaceous species. However, with increased disturbance, weedy species such as *Cirsium arvense* (Canada thistle) may invade.

SOILS

Soils are generally Entisols (Aquents) and Mollisols (Aquolls). Soil texture ranges from clay to sandy loam. Sites frequently experience prolonged flooding. Water tables fluctuate tremendously, particularly in drawdown areas, ranging from 50 cm (20 in) above to 1 m (39 in) below the soil surface at the end of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Typha latifolia* (common cattail) or the *Scirpus acutus* (hardstem bulrush) habitat types. In some situations, wetter communities may be the open water. Adjacent drier sites may be dominated by a

variety of communities including the *Salix exigua* (sandbar) community type, cottonwood community types, or sedge types. In some instances, upland species may dominated drier sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production in the *Phragmites australis* (common reed) habitat type is high to very high. *Phragmites australis* (common reed) is highly palatable to both livestock and wildlife, especially when the plants are young and growing vigorously. *Phragmites australis* (common reed) is moderately tolerant of grazing. However, heavy grazing pressure may reduce the size and extent of stands. In addition, *Phragmites australis* (common reed) produces good quality hay or silage.

Wildlife

Phragmites australis (common reed) is highly palatable to both livestock and wildlife, especially when the plants are young and growing vigorously. In addition, the high structural diversity of *Phragmites australis* (common reed) provides excellent thermal and hiding cover for big game species. Waterfowl use this habitat type for nesting and hiding cover. Other birds such as red-winged blackbirds and yellow headed blackbirds are also common inhabitants.

Fisheries

The *Phragmites australis* (common reed) habitat type provides excellent streambank protection. The rhizomes hold and stabilize the bank while the above ground vegetation helps trap and filter sediments.

Soil Management and Rehabilitation Opportunities

Phragmites australis (common reed) can provide excellent streambank protection. Rhizomes hold and stabilize the bank while the above ground vegetation helps trap and filter sediments. Once established, these characteristics help to stabilize the site.

Recreational Uses and Considerations

The *Phragmites australis* (common reed) habitat type provides excellent opportunities for viewing wildlife.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

Similar communities were described by Ward (1942), Walker and Waygood (1968), and Shay and Shay (1986).

Poa palustris Community Type
(Fowl Bluegrass Community Type)

POAPAL (POPA2)
Number Of Stands Sampled = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Poa palustris* (fowl bluegrass) community type is a minor type throughout Montana, occurring at low to mid elevations. It occupies wet meadows, alluvial terraces, and streamside locations. Sites range from 927 to 2,044 m (3,040 to 6,700 ft).

FLORISTIC CHARACTERISTICS

Stands of the *Poa palustris* (fowl bluegrass) community type are generally wetter than stands of the *Poa pratensis* (Kentucky bluegrass) community type. *Agropyron repens* (quackgrass) and *Poa pratensis* (Kentucky bluegrass) may also be common (Appendix 00).

SUCCESSIONAL INFORMATION

Potential for stands dominated by *Poa palustris* (fowl bluegrass) and other introduced, moist site grasses is unclear. In many situations, the *Poa palustris* (fowl bluegrass) community type represents a pioneering stage that will be eventually taken over by a variety of later successional species. Close observation of similar sites may give insight to the climax community for the site.

Sites are similar to a number of habitat types, including the *Deschampsia cespitosa* (tufted hairgrass) and *Calamagrostis canadensis* (bluejoint reedgrass) habitat types. However, conversion to these types is unlikely to occur due to the vigorous, competitive nature of these naturalized species. The highly competitive nature of *Poa palustris* (fowl bluegrass) is illustrated by its ability to roots at the nodes of decumbent culms, thereby establishing new plants.

SOILS

Soils are Mollisols (usually Aquolls) and Entisols. Thin organic surface horizons may be present. Soil texture vary little from clay loam to sandy loam. Water tables are near the soil surface in spring, but may drop below 1 m (39 in) of the soil surface by fall. Redoximorphic features (mottling or gleyed soil) are often found within 50 cm (20 in) of the soil surface. Soil reaction is typically alkaline (pH 8.0).

ADJACENT COMMUNITIES

Adjacent wetter communities are dominated by a variety of shrubs and graminoids, including *Salix geyeriana* (Geyer willow), *Salix bebbiana* (Bebb willow), *Carex rostrata* (beaked sedge), and *Carex aquatilis* (water sedge). Drier sites support a range of communities including the *Phleum pratense* (common timothy) and *Poa pratensis* (Kentucky bluegrass) community types. Upland communities are dominated by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is moderate to high. *Poa palustris* (fowl bluegrass) and the other grasses of this group are palatable, especially when young.

Wildlife

Poa palustris (fowl bluegrass) and *Agrostis stolonifera* (redtop) make rapid growth in the spring and provide early spring forage. *Taraxacum officinale* (common dandelion) and *Trifolium repens* (white clover) are of high food value for deer and elk. Waterfowl, upland game birds, and small mammals utilize the grasses in this type for cover (Dittberner and Olson 1983).

Fisheries
Streambanks of this community type are subject to erosional problems. The grasses of this type are of limited beneficial use due to their low bank holding capabilities.

Fire
All but hot fires will have an effect on the grasses of this community type.

Soil Management and Rehabilitation Opportunities
Seasonally high water tables common to this type can make soils particularly susceptible to compaction problems. Vehicles and livestock readily compact these moist sites. . Coarse textured soils, such as those on sand and gravel bars, are less readily affected.

The associated graminoids of this type provide highly limited streambank protection. The potential for erosional problems associated with this community type may be quite high. Managers need to pay close attention to streambanks associated with *Poa palustris* (fowl bluegrass) community type in order to detect early signs of streambank collapse. Once the streambank starts to degrade, with no change in management, there is little that can be done to save it short of expensive riprap.

Unless water tables are restored, these sites will, for all practical purposes, remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table, thereby allowing the willows and sedges to reclaim a degraded site.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) described a similar *Poa palustris* (fowl bluegrass) community type for eastern Idaho and western Wyoming that contained *Juncus balticus* (Baltic rush) and *Phleum pratense* (common timothy).

Poa pratensis Community Type
(Kentucky Bluegrass Community Type)

POAPRA (POPR)
Number Of Stands Sampled = 12

LOCATION AND ASSOCIATED LANDFORMS

The *Poa pratensis* (Kentucky bluegrass) community type is a major, widespread type at low to mid elevations. Sites range from 1,094 to 2,044 m (3,590 to 6,700 ft). Stands are located throughout Montana with the best examples found on mesic alluvial terraces subjected to past abusive grazing.

FLORISTIC CHARACTERISTICS

The *Poa pratensis* (Kentucky bluegrass) community type represents a grazing disclimax. *Poa pratensis* (Kentucky bluegrass) is a European meadow grass that is widely introduced and naturalized in North America. Stands are either dominated by *Poa pratensis* (Kentucky bluegrass), or have a mixture of herbaceous "weedy" species. Stands of this type represent one of the drier of the herbaceous riparian or wetland community types.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Juncus balticus (Baltic rush)	30	0-60	58
Phleum pratense (common timothy)	8	0-20	58
Poa pratensis (Kentucky bluegrass)	66	20-98	100
Forbs			
Potentilla anserina (common silverweed)	7	0-20	42
Potentilla gracilis (slender cinquefoil)	4	0-20	50
Taraxacum officinale (common dandelion)	13	0-40	42

SUCCESSIONAL INFORMATION

The *Poa pratensis* (Kentucky bluegrass) community type represents a grazing disclimax of an early/mid seral secondary successional stage. Overgrazing by herbivores has produced drastic changes on sites formerly dominated by native graminoids (Volland 1978). Once a suitable site is disturbed, the extensive rhizome system of *Poa pratensis* (Kentucky bluegrass) allows it to rapidly spread and establish on these areas. It also withstands high levels of utilization, making replacement by former dominants such as *Deschampsia cespitosa* (tufted hairgrass) unlikely.

The *Poa pratensis* (Kentucky bluegrass) community type represents a seral stage of many types including the *Deschampsia cespitosa* (tufted hairgrass) and the *Agropyron smithii* (western wheatgrass) habitat types. Close observation of similar sites may give insight to the climax community for the site.

SOILS

Soils are typically Mollisols (Borolls) or Entisols (Fluvents). *Poa pratensis* (Kentucky bluegrass) thrives on moist, fertile sandy to clay alluvial soils high in organic matter. *Poa pratensis* (Kentucky bluegrass) also survives, but grows less

vigorously on sands, dense clays, and thin, rocky soils when adequate moisture is available. *Poa pratensis* (Kentucky bluegrass) is generally intolerant of prolonged flooding, seasonally high water tables, or poor drainage. It is tolerant of mildly alkaline (pH 8.0), and saline soils.

ADJACENT COMMUNITIES

Wetter sites support a wide range of communities including those within the *Populus* (cottonwood), *Salix* (willow), *Potentilla fruticosa* (shrubby cinquefoil), *Carex rostrata* (beaked sedge), and *Juncus balticus* (Baltic rush) types. Adjacent drier sites may be dominated by wide variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Poa pratensis* (Kentucky bluegrass) community type is moderately productive, and provides a significant amount of early season forage. It is highly palatable in the rapid growth phase with palatability becoming greatly reduced during semidormancy of late summer and winter. Fall regrowth can occur provided moisture is sufficient and temperatures remain above freezing. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater. Streambanks associated with *Poa pratensis* (Kentucky bluegrass) stands are susceptible to sloughing.

Wildlife

Elk and deer make use of the grasses and forbs of this type, especially in early spring when other forages have not yet greened. Waterfowl utilize *Poa pratensis* (Kentucky bluegrass) for food and cover. Upland game birds, small mammals and small nongame birds also use this type for cover (Dittberner and Olson 1983).

Fisheries

The *Poa pratensis* (Kentucky bluegrass) community type is not very effective in stabilizing streambanks (Youngblood and others 1985b). Bank undercutting and sloughing may occur, especially when soils are wet or stands weakened by excessive grazing.

Fire

Poa pratensis (Kentucky bluegrass) is well adapted to fire, and is able to quickly resprout following burning because of its extensive network of rhizomes. However, it is intolerant of burning during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967).

Soil Management and Rehabilitation Opportunities

The potential for soil compaction is greatest in the spring when soils are moist. *Poa pratensis* (Kentucky bluegrass) has an extensive rhizome system, but its shallow rooting characteristics make it only marginally effective in stabilizing streambanks. The potential for erosional problems associated with this community type can be quite high. Managers need to pay close attention to streambanks associated with *Poa pratensis* (Kentucky bluegrass) community type in order to detect early signs of streambank collapse. Once the streambank starts to degrade, with no change in management, there is little that can be done to save it short of expensive riprap.

Unless water tables are restored, these sites will remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

A number of other researchers have identified similar *Poa pratensis* (Kentucky bluegrass) communities, including Norton (1981; Greys River, Wyoming), Ratliff (1982; Sierra Nevada, California), Youngblood and others (1985; eastern Idaho and western Wyoming), and Padgett and others (1989; Utah and southeastern Idaho).

Polygonum amphibium Community Type
(Water Smartweed Community Type)

POLAMP (POAM8)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Polygonum amphibium* (water smartweed) community type is a minor type at lower elevations in central and eastern Montana. It seems to be more abundant in the prairie pothole region of northern Montana. It occupies shallow water along the edges of reservoirs, lakes, ponds, marshes, and other wet areas. Sites are classified as seasonally flooded. Sites range in elevation from 640 to 1,082 m (2,100 to 3,550 ft).

FLORISTIC CHARACTERISTICS

The *Polygonum amphibium* (water smartweed) community type is an aggressive invader of shallow water and exposed mud flats where there is minimal wave action, forming dense, monotypic stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Forbs			
Polygonum amphibium (water smartweed)	98	98-98	100

SUCCESSIONAL INFORMATION

The *Polygonum amphibium* (water smartweed) community type is an early seral (pioneer) primary successional stage representing a variety of site types. Careful observation of the site characteristics will aid in determining the potential of the site.

SOILS

The *Polygonum amphibium* (water smartweed) community type occurs on most soil textures from fine clay to sandy loam. The community type is intolerant of saline or alkaline conditions. It is tolerant of frequent and prolonged flooding.

ADJACENT COMMUNITIES

Adjacent wetter communities may be the *Typha latifolia* (common cattail) or the *Scirpus acutus* (hardstem bulrush) habitat type, or open water. Adjacent drier communities are a wide variety of types including upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production of the *Polygonum amphibium* (water smartweed) community type rates low to moderate. *Polygonum amphibium* (water smartweed) is of low palatability to livestock and wildlife.

Wildlife

Polygonum amphibium (water smartweed) is of low palatability to wildlife. However, a wide variety of waterfowl may use these areas for nesting or nest building.

Soil Management and Rehabilitation Opportunities

Shore vegetation around reservoirs is a mosaic of short lived plant communities that survive one or more years before being eliminated by a combination of high water or grazing. These shore communities are composed primarily of early successional species that become established either during the fall or spring when water levels are low (Hoffman and Stanley 1978). Repeated annual drawdowns perpetuate this disturbance and associated vegetation.

Shore vegetation is important in providing habitat for terrestrial wildlife, certain fish species, and livestock. These communities also protect shores from accelerated erosion, and enhance the aesthetic quality of the shore environment.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

A number of authors have described similar communities for the prairie pothole region of North America (Van der Valk 1989).

Salicornia rubra Community Type
(Red Glasswort Community Type)

SALRUB (SARU)
Number Of Stands Sampled = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Salicornia rubra* (red glasswort) community type is a minor type at lower elevations in central and eastern Montana. The community type is more common in the northern half than in the southern portions of the region. The *Salicornia rubra* (red glasswort) community type occurs in the drawdown zone of saline or alkaline seeps, basins, swales, pond and lake margins. This drawdown zone is flooded during the early part of the growing season but the water table falls to below the soil surface by late spring or early summer. The drawdown zone takes on the appearance of narrow bands encircling the open water. The soil surface is typically covered with white salt crusts. Sites range in elevation from 975 to 1,372 m (3,200 to 4,500 ft). Stands can be found in the Lewistown and Malta areas, near Big Lake northwest of Billings, and on the Blackfeet Indian Reservation.

FLORISTIC CHARACTERISTICS

Harsh soil conditions allow the annual, *Salicornia rubra* (red glasswort), to frequently occur in nearly pure stands. In some instances, *Hordeum jubatum* (foxtail barley) and *Puccinellia nuttalliana* (Nuttall's alkaligrass) may be present (Appendix 00).

SUCCESSIONAL INFORMATION

The *Salicornia rubra* (red glasswort) community type is an early seral (pioneer) primary successional stage representing a variety of site salt-tolerant types. Limited information suggests that the *Salicornia rubra* (red glasswort) community type may be successional to the *Distichlis spicata* (inland saltgrass) habitat type. The *Salicornia rubra* (red glasswort) community type occupies the seasonal drawdown areas that are generally too wet for *Distichlis spicata* (inland saltgrass).

SOILS

Soils are generally Aridisols (Natrargids) or Mollisols (Natraquolls and Natriborolls). Soil texture is commonly clay. Soils are poorly to very poorly drained with water tables remaining slightly below the soil surface and dropping below 1 m (39 in) in some years. Water movement is slow enough that it evaporates and becomes concentrated with salts (sodium and magnesium sulfates), forming white crusts on the soil surface and on objects protruding out of the water. On the Blackfeet Indian Reservation, Lesica and Shelly (1988) measured the conductivities of associated waters and found them to range from 1,550 to 40,000 uhmos/cm (a median of 18,800 uhmos/cm). Soil reaction is alkaline (pH 8.0) with high concentrations of soluble salts (saline soils).

ADJACENT COMMUNITIES

Adjacent wetter communities are usually occupied by open water. Adjacent drier communities may be dominated by a variety of upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is very low. *Salicornia rubra* (red glasswort) is unpalatable but associated grasses may provide limited forage.

Wildlife

Due to the extremely low forage production and short stature of the *Salicornia rubra* (red glasswort) (<1 dm in height [<4 in]), it is of little value to wildlife.

Soil Management and Rehabilitation Opportunities

Most management concerns associated with this type are centered around the increasing saline seep problems. The presence or expansion of seep areas may indicate that upland vegetation, small grains, fallow fields, or excess irrigation are not allowing the water table to drop to levels these sites have routinely experienced in the past. Excess water then flows through the soil, gathering soluble salts before evaporating in depressions. The salts remain, increasing in concentration with time, thereby restricting the types of plants able to tolerate this environment. The state of Montana is working with landowners to solve or reduce saline related problems. However, it is important to note that saline areas occur naturally due to the arid climate, parent material, and local topography.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = nonpersistent; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = saline lowland range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = saline lowland range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = saline lowland range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site; Foothills and Mountains, 10-14 inch Precipitation Zone = saline lowland range site.

OTHER STUDIES

A similar community was described by Jorgensen (1979) for the Yellow Water Triangle of central Montana, and by Lesica and Shelly (1988) for the Blackfeet Indian Reservation.

Scirpus acutus Habitat Type
(Hardstem Bulrush Habitat Type)

SCIACU (SCAC)

Number Of Stands Sampled = 58

Note: The *Scirpus acutus* (hardstem bulrush) habitat type includes all combinations of *Scirpus acutus* (hardstem bulrush) and *Scirpus validus* (softstem bulrush) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus acutus* (hardstem bulrush) habitat type is a major type occurring at low to mid elevations throughout Montana. Typical locations include pond and lake margins and backwater areas. Sites are generally classified as the open water portion of the semipermanent wetland. Sites range in elevation from 665 to 2,027 m (2,180 to 6,650 ft).

FLORISTIC CHARACTERISTICS

The *Scirpus acutus* (hardstem bulrush) habitat type typically occurs as a fringe along the margins of ponds in water up to about 2 m (6.5 ft) deep. It also occupies basins where water tables remain relatively high but may drop below the soil surface later on in the growing season. Other species are largely absent or present in small amounts.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Salix exigua (sandbar willow)	1	0-1	3
Graminoids			
Agrostis stolonifera (redtop)	1	0-1	3
Carex buxbaumii (Buxbaum's sedge)	20	0-20	3
Carex lanuginosa (woolly sedge)	1	0-1	3
Carex rostrata (beaked sedge)	12	0-20	6
Carex spp. (sedge)	1	0-1	3
Carex vesicaria (inflated sedge)	1	0-1	3
Eleocharis palustris (common spikesedge)	1	0-1	3
Eleocharis rostellata (beaked spike-rush)	20	0-20	3
Polypogon monspeliensis (rabbitfoot polypogon)	1	0-1	3
Scirpus acutus (hardstem bulrush)	81	0-98	88
Scirpus validus (softstem bulrush)	80	0-80	12
Forbs			
Chenopodium album (lambsquarter)	1	0-1	3
Cirsium arvense (Canada thistle)	1	0-1	6
Epilobium ciliatum (common willow-herb)	1	0-1	3
Erigeron glabellus (smooth daisy)	3	0-3	3
Galium triflorum(sweetscented bedstraw)	10	0-10	3
Helianthus nuttallii (Nuttall's sunflower)	1	0-1	3
Lycopus asper (rough bugleweed)	3	0-3	3
Mentha arvensis (field mint)	5	0-20	12
Myriophyllum spicatum (spiked water-milfoil)	1	0-1	6
Najas flexilis (wavy water-nymph)	1	0-1	3
Nuphar luteum (yellow water-lily)	30	0-30	3

Polygonum amphibium (water smartweed)	18	0-60	15
Potamogeton crispus (curly pondweed)	3	0-3	3
Potamogeton filiformis (slender-leaved pondweed)	40	0-40	3
Potamogeton natans (floating-leaved pondweed)	20	0-20	3
Potamogeton spp. (pondweed)	1	0-1	3
Potentilla anserina (common silverweed)	1	0-1	3
Potentilla palustris (purple cinquefoil)	1	0-1	3
Rumex crispus (curly dock)	5	0-10	6
Rumex maritimus (golden dock)	3	0-3	3
Sagittaria latifolia (wapato)	40	0-40	6
Triglochin maritimum (seaside arrow-grass)	1	0-1	3
Typha latifolia (common cattail)	2	0-3	6

SUCCESSIONAL INFORMATION

Scirpus acutus (hardstem bulrush) and *Scirpus validus* (softstem bulrush) are early colonizers of suitable habitats and are able to persist under wet conditions. Due to the continually saturated conditions and the aggressive characteristic of *Scirpus acutus* (hardstem bulrush), most other species are precluded.

SOILS

Soils are commonly Mollisols (Aquolls), Entisols (Aquents), or occasionally Histosols (Brichta 1987). Water tables are generally at or above the soil surface throughout the growing season. Soil reaction varies from neutral to moderately alkaline (pH 7.0 to 8.0).

ADJACENT COMMUNITIES

The *Typha latifolia* (common cattail) habitat type is often adjacent to this type, especially where surface water persists year round. Drier sites support the *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge), *Poa pratensis* (Kentucky bluegrass), and *Betula occidentalis* (water birch) types. Uplands are dominated by a variety of types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Wet conditions and the lack of palatable forage limit livestock use of this type. However, if upland forage becomes limited and soil conditions dry, livestock may make use of *Scirpus acutus* (hardstem bulrush).

Wildlife

Scirpus acutus (hardstem bulrush) provides valuable nesting and roosting cover for a variety of songbirds and waterfowl, notably redwinged and yellow headed blackbirds. *Scirpus acutus* (hardstem bulrush) is a staple food for muskrats and is used in construction of their huts. Seeds of *Scirpus acutus* (hardstem bulrush) are eaten by a variety of birds. Waterfowl managers often attempt to increase the proportion of *Scirpus acutus* (hardstem bulrush) relative to *Typha* species (cattails) as a means of improving habitat. *Triglochin maritimum* (seaside arrow-grass), if present, may be heavily grazed by elk.

Fire

The *Scirpus acutus* (hardstem bulrush) habitat type will burn in either late fall or early spring if the water levels have fallen.

Soil Management and Rehabilitation Opportunities

Soils are commonly wet throughout the growing season and easily damaged from trampling by livestock and wildlife.

Vegetation can also be damaged by trampling.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = permanently flooded to semipermanently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

Similar communities dominated by *Scirpus acutus* (hardstem bulrush) have been identified by Pierce and Johnson (1986) for west central Montana and by Chadde and others (1988) for northern Yellowstone National Park.

Scirpus maritimus Habitat Type
(Alkali Bulrush Habitat Type)

SCIMAR (SCMA)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus maritimus* (alkali bulrush) habitat type is a minor type at lower elevations throughout central and eastern Montana. Sites are located in areas with standing water such as along smaller perennial streams, and the edges of marshes and ponds. Sites are classified as semipermanently flooded. The *Scirpus pungens* (sharp bulrush) habitat type occurs in similar positions on the landscape as the *Scirpus maritimus* (alkali bulrush) habitat type. However, sites of the *Scirpus pungens* (sharp bulrush) habitat type are generally classified as only seasonally flooded. Sites range in elevation from 732 to 1,021 m (2,400 to 3,350 ft).

FLORISTIC CHARACTERISTICS

The *Scirpus maritimus* (alkali bulrush) habitat type usually forms dense, monotypic stands. In some instances, limited amounts of the shorter *Eleocharis palustris* (common spikesedge) may be present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Eleocharis palustris (common spikesedge)	3	0-3	25
Scirpus maritimus (alkali bulrush)	91	80-98	100
Forbs			
Bassia hyssopifolia (fivehook bassia)	1	0-1	25

SUCCESSIONAL INFORMATION

Scirpus maritimus (alkali bulrush) is an early colonizer of suitable habitats and are able to persist under wet conditions. Permanently wet conditions usually limit most forms of disturbance.

SOILS

Soils are typically Entisols (Fluvaquents) or Mollisols (Haplaquolls). Soil texture ranges from clay to loam. Water tables are high, often remaining above the soil surface throughout the growing season. Soils are poorly to very poorly drained with available water estimates ranging from moderate to high. Soil reaction is generally alkali (pH 8.5). Saline soils are also common to this habitat type.

ADJACENT COMMUNITIES

Adjacent wetter sites may be occupied by the *Typha latifolia* (common cattail) or the *Scirpus acutus* (hardstem bulrush) habitat types, or by open water. Adjacent drier sites may include a wide variety of types such as the *Spartina pectinata* (prairie cordgrass) or the *Distichlis spicata* (inland saltgrass) habitat types, or the *Salicornia rubra* (red glasswort) community type. In other situations, drier sites may be classified as upland sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is high to very high. However, palatability is low to moderate. *Scirpus maritimus* (alkali bulrush) is seldom grazed by livestock or wildlife, provided additional forage is available or the site is in fairly deep water. However, if water levels drop or upland forage is limited, livestock may heavily utilize these communities.

Wildlife

The *Scirpus maritimus* (alkali bulrush) habitat type is an important source of shade, hiding cover, and food for wildlife. *Scirpus maritimus* (alkali bulrush) is used by muskrats for construction of huts. Waterfowl use this site type for nesting and hiding cover. Other birds such as red-winged blackbirds and yellow headed blackbirds are common inhabitants. Deer also use this site type for hiding cover.

Fisheries

The *Scirpus maritimus* (alkali bulrush) habitat type buffers wind and wave action on bodies of water. Warm water fish may make use of this site type as spawning beds. Along streams, this site type helps to filter out sediments and build streambanks.

Soil Management and Rehabilitation Opportunities

The *Scirpus maritimus* (alkali bulrush) habitat type helps filter sediments to build streambanks. This type is fairly drought tolerant, and can persist through several years of dry conditions. *Scirpus maritimus* (alkali bulrush) is a prolific seed producer. Dissemination occurs by both wind and water. Seeds require moist, bare soil for germination. Rhizomes spread into exposed areas, rapidly colonizing mudflats and drawdown areas.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar sites in the prairie pothole region of the northern Great Plains have been described by Van der Valk (1989).

Scirpus pungens Habitat Type
(Sharp Bulrush Habitat Type)

SCIPUN (SCPU3)
Number Of Stands Sampled = 18

LOCATION AND ASSOCIATED LANDFORMS

The *Scirpus pungens* (sharp bulrush) habitat type is a minor type at lower elevations throughout central and eastern Montana. Sites are located in wet areas such as along smaller streams (usually perennial), and the edges of marshes and ponds. Sites are classified as seasonally flooded. The *Scirpus maritimus* (alkali bulrush) habitat type occurs in similar positions on the landscape as the *Scirpus pungens* (sharp bulrush) habitat type. However, sites of the *Scirpus maritimus* (alkali bulrush) habitat type are generally classified as semipermanently flooded. Sites range in elevation from 747 to 991 m (2,450 to 3,250 ft).

FLORISTIC CHARACTERISTICS

The *Scirpus pungens* (sharp bulrush) habitat type usually forms dense, monotypic stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Graminoids			
Eleocharis acicularis (needle spike-rush)	1	0-1	20
Hordeum jubatum (foxtail barley)	1	0-1	20
Scirpus americanus (American bulrush)	53	0-80	17
Scirpus maritimus (alkali bulrush)	1	0-1	20
Scirpus pungens (sharp bulrush)	89	70-98	100
Scirpus validus (softstem bulrush)	1	0-1	20
Forbs			
Rumex crispus (curly dock)	1	0-1	20

Rumex salicifolius (willow dock)	1	0-1	20
Typha latifolia (common cattail)	3	0-3	20

SUCCESSIONAL INFORMATION

Scirpus pungens (sharp bulrush) is an early colonizer of suitable habitats and are able to persist under wet conditions. Due to the continually saturated conditions and the aggressive characteristic of *Scirpus pungens* (sharp bulrush) habitat type, most other species are precluded. Wet conditions usually limit most forms of disturbance other than limited trampling by livestock.

SOILS

Soils are typically Entisols (Fluvaquents) or Mollisols (Haplaquolls). Soil texture ranges from clay loam to sandy loam. Water tables are high, remaining within 1 m (39 in) of the soil surface throughout the year. Soils are rated as somewhat poorly drained to poorly drained. Soil reaction is typically alkali (pH 8.5). Saline soils are also common. Lesica and Shelly (1988) measured soil water conductivities of this type to range from 2,920 to 41,000 uhmos/cm (a median of 81,000 uhmos/cm) on the Blackfeet Indian Reservation.

ADJACENT COMMUNITIES

Adjacent wetter sites along streams are usually occupied by *Eleocharis palustris* (common spike sedge). Other adjacent wetter sites include open water, the *Typha latifolia* (common cattail), or the *Scirpus acutus* (hardstem bulrush) habitat types. Adjacent drier sites include a wide variety of types, including the *Spartina pectinata* (prairie cordgrass), the *Distichlis spicata* (inland saltgrass), or the *Agropyron smithii* (western wheatgrass) habitat types; and the *Salicornia rubra* (red glasswort) community type. In other situations, drier sites may be classified as upland sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is high to very high. However, palatability is low to moderate. *Scirpus pungens* (sharp bulrush) is seldom grazed by livestock or wildlife, provided additional forage is available or the site is in fairly deep water. However, if water levels drop or upland forage is limited, livestock may heavily utilize these communities.

Wildlife

The *Scirpus pungens* (sharp bulrush) habitat type is an important source of shade, hiding cover, and food for wildlife. *Scirpus pungens* (sharp bulrush) is used by muskrats for construction of huts. Waterfowl use this site type for nesting and hiding cover. Other birds such as red-winged blackbirds and yellow headed blackbirds are common inhabitants. Deer also use this site type for hiding cover.

Fisheries

The *Scirpus pungens* (sharp bulrush) habitat type buffers wind and wave action on bodies of water. Warm water fish may make use of this site type as spawning beds. Along streams, this site type helps to filter out sediments and build streambanks.

Soil Management and Rehabilitation Opportunities

The *Scirpus pungens* (sharp bulrush) habitat type helps filter sediments to build streambanks. This type is fairly drought tolerant being able to persist through several years of dry conditions. *Scirpus pungens* (sharp bulrush) is a prolific seed producer. Dissemination occurs by both wind and water. Seeds require moist, bare soil for germination. Rhizomes spread into exposed areas, rapidly colonizing mudflats and drawdown areas.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Lesica and Shelly (1988) described a similar community for the Blackfeet Indian Reservation. Similar sites in the prairie pothole region of the northern Great Plains have been described by Van der Valk (1989).

Senecio triangularis Community Type
(Arrowleaf Groundsel Community Type)

SENTRI (SETR)
Number Of Stands Sampled = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Senecio triangularis* (arrowleaf groundsel) community type is an incidental type at mid to high elevations in the mountains of Montana. Elevations of sampled sites range from 1,226 to 2,028 m (4,020 to 6,650 ft). This type occupies the stream beds of high gradient, ephemeral, first or second order streams.

FLORISTIC CHARACTERISTICS

No one species dominates this type though *Senecio triangularis* (arrowleaf groundsel) has a 100 percent constancy and a moderate average canopy cover. Tree seedlings and saplings such as *Abies lasiocarpa* (subalpine fir) and *Picea* (spruce), and *Thuja plicata* (western red cedar) at lower elevations, are often present. Common herbaceous species include *Parnassia fimbriata* (fringed grass-of-parnassus), *Thalictrum occidentale* (western meadowrue), and *Trollius laxus* (American globeflower).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Graminoids			

Elymus glaucus (blue wildrye)	1	0-1	43
Forbs			
Aquilegia flavescens (yellow columbine)	1	0-3	43
Epilobium ciliatum (common willow-herb)	1	0-1	43
Parnassia fimbriata (fringed grass-of-parnassus)	7	0-10	43
Senecio triangularis (arrowleaf groundsel)	22	3-40	100
Thalictrum occidentale (western meadowrue)	5	0-10	43
Trollius laxus (American globeflower)	2	0-3	43

SUCCESSIONAL INFORMATION

The *Senecio triangularis* (arrowleaf groundsel) community type represents an early seral successional stage. Substrates and water tables are highly variable due to the unstable nature of ephemeral stream beds. Yearly alluvial deposition of sediments behind boulders and downed logs, and rearrangement of the stream bed by flooding creates a highly variable mosaic of microsites. Conifers occur as scattered individuals on elevated microsites within most stands but, due to flooding and scouring, rarely mature past the sapling stage. Many herbaceous species in this type grow on down and decomposing tree trunks deposited from the adjoining upland conifer habitat types.

SOILS

Soils of the *Senecio triangularis* (arrowleaf groundsel) community type are typically of alluvial origin. Sites are a highly variable mosaic of microsites; characteristically located on silt and sand deposits behind boulders, downed trees, and perennially rearranged small sediment traps along the stream bed. Soils show little development and are generally classified as Entisols. Water tables are typically at the soil surface throughout the summer. Organic layers and redoximorphic features (mottles or gleyed soil) were recorded on several stands.

ADJACENT COMMUNITIES

Due to the abrupt change from wetland to upland only one drier wetland type, *Alnus sinuata* (sitka alder), was recorded. No wetter types were found. Adjacent upland types include habitat types from the *Abies lasiocarpa* (subalpine fir), *Picea* (spruce), *Thuja plicata* (western red cedar), and *Tsuga heterophylla* (western hemlock) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The fragile nature of these sites should preclude livestock use.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

Similar communities have not been described.

Spartina pectinata Habitat Type
(Prairie Cordgrass Habitat Type)

SPAPEC (SPPE)
Number Of Stands Sampled = 19

Note: The *Spartina pectinata* (prairie cordgrass) habitat type includes all combinations of *Spartina pectinata* (prairie cordgrass) and *Spartina gracilis* (alkali cordgrass) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Spartina pectinata* (prairie cordgrass) habitat type is a minor type at lower elevations throughout central and eastern Montana. Sites are located in wet (sometimes saline) areas such as along smaller streams (including ephemeral, intermittent and perennial streams), swales, meadows, and the edges of marshes and ponds. Sites may be classified as temporarily flooded or overflow sites. Sites range in elevation from 716 to 1,140 m (2,350 to 3,740 ft). Extensive areas of this habitat type are located in southeastern Montana in the Big Gumbo area west of Baker.

FLORISTIC CHARACTERISTICS

Spartina pectinata (prairie cordgrass) and/or *Spartina gracilis* (alkali cordgrass) dominate the sites. Vigorous rhizomes allow either species to form pure stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Calamagrostis stricta (narrow-spiked reedgrass)	3	0-3	11
Distichlis spicata (inland saltgrass)	1	0-1	11
Eleocharis palustris (common spikesedge)	20	0-20	11
Hordeum jubatum (foxtail barley)	1	0-1	11
Puccinellia nuttalliana (Nuttall's alkaligrass)	60	0-60	11
Scirpus pungens (sharp bulrush)	3	0-3	11
Spartina gracilis (alkali cordgrass)	73	0-80	33
Spartina pectinata (prairie cordgrass)	86	0-98	67
Forbs			
Epilobium ciliatum (common willow-herb)	3	0-3	11
Solidago spp. (goldenrod)	1	0-1	11

SUCCESSIONAL INFORMATION

Spartina pectinata (prairie cordgrass) and *Spartina gracilis* (alkali cordgrass) are early colonizers of suitable saline habitats and are able to persist under wet conditions. Palatability of *Spartina pectinata* (prairie cordgrass) and *Spartina gracilis* (alkali cordgrass) are greatest in the spring when young plants are actively growing. However, sites are generally quite wet in

the spring thereby limiting access to livestock. As the plants mature, the palatability decreases significantly. The low palatability of mature plants limits livestock use during most of the growing season.

SOILS

Soil texture ranges from clay to silt loam. Water tables are usually within 1 m (39 in) of the soil surface throughout the year. Sites are never permanently flooded. Soil water movement is rapid enough to prevent an accumulation of salts on the soil surface. These soils are generally slightly to moderately saline or alkali (pH 7.5 to 8.5), yet are less saline or alkaline than sites of the *Distichlis spicata* (inland saltgrass) habitat type or the *Salicornia rubra* (red glasswort) community type.

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by the *Typha latifolia* (common cattail) or the *Scirpus acutus* (hardstem bulrush) habitat types. In some situations, wetter communities may be the open water. Adjacent drier sites may be dominated by the *Agropyron smithii* (western wheatgrass) habitat type or a variety of upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production in stands of the *Spartina pectinata* (prairie cordgrass) habitat type is high. However, because of coarse stems and very rough edged leaves, *Spartina pectinata* (prairie cordgrass) is not readily eaten by livestock or wildlife except in the spring or when other forage is dry (Johnson and Nichols 1982). *Spartina pectinata* (prairie cordgrass) is commonly used for hay, with two or three cuttings a year being a desirable practice to prevent coarseness.

Wildlife

Coarse stems and very rough edged leaves limit the forage value of *Spartina pectinata* (prairie cordgrass) for wildlife except in the spring or when other forage is dry (Johnson and Nichols 1982).

The *Spartina pectinata* (prairie cordgrass) habitat type provides important shade and hiding cover for wildlife, especially deer. Birds also make limited use of this type.

Soil Management and Rehabilitation Opportunities

The rhizomatous nature of *Spartina pectinata* (prairie cordgrass) makes it an excellent species for rehabilitating disturbed saline or alkali sites.

Recreational Uses and Considerations

Spartina pectinata was used by Indians for thatching lodges. The thatched mats were then covered with soil. Later, pioneers used it for thatching roofs and covering haystacks.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range

site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar sites in the prairie pothole region of the northern Great Plains have been described by Van der Valk (1989).

Typha latifolia Habitat Type
(Common Cattail Habitat Type)

TYPLAT (TYLA)
Number Of Stands Sampled = 82

Note: The *Typha latifolia* (common cattail) habitat type includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Typha latifolia* (common cattail) habitat type is a major type at low and mid elevations throughout Montana. Sites range in elevation from 594 to 1,937 m (1,950 to 6,350 ft). This type commonly occurs along pond margins, ditches, oxbows, and backwater areas. Sites are generally classified as semipermanent wetlands.

FLORISTIC CHARACTERISTICS

Continually wet conditions tend to limit the species diversity within this habitat type. *Typha latifolia* (common cattail) is dominant, with *Typha angustifolia* (narrow-leaved cattail) occurring in some stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Beckmannia syzigachne (American sloughgrass)	3	0-3	2
Carex rostrata (beaked sedge)	3	0-3	2
Carex stipata (sawbeak sedge)	3	0-3	2
Glyceria grandis (American mannagrass)	2	0-3	4
Scirpus acutus (hardstem bulrush)	3	0-3	2
Scirpus validus (softstem bulrush)	8	0-20	6
Forbs			
Cicuta maculata (spotted water-hemlock)	20	0-20	2

Cirsium arvense (Canada thistle)	3	0-3	2
Epilobium ciliatum (common willow-herb)	3	0-3	2
Lemna minor (water lentil)	32	0-60	4
Polygonum amphibium (water smartweed)	3	0-3	2
Potentilla palustris (purple cinquefoil)	3	0-3	2
Typha angustifolia (narrow-leaved cattail)	90	0-98	23
Typha latifolia (common cattail)	77	0-98	91

SUCCESSIONAL INFORMATION

Typha latifolia (common cattail) and *Typha angustifolia* (narrow-leaved cattail) are early colonizers of suitable habitats and are able to persist under wet conditions. *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail) are well adapted to prolonged submergence of its roots and lower stems, but requires some period of bare soil exposure for germination and establishment. Because seed production is extremely high, it is capable of rapid colonization of wet mineral soils. Due to the saturated soils with water levels either above or near the soil surface throughout the growing season, the sites are minimally impacted. However, heavy livestock use can converts stands of this type to the *Carex nebrascensis* (Nebraska sedge) community type.

SOILS

Soils are commonly Entisols (Typic Fluvaquents) or Mollisols (Aquolls), often characterized by accumulations of organic matter overlying deposits of fine silt and clay. These types are commonly inundated with 30-100 cm (12-39 in) of water throughout the year. Redoximorphic features (mottling or gleyed soil) in mineral horizons are common resulting from permanently saturated, anaerobic soil conditions.

ADJACENT COMMUNITIES

Scirpus acutus (hardstem bulrush) is a common dominant of sites with similar water regimes, although *Scirpus acutus* (hardstem bulrush) appears to tolerate more brackish conditions than *Typha latifolia* (common cattail). The *Carex rostrata* (beaked sedge) habitat type frequently occupies adjacent drier sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Typha latifolia (common cattail) is normally little used by livestock. However, if water levels drop or upland forage limiting, livestock may heavily utilize this type. *Typha latifolia* (common cattail) is a highly preferred food of muskrats (Allen and Hoffman 1984).

Wildlife

Typha latifolia (common cattail) is an important source of shade, hiding cover, and food for wildlife. In addition, it is used by muskrats for construction of huts. Waterfowl use this type for nesting and hiding cover, provided the stands are not too dense. Dense stands of *Typha latifolia* (common cattail) will hinder waterfowl uses. Deer also use this type for forage and hiding cover. This type is a critical source of nesting and roosting cover for yellow headed and redwinged blackbirds.

Fire

Dense stands of *Typha latifolia* (common cattail) can be burned in late fall or early spring in order to improve habitat for waterfowl.

Soil Management and Rehabilitation Opportunities

Standing water and continually wet conditions restrict most development on these sites.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = permanently flooded to semipermanently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

Pierce and Johnson (1985) and Chadde and others (1988) described similar *Typha latifolia* (common cattail) communities. In addition, a similar community was described by Padgett and others (1989) for Utah and southeastern Idaho.

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APPENDICES

Appendices 1-7 contain the following information on a species by species basis: 1) forage palatability (cattle, sheep, and horses), 2) wetland status, 3) energy value, 4) protein value, 5) thermal or feeding cover values (elk, mule deer, whitetail deer, upland game birds, waterfowl, small nongame birds, and small mammals), 6) food value or degree of use (elk, mule deer, whitetail deer, antelope, upland game birds, waterfowl, small nongame birds, and small mammals), 7) potential biomass production, 8) erosion control potential, 9) short term revegetation potential, and 10) long term revegetation potential.

Appendix 1. Forage palatability

Species	Cattle Forage Palatabil.[1]	Sheep Forage Palatabil.[1]	Horse Forage Palatabil.[1]
TREES			
Abies lasiocarpa (subalpine fir)	P	P	P
Acer negundo (box-elder)	P	P	P
Elaeagnus angustifolia (Russian olive)	P	P	P
Fraxinus pennsylvanica (green ash)	F	F	F
Juniperus scopulorum (Rocky Mountain juniper)	P	P	P
Picea engelmannii (Engelmann spruce)	P	P	P
Picea glauca (white spruce)	P	P	P
Pinus contorta (lodgepole pine)	P	P	P
Pinus ponderosa (ponderosa pine)	P	P	P
Populus angustifolia (narrowleaf cottonwood)	P	F	P
Populus deltoides (Great Plains cottonwood)	P	F	P
Populus tremuloides (quaking aspen)	F	G	F
Populus trichocarpa (black cottonwood)	P	F	P
Pseudotsuga menziesii (Douglas fir)	P	P	P
Salix amygdaloides (peach-leaf willow)	F	G	F
SHRUBS			
Acer glabrum (Rocky Mountain maple)	P	F	P
Alnus incana (mountain alder)	P	F	P
Amelanchier alnifolia (western serviceberry)	F	G	F
Arctostaphylos uva-ursi (kinnikinnick)	P	P	P
Artemisia cana (silver sagebrush)	F	G	F
Betula glandulosa (bog birch)	P	F	P
Betula occidentalis (water birch)	P	P	P
Clematis ligusticifolia (western virgins-bower)	P	F	P
Cornus stolonifera (red-osier dogwood)	F	F	P
Crataegus douglasii (black hawthorn)	F	F	P
Crataegus succulenta (succulent hawthorn)	F	F	P
Elaeagnus commutata (silverberry)	P	F	P
Kalmia microphylla (small-leaved laurel)	P	P	P
Lonicera utahensis (Utah honeysuckle)	F	F	P
Potentilla fruticosa (shrubby cinquefoil)	P	F	P
Prunus americana (wild plum)	F	F	P

Prunus virginiana (common chokecherry)	F	G	P
Rhus aromatica (fragrant sumac)	P	F	P
Ribes odoratum (buffalo currant)	F	F	P
Ribes setosum (Missouri gooseberry)	P	P	P
Rosa acicularis (prickly rose)	F	F	P
Rosa woodsii (woods rose)	F	F	P
Rubus parviflorus (thimbleberry)	P	F	P
Salix bebbiana (Bebb willow)	F	F	F
Salix boothii (Booth willow)	F	F	F
Salix drummondiana (Drummond willow)	P	F	P
Salix exigua (sandbar willow)	F	F	F
Salix geyeriana (Geyer willow)	F	G	G
Salix lasiandra (Pacific willow)	F	F	F
Salix lutea (yellow willow)	F	G	G
Sarcobatus vermiculatus (black greasewood)	F	F	F
Shepherdia argentea (thorny buffaloberry)	P	F	P
Shepherdia canadensis (Canada buffaloberry)	P	F	P
Spiraea betulifolia (shiny-leaf spiraea)	P	F	P
Symphoricarpos albus (common snowberry)	F	F	P
Symphoricarpos occidentalis (western snowberry)	F	F	P
Vaccinium cespitosum (dwarf huckleberry)	P	F	P
Vaccinium scoparium (whortleberry)	P	F	P
GRAMINOIDS			
Agropyron caninum (bearded wheatgrass)	G	G	G
Agropyron repens (quackgrass)	G	F	G
Agropyron smithii (western wheatgrass)	G	G	G
Agrostis stolonifera (redtop)	F	F	F
Beckmannia syzigachne (American sloughgrass)	G	F	G
Bromus anomalus (nodding brome)	G	F	G
Bromus ciliatus (fringed brome)	G	G	G
Bromus inermis (smooth brome)	G	G	G
Calamagrostis canadensis (bluejoint reedgrass)	G	F	G
Calamagrostis rubescens (pinegrass)	F	P	F
Calamagrostis stricta (narrow-spiked reedgrass)	G	F	G
Carex aquatilis (water sedge)	G	G	G
Carex atherodes (awned sedge)	G	F	G
Carex lanuginosa (woolly sedge)	G	G	F
Carex lasiocarpa (slender sedge)	P	P	P
Carex microptera (small-winged sedge)	F	P	F
Carex nebrascensis (Nebraska sedge)	G	F	G
Carex nigricans (black alpine sedge)	F	F	F
Carex rostrata (beaked sedge)	F	F	G
Carex scopulorum (Holm's Rocky Mountain sedge)	F	F	F
Carex simulata (short-beaked sedge)	P	P	P
Carex vesicaria (inflated sedge)	F	F	F
Deschampsia cespitosa (tufted hairgrass)	G	F	G
Distichlis spicata (inland saltgrass)	F	F	G
Eleocharis acicularis (needle spike-rush)	F	F	F

Eleocharis palustris (common spikesedge)	P	P	P
Eleocharis pauciflora (few-flowered spike-rush)	P	P	P
Elymus canadensis (Canada wildrye)	F	F	G
Elymus cinereus (basin wildrye)	G	F	G
Elymus glaucus (blue wildrye)	G	F	G
Festuca idahoensis (Idaho fescue)	G	G	G
Glyceria borealis (northern mannagrass)	G	G	G
Glyceria grandis (American mannagrass)	G	G	G
Glyceria striata (fowl mannagrass)	G	G	G
Hordeum jubatum (foxtail barley)	P	F	F
Juncus balticus (Baltic rush)	F	P	F
Phalaris arundinacea (reed canarygrass)	G	G	G
Phleum alpinum (alpine timothy)	G	G	G
Phleum pratense (common timothy)	G	G	G
Phragmites australis (common reed)	F	P	F
Poa palustris (fowl bluegrass)	F	F	F
Poa pratensis (Kentucky bluegrass)	G	G	G
Puccinellia nuttalliana (Nuttall alkaligrass)	F	F	F
Scirpus acutus (hardstem bulrush)	F	P	F
Scirpus maritimus (alkali bulrush)	F	F	F
Scirpus pungens (sharp bulrush)	F	F	F
Scirpus validus (softstem bulrush)	F	P	P
Spartina gracilis (alkali cordgrass)	F	F	F
Spartina pectinata (prairie cordgrass)	G	F	F
Stipa occidentalis (western needlegrass)	G	F	G
Trisetum spicatum (spike trisetum)	F	F	G
FORBS			
Achillea millefolium (common yarrow)	P	F	P
Actaea rubra (baneberry)	P	F	P
Arnica cordifolia (heart-leaf arnica)	P	F	P
Aster foliaceus (leafy aster)	F	G	G
Cirsium arvense (Canada thistle)	P	P	P
Epilobium angustifolium (fireweed)	F	G	F
Equisetum arvense (field horsetail)	P	P	P
Equisetum fluviatile (water horsetail)	P	P	P
Equisetum laevigatum (smooth scouring-rush)	P	P	P
Fragaria virginiana (Virginia strawberry)	P	G	P
Galium boreale (northern bedstraw)	P	F	P
Geranium richardsonii (white geranium)	F	G	F
Geranium viscosissimum (sticky geranium)	F	G	F
Geum triflorum (old man's whiskers)	P	F	P
Glycyrrhiza lepidota (American licorice)	P	F	P
Heracleum lanatum (cow-parsnip)	G	G	G
Melilotus alba (white sweetclover)	G	G	G
Melilotus officinalis (yellow sweet-clover)	G	G	G
Mertensia ciliata (mountain bluebell)	F	G	F
Osmorhiza chilensis (mountain sweet-cicely)	F	F	F
Pedicularis groenlandica (elephant's head)	P	F	P
Polygonum amphibium (water smartweed)	F	F	F

Polygonum bistortoides (American bistort)	P	F	P
Polygonum lapathifolium (willow weed)	P	P	P
Potentilla anserina (common silverweed)	F	F	P
Potentilla gracilis (slender cinquefoil)	P	F	P
Senecio triangularis (arrowleaf groundsel)	F	G	F
Smilacina stellata (starry Solomon-plume)	P	F	P
Solidago canadensis (Canada goldenrod)	P	P	P
Taraxacum officinale (common dandelion)	F	G	G
Thalictrum occidentale (western meadowrue)	P	F	P
Trifolium repens (white clover)	G	G	G
Triglochin maritimum (seaside arrow-grass)	P	P	P
Typha angustifolia (hybrid cattail)	P	P	P
Typha latifolia (common cattail)	P	P	P
Urtica dioica (stinging nettle)	P	F	P
Viola adunca (hook violet)	F	G	P

[1]Palatability—refers to the relish and degree of use shown by livestock for a plant or plant part.

A) Good (G)—highly relished and consumed to a high degree.

B) Fair (F)—moderately relished and consumed to a moderate degree.

C) Poor (P)—not relished and normally consumed to only a small degree or not at all.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 2. Wetland status, energy, and protein values

Species	Wetland Status[1]	Energy Value[2]	Protein Value[3]
TREES			
Abies lasiocarpa (subalpine fir)	FACU	M	L
Acer negundo (box-elder)	FACW	M	L
Elaeagnus angustifolia (Russian olive)	FACW	M	M
Fraxinus pennsylvanica (green ash)	FACW	M	L
Juniperus scopulorum (Rocky Mountain juniper)	FACU	H	M
Picea engelmannii (Engelmann spruce)	FAC	M	L
Picea glauca (white spruce)	FAC	M	L
Pinus contorta (lodgepole pine)	FAC	M	L
Pinus ponderosa (ponderosa pine)	FACU	M	L
Populus angustifolia (narrowleaf cottonwood)	FACW	M	M
Populus deltoides (Great Plains cottonwood)	FACW	M	M
Populus tremuloides (quaking aspen)	FAC	M	M
Populus trichocarpa (black cottonwood)	FACW	M	M
Pseudotsuga menziesii (Douglas fir)	FACU	M	M
Salix amygdaloides (peach-leaf willow)	FACW	M	L

SHRUBS			
Acer glabrum (Rocky Mountain maple)	FAC	M	L
Alnus incana (mountain alder)	FACW	M	L
Amelanchier alnifolia (western serviceberry)	FACU	M	M
Artemisia cana (silver sagebrush)	FAC	M	M
Berberis repens (creeping Oregongrape)	FAC	M	M
Betula glandulosa (bog birch)	OBL	L	L
Betula occidentalis (water birch)	FACW	M	M
Clematis ligusticifolia (western virgins-bower)	FACU	L	L
Cornus stolonifera (red-osier dogwood)	FACW	M	L
Crataegus douglasii (black hawthorn)	FAC	M	M
Crataegus succulenta (succulent hawthorn)	FAC	M	M
Elaeagnus commutata (silverberry)	FAC	M	M
Kalmia microphylla (small-leaved laurel)	FACW	—	—
Ledum glandulosum (Labrador tea)	FACW	M	M
Lonicera utahensis (Utah honeysuckle)	FACU	L	L
Potentilla fruticosa (shrubby cinquefoil)	FAC	M	L
Prunus americana (wild plum)	FACU	M	M
Prunus virginiana (common chokecherry)	FACU	H	M
Rhus aromatica (fragrant sumac)	FACU	M	L
Ribes lacustre (swamp currant)	FAC	M	L
Ribes odoratum (buffalo currant)	FACU	L	L
Ribes setosum (Missouri gooseberry)	—	L	L
Rosa acicularis (prickly rose)	FACU	L	L
Rosa woodsii (woods rose)	FACU	L	L
Rubus parviflorus (thimbleberry)	FACU	L	L
Salix bebbiana (Bebb willow)	FACW	M	L
Salix boothii (Booth willow)	OBL	M	L
Salix brachycarpa (short-fruited willow)	FACW	M	L
Salix candida (hoary willow)	OBL	M	L
Salix commutata (undergreen willow)	OBL	M	L
Salix drummondiana (Drummond willow)	FACW	M	L
Salix exigua (sandbar willow)	OBL	M	L
Salix geyeriana (Geyer willow)	FACW	M	L
Salix lasiandra (Pacific willow)	FACW	M	L
Salix lutea (yellow willow)	OBL	M	L
Salix planifolia (planeleaf willow)	OBL	M	L
Salix wolfii (Wolf's willow)	FACW	M	L
Sarcobatus vermiculatus (black greasewood)	FACU	M	M
Shepherdia argentea (thorny buffaloberry)	FACU	M	L
Shepherdia canadensis (Canada buffaloberry)	—	M	L
Symphoricarpos albus (common snowberry)	FACU	M	M
Symphoricarpos occidentalis (western snowberry)	FACU	M	M
Vaccinium cespitosum (dwarf huckleberry)	FACU	L	M
Vaccinium scoparium (whortleberry)	FACU	L	M
GRAMINOIDS			
Agropyron caninum (bearded wheatgrass)	FAC	H	M
Agropyron repens (quackgrass)	FACU	M	L

Agropyron smithii (western wheatgrass)	FACU	H	M
Agrostis stolonifera (redtop)	FACW	M	L
Beckmannia syzigachne (American sloughgrass)	OBL	L	L
Bromus anomalus (nodding brome)	—	M	L
Bromus ciliatus (fringed brome)	FAC	M	L
Bromus inermis (smooth brome)	FAC	M	L
Calamagrostis canadensis (bluejoint reedgrass)	FACW	M	L
Calamagrostis rubescens (pinegrass)	—	M	L
Calamagrostis stricta (narrow-spiked reedgrass)	FACW	M	L
Carex aquatilis (water sedge)	OBL	M	M
Carex atherodes (awned sedge)	OBL	M	L
Carex buxbaumii (Buxbaum's sedge)	OBL	M	M
Carex lanuginosa (woolly sedge)	OBL	M	L
Carex lasiocarpa (slender sedge)	OBL	M	M
Carex lenticularis (lentil-fruit sedge)	FACW	M	M
Carex limosa (mud sedge)	OBL	M	M
Carex microptera (small-winged sedge)	FAC	M	M
Carex nebrascensis (Nebraska sedge)	OBL	H	M
Carex nigricans (black alpine sedge)	FACW	M	M
Carex rostrata (beaked sedge)	OBL	M	L
Carex scopulorum (Holm's Rocky Mountain sedge)	FACW	M	M
Carex simulata (short-beaked sedge)	OBL	M	M
Carex vesicaria (inflated sedge)	OBL	M	L
Deschampsia cespitosa (tufted hairgrass)	FACW	M	L
Distichlis spicata (inland saltgrass)	FACW	M	L
Eleocharis acicularis (needle spike-rush)	OBL	M	L
Eleocharis palustris (common spikesedge)	OBL	M	L
Eleocharis pauciflora (few-flowered spike-rush)	OBL	M	L
Elymus canadensis (Canada wildrye)	FAC	H	L
Elymus cinereus (basin wildrye)	FACU	H	L
Elymus glaucus (blue wildrye)	FACU	H	L
Festuca idahoensis (Idaho fescue)	—	H	M
Glyceria borealis (northern mannagrass)	OBL	M	L
Glyceria grandis (American mannagrass)	FACW	M	L
Glyceria striata (fowl mannagrass)	OBL	M	L
Hordeum jubatum (foxtail barley)	FAC	M	L
Juncus balticus (Baltic rush)	OBL	M	L
Phalaris arundinacea (reed canarygrass)	FACW	M	L
Phleum alpinum (alpine timothy)	FAC	H	L
Phleum pratense (common timothy)	FACU	M	L
Phragmites australis (common reed)	FACW	M	L
Poa palustris (fowl bluegrass)	FAC	M	L
Poa pratensis (Kentucky bluegrass)	FACU	M	L
Puccinellia nuttalliana (Nuttall alkaligrass)	OBL	M	L
Scirpus acutus (hardstem bulrush)	OBL	M	L
Scirpus maritimus (alkali bulrush)	OBL	M	L
Scirpus pungens (sharp bulrush)	OBL	M	L
Scirpus validus (softstem bulrush)	OBL	L	L
Spartina gracilis (alkali cordgrass)	FACW	M	L

Spartina pectinata (prairie cordgrass)	OBL	M	L
Trisetum spicatum (spike trisetum)	FACU	M	L
FORBS			
Achillea millefolium (common yarrow)	FACU	L	L
Actaea rubra (baneberry)	—	L	L
Aralia nudicaulis (wild sarsaparilla)	FACU	L	L
Arnica cordifolia (heart-leaf arnica)	—	L	L
Aster conspicuus (showy aster)	—	L	L
Aster foliaceus (leafy aster)	FACW	L	L
Caltha leptosepala (elkslip marshmarigold)	OBL	L	L
Cirsium arvense (Canada thistle)	FACU	L	L
Cirsium scariosum (elk thistle)	—	L	L
Clintonia uniflora (queen's cup)	FAC	L	L
Epilobium angustifolium (fireweed)	FACU	L	L
Epilobium ciliatum (common willow-herb)	FACW	L	L
Equisetum arvense (field horsetail)	FAC	L	L
Equisetum fluviatile (water horsetail)	OBL	L	L
Equisetum laevigatum (smooth scouring-rush)	FACW	L	L
Fragaria virginiana (Virginia strawberry)	—	L	L
Galium boreale (northern bedstraw)	FACU	L	L
Galium trifidum (small bedstraw)	FACW	L	L
Galium triflorum (sweetscented bedstraw)	FACU	L	L
Geranium richardsonii (white geranium)	FACU	L	L
Geranium viscosissimum (sticky geranium)	FAC	L	L
Geum macrophyllum (large-leaved avens)	FACW	L	L
Geum triflorum (old man's whiskers)	FACU	L	L
Glycyrrhiza lepidota (American licorice)	FAC	M	L
Heracleum lanatum (cow-parsnip)	FAC	L	L
Melilotus alba (white sweetclover)	FACU	M	L
Melilotus officinalis (yellow sweet-clover)	FACU	M	L
Mertensia ciliata (mountain bluebell)	FACW	L	L
Osmorhiza occidentalis (western sweet-cicely)	FAC	L	L
Pedicularis groenlandica (elephant's head)	OBL	L	L
Polygonum amphibium (water smartweed)	OBL	L	L
Polygonum bistortoides (American bistort)	FACW	L	L
Polygonum lapathifolium (willow weed)	FACW	L	L
Potentilla anserina (common silverweed)	OBL	L	L
Potentilla diversifolia (diverse-leaved cinquefoil)	FACU	L	L
Potentilla gracilis (slender cinquefoil)	FAC	L	L
Potentilla norvegica (Norwegian cinquefoil)	FAC	L	L
Potentilla palustris (purple cinquefoil)	OBL	L	L
Sagittaria cuneata (arumleaf arrowhead)	OBL	L	L
Salicornia rubra (red glasswort)	OBL	L	L
Senecio hydrophilus (alkali-marsh butterweed)	OBL	L	L
Senecio triangularis (arrowleaf groundsel)	FACW	L	L
Smilacina stellata (starry Solomon-plume)	FAC	L	L
Solidago canadensis (Canada goldenrod)	FACU	L	L
Streptopus amplexifolius (clasping-leaved twisted stalk)	FAC	L	L

Taraxacum officinale (common dandelion)	FACU	L	L
Thalictrum occidentale (western meadowrue)	FACU	L	L
Trifolium repens (white clover)	FACU	L	L
Triglochin maritimum (seaside arrow-grass)	OBL	L	L
Typha angustifolia (hybrid cattail)	OBL	M	L
Typha latifolia (common cattail)	OBL	L	L
Urtica dioica (stinging nettle)	FAC	L	L
Viola adunca (hook violet)	FAC	L	L
Viola canadensis (Canada violet)	FAC	L	L
Viola orbiculata (round-leaved violet)	—	L	L

[1]Wetland Status—refers to to plant species that have exhibited and ability to develop to maturity and reproduce in an environment where all or portions of the soil within the root zone become, periodically or continuously, saturated or inundated during the growing season. The ability to grow and reproduce in wetlands is due to morphological and/or physiological adaptations and/or reproductive strategies of the plant (Reed 1988). Categories are as follows:

OBL (Obligate Wetland)—refers to species that almost always occur (estimated probability greater than 99%) under natural conditions in wetlands.

FACW (Facultative Wetland)—refers to species that usually occur in wetlands (estimated probability 67-99%), but is occasionally found in non-wetlands.

FAC (Facultative)—refers to species that are equally likely to occur in wetlands or non-wetlands (estimated probability 34-66%).

FACU (Facultative Upland)—refers to species that usually occur in non-wetlands (estimated probability 67-99%), but is occasionally found in wetlands (estimated probability 1-33%).

The category for the species listed above where obtained from Reed (1988); however, for some species no information was available. In those instances, the authors made an estimate using information available for species with similar morphological or physiological characteristics.

[2]Energy Value—refers to the usable energy a plant provides to livestock or wildlife during the period from flowering or early seed formation to the following spring, within a ***comparable life form*** (e.g., a grass is compared to other grasses).

A) High (H)—retains usable energy value well during fall and winter (e.g., cures well and/or retains leaves).
B) Medium (M)—retains usable energy value moderately well during fall and winter.
C) Low (L)—poor retention of usable energy value during fall and winter (e.g., cures poorly and/or drops leaves).

[3]Protein Value—refers to the digestible protein a plant provides to livestock or wildlife during the period from flowering or early seed formation to the following spring, within a comparable life form (e.g., a grass is compared to other grasses).

A) High (H)—retains digestible protein value well during fall and winter (e.g., cures well and/or retains leaves).
B) Medium (M)—retains digestible protein value moderately well during fall and winter.
C) Low (L)—poor retention of digestible protein value during fall and winter (e.g., cures poorly and/or drops leaves).

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 3. Thermal or feeding cover values — elk, mule deer, and whitetail deer

Species	Elk Cover Value[1]	Mule Deer Cover Value[1]	Whitetail Deer Cover Value[1]
TREES			
Abies lasiocarpa (subalpine fir)	F	F	F
Acer negundo (box-elder)	P	G	G
Elaeagnus angustifolia (Russian olive)	F	F	G
Fraxinus pennsylvanica (green ash)	F	F	G
Juniperus scopulorum (Rocky Mountain juniper)	G	G	G
Picea engelmannii (Engelmann spruce)	G	G	G
Picea glauca (white spruce)	G	G	G
Pinus contorta (lodgepole pine)	G	G	G
Pinus ponderosa (ponderosa pine)	G	G	G
Populus angustifolia (narrowleaf cottonwood)	F	F	F
Populus deltoides (Great Plains cottonwood)	F	F	G
Populus tremuloides (quaking aspen)	G	G	G
Populus trichocarpa (black cottonwood)	F	F	G
Pseudotsuga menziesii (Douglas fir)	G	G	G
Salix amygdaloides (peach-leaf willow)	F	G	G
SHRUBS			
Acer glabrum (Rocky Mountain maple)	F	F	F
Alnus incana (mountain alder)	F	F	F
Amelanchier alnifolia (western serviceberry)	P	F	F
Artemisia cana (silver sagebrush)	P	F	P
Betula glandulosa (bog birch)	P	P	P
Betula occidentalis (water birch)	F	G	G
Cornus stolonifera (red-osier dogwood)	F	F	F
Crataegus douglasii (black hawthorn)	F	G	G
Crataegus succulenta (succulent hawthorn)	F	G	G
Elaeagnus commutata (silverberry)	F	F	F
Kalmia microphylla (small-leaved laurel)	F	F	F
Lonicera utahensis (Utah honeysuckle)	F	F	F
Potentilla fruticosa (shrubby cinquefoil)	P	P	P
Prunus americana (wild plum)	P	F	G
Prunus virginiana (common chokecherry)	F	G	G
Rhus aromatica (fragrant sumac)	F	F	F
Ribes lacustre (swamp currant)	P	F	F
Ribes odoratum (buffalo currant)	F	G	G
Ribes setosum (Missouri gooseberry)	P	F	F
Rosa acicularis (prickly rose)	F	G	G
Rosa woodsii (woods rose)	F	G	G
Salix bebbiana (Bebb willow)	G	G	G
Salix boothii (Booth willow)	G	G	G
Salix drummondiana (Drummond willow)	G	G	G

Salix exigua (sandbar willow)	G	G	G
Salix geyeriana (Geyer willow)	G	G	G
Salix lasiandra (Pacific willow)	G	G	G
Salix lutea (yellow willow)	G	G	G
Salix planifolia (planeleaf willow)	F	F	F
Salix wolfii (Wolf's willow)	F	F	F
Sarcobatus vermiculatus (black greasewood)	P	F	F
Shepherdia argentea (thorny buffaloberry)	G	G	G
Shepherdia canadensis (Canada buffaloberry)	P	F	F
Spiraea betulifolia (shiny-leaf spiraea)	P	P	P
Symphoricarpos albus (common snowberry)	P	F	F
Symphoricarpos occidentalis (western snowberry)	P	F	F
Vaccinium cespitosum (dwarf huckleberry)	P	P	P
Vaccinium scoparium (whortleberry)	P	P	P
GRAMINOIDS—in general, provide poor cover except for the following species:			
Phalaris arundinacea (reed canarygrass)	P	G	G
Phragmites australis (common reed)	F	G	G
Scirpus acutus (hardstem bulrush)	P	F	P
Scirpus pungens (sharp bulrush)	P	F	F
Scirpus validus (softstem bulrush)	P	G	G
Spartina gracilis (alkali cordgrass)	P	F	G
Spartina pectinata (prairie cordgrass)	P	F	G
FORBS—in general, provide poor cover except for the following species:			
Melilotus alba (white sweetclover)	P	F	F
Melilotus officinalis (yellow sweet-clover)	P	F	F
Typha angustifolia (hybrid cattail)	P	F	G
Typha latifolia (common cattail)	P	F	G

[1]Thermal or Feeding Cover Value—refers to the degree to which a plant provides environmental protection (e.g., thermal or feeding cover), during one or more seasons.

A) Good (G)—readily utilized for cover when available.

B) Fair (F)—moderately utilized for cover when available.

C) Poor (P)—rarely or never utilized for cover when available.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 4. Thermal or feeding cover values — upland game birds, waterfowl, small non-game birds, and small mammals

Species	Upland Game Bird Cover Value[1]	Waterfowl Cover Value[1]	Small Non-game Bird Cover Value[1]	Small Mammal Cover Value[1]
TREES				
Abies lasiocarpa (subalpine fir)	G	—	F	G
Acer negundo (box-elder)	G	P	G	F
Elaeagnus angustifolia (Russian olive)	G	F	G	F
Fraxinus pennsylvanica (green ash)	F	F	G	G
Juniperus scopulorum (Rocky Mountain juniper)	F	F	F	F
Picea engelmannii (Engelmann spruce)	G	—	G	G
Picea glauca (white spruce)	G	—	G	G
Pinus contorta (lodgepole pine)	G	—	G	G
Pinus ponderosa (ponderosa pine)	G	P	G	G
Populus angustifolia (narrowleaf cottonwood)	F	F	G	G
Populus deltoides (Great Plains cottonwood)	F	F	F	P
Populus tremuloides (quaking aspen)	G	F	G	G
Populus trichocarpa (black cottonwood)	F	F	G	G
Pseudotsuga menziesii (Douglas fir)	G	P	G	G
Salix amygdaloides (peach-leaf willow)	G	F	G	G
SHRUBS				
Acer glabrum (Rocky Mountain maple)	F	F	F	F
Alnus incana (mountain alder)	F	G	F	F
Amelanchier alnifolia (western serviceberry)	F	G	F	F
Artemisia cana (silver sagebrush)	F	G	G	G
Betula glandulosa (bog birch)	F	—	F	F
Betula occidentalis (water birch)	G	G	G	G
Cornus stolonifera (red-osier dogwood)	F	F	F	F
Crataegus douglasii (black hawthorn)	F	F	F	F
Crataegus succulenta (succulent hawthorn)	F	F	F	F
Elaeagnus commutata (silverberry)	F	G	F	F
Kalmia microphylla (small-leaved laurel)	F	P	F	F
Lonicera utahensis (Utah honeysuckle)	F	P	F	F
Potentilla fruticosa (shrubby cinquefoil)	F	P	P	P
Prunus americana (wild plum)	G	G	G	G
Prunus virginiana (common chokecherry)	G	G	G	G
Rhus aromatica (fragrant sumac)	F	G	F	F
Ribes lacustre (swamp currant)	G	G	G	G
Ribes odoratum (buffalo currant)	G	G	G	G
Ribes setosum (Missouri gooseberry)	G	G	G	G
Rosa acicularis (prickly rose)	F	G	F	F
Rosa woodsii (woods rose)	F	G	F	F
Salix bebbiana (Bebb willow)	G	F	G	G
Salix boothii (Booth willow)	G	F	G	G
Salix drummondiana (Drummond willow)	G	F	G	G
Salix exigua (sandbar willow)	G	G	G	G

Salix geyeriana (Geyer willow)	G	F	G	G
Salix lasiandra (Pacific willow)	G	F	G	G
Salix lutea (yellow willow)	G	F	G	G
Salix planifolia (planeleaf willow)	F	F	F	F
Salix wolfii (Wolf's willow)	F	F	F	F
Sarcobatus vermiculatus (black greasewood)	F	G	G	G
Shepherdia argentea (thorny buffaloberry)	G	G	G	F
Shepherdia canadensis (Canada buffaloberry)	G	—	G	F
Spiraea betulifolia (shiny-leaf spiraea)	P	G	P	P
Symphoricarpos albus (common snowberry)	G	G	G	G
Symphoricarpos occidentalis (western snowberry)	G	G	G	G
Vaccinium cespitosum (dwarf huckleberry)	P	G	P	P
Vaccinium scoparium (whortleberry)	P	G	P	P
GRAMINOIDS				
Agropyron caninum (bearded wheatgrass)	G	G	F	F
Agropyron repens (quackgrass)	G	G	F	G
Agropyron smithii (western wheatgrass)	G	G	G	G
Agrostis stolonifera (redtop)	G	G	F	F
Bromus inermis (smooth brome)	G	G	G	F
Calamagrostis canadensis (bluejoint reedgrass)	P	G	P	P
Calamagrostis rubescens (pinegrass)	F	G	P	P
Carex aquatilis (water sedge)	P	F	F	F
Carex lanuginosa (woolly sedge)	P	F	F	F
Carex lasiocarpa (slender sedge)	P	F	F	F
Carex lenticularis (lentil-fruit sedge)	P	F	F	F
Carex nebrascensis (Nebraska sedge)	P	F	F	G
Carex rostrata (beaked sedge)	P	P	F	F
Carex vesicaria (inflated sedge)	P	F	F	F
Deschampsia cespitosa (tufted hairgrass)	P	G	P	P
Distichlis spicata (inland saltgrass)	P	P	P	P
Elymus canadensis (Canada wildrye)	F	G	P	P
Elymus cinereus (basin wildrye)	F	G	P	P
Glyceria borealis (northern mannagrass)	F	G	G	G
Glyceria grandis (American mannagrass)	F	G	G	G
Glyceria striata (fowl mannagrass)	F	G	G	G
Hordeum jubatum (foxtail barley)	P	G	P	P
Juncus balticus (Baltic rush)	F	G	F	F
Phalaris arundinacea (reed canarygrass)	F	G	F	F
Phleum alpinum (alpine timothy)	P	F	P	P
Phleum pratense (common timothy)	F	G	F	F
Phragmites australis (common reed)	G	G	G	G
Eleocharis acicularis (needle spike-rush)	F	G	F	F
Eleocharis palustris (common spikesedge)	F	G	F	F
Eleocharis pauciflora (few-flowered spike-rush)	F	G	F	F
Poa pratensis (Kentucky bluegrass)	G	G	G	G
Puccinellia nuttalliana (Nuttall alkaligrass)	F	G	F	G
Scirpus acutus (hardstem bulrush)	G	G	G	F
Scirpus maritimus (alkali bulrush)	G	G	F	F

Scirpus pungens (sharp bulrush)	G	G	G	G
Scirpus validus (softstem bulrush)	G	G	G	G
Spartina gracilis (alkali cordgrass)	G	G	G	G
Spartina pectinata (prairie cordgrass)	G	G	G	G
Trisetum spicatum (spike trisetum)	P	P	P	P
Trisetum wolfii (Wolf's trisetum)	P	P	P	P
FORBS—most forbs are generally poor to fair except for the following species:				
Melilotus alba (white sweetclover)	G	G	G	G
Melilotus officinalis (yellow sweet-clover)	G	G	G	G
Typha angustifolia (hybrid cattail)	G	G	G	F
Typha latifolia (common cattail)	G	G	G	F

[1]Thermal or Feeding Cover Value—refers to the degree to which a plant provides environmental protection (e.g., thermal, nesting, brooding, or feeding cover), during one or more seasons.

A) Good (G)—readily utilized for cover when available.
B) Fair (F)—moderately utilized for cover when available.
C) Poor (P)—rarely or never utilized for cover when available.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 5. Food value or degree of use — elk, mule deer, whitetail deer, and antelope

Species	Elk Food Value[1]	Mule Deer Food Value[1]	Whitetail Deer Food Value[1]	Antelope Food Value[1]
TREES				
Abies lasiocarpa (subalpine fir)	P	P	P	—
Acer negundo (box-elder)	F	P	F	P
Elaeagnus angustifolia (Russian olive)	F	P	F	F
Fraxinus pennsylvanica (green ash)	F	F	F	P
Juniperus scopulorum (Rocky Mountain juniper)	P	P	P	P
Picea engelmannii (Engelmann spruce)	P	P	P	—
Picea glauca (white spruce)	P	P	P	—
Pinus contorta (lodgepole pine)	P	P	P	—
Pinus ponderosa (ponderosa pine)	P	P	P	P
Populus angustifolia (narrowleaf cottonwood)	P	P	P	P
Populus deltoides (Great Plains cottonwood)	P	P	F	P
Populus tremuloides (quaking aspen)	F	F	F	P
Populus trichocarpa (black cottonwood)	P	P	P	P
Pseudotsuga menziesii (Douglas fir)	P	F	P	P
Salix amygdaloides (peach-leaf willow)	G	G	F	P
SHRUBS				
Acer glabrum (Rocky Mountain maple)	F	G	F	P

Alnus incana (mountain alder)	P	P	P	P
Amelanchier alnifolia (western serviceberry)	F	G	G	G
Arctostaphylos uva-ursi (kinnikinnick)	F	F	F	P
Artemisia cana (silver sagebrush)	F	F	F	P
Betula glandulosa (bog birch)	P	P	P	P
Betula occidentalis (water birch)	F	P	F	P
Cornus stolonifera (red-osier dogwood)	P	G	G	F
Crataegus douglasii (black hawthorn)	F	F	F	F
Crataegus succulenta (succulent hawthorn)	F	F	F	F
Elaeagnus commutata (silverberry)	G	P	P	F
Kalmia microphylla (small-leaved laurel)	P	P	P	P
Potentilla fruticosa (shrubby cinquefoil)	F	F	F	P
Prunus americana (wild plum)	F	F	F	F
Prunus virginiana (common chokecherry)	F	G	G	F
Rhus aromatica (fragrant sumac)	P	G	P	P
Ribes lacustre (swamp currant)	G	F	F	P
Ribes odoratum (buffalo currant)	F	G	F	F
Ribes setosum (Missouri gooseberry)	P	F	F	P
Rosa acicularis (prickly rose)	F	F	F	G
Rosa woodsii (woods rose)	F	F	F	G
Rubus parviflorus (thimbleberry)	P	P	P	P
Salix bebbiana (Bebb willow)	G	F	F	F
Salix boothii (Booth willow)	F	F	F	F
Salix candida (hoary willow)	F	F	F	P
Salix drummondiana (Drummond willow)	F	F	F	P
Salix exigua (sandbar willow)	G	G	G	F
Salix geyeriana (Geyer willow)	G	F	F	F
Salix lutea (yellow willow)	G	F	F	P
Sarcobatus vermiculatus (black greasewood)	P	P	P	F
Shepherdia argentea (thorny buffaloberry)	F	G	F	P
Shepherdia canadensis (Canada buffaloberry)	P	P	P	F
Spiraea betulifolia (shiny-leaf spiraea)	P	F	F	F
Symphoricarpos albus (common snowberry)	F	F	F	F
Symphoricarpos occidentalis (western snowberry)	F	G	G	F
Vaccinium cespitosum (dwarf huckleberry)	G	G	F	F
Vaccinium scoparium (whortleberry)	P	P	P	P
GRAMINOIDS				
Agropyron caninum (bearded wheatgrass)	F	P	P	P
Agropyron repens (quackgrass)	G	G	P	P
Agropyron smithii (western wheatgrass)	G	P	P	P
Agrostis stolonifera (redtop)	G	G	F	P
Beckmannia syzigachne (American sloughgrass)	F	G	P	P
Bromus inermis (smooth brome)	F	F	F	F
Calamagrostis canadensis (bluejoint reedgrass)	F	P	P	P
Calamagrostis rubescens (pinegrass)	P	P	P	P
Calamagrostis stricta (narrow-spiked reedgrass)	F	P	P	P
Carex aquatilis (water sedge)	F	F	F	P
Carex atherodes (awned sedge)	F	F	F	P
Carex lanuginosa (woolly sedge)	F	F	F	F

Carex lasiocarpa (slender sedge)	P	P	P	P
Carex nebrascensis (Nebraska sedge)	F	F	F	P
Carex rostrata (beaked sedge)	F	F	P	P
Carex vesicaria (inflated sedge)	F	P	P	P
Deschampsia cespitosa (tufted hairgrass)	G	F	F	F
Distichlis spicata (inland saltgrass)	P	P	P	P
Eleocharis acicularis (needle spike-rush)	G	F	P	P
Eleocharis palustris (common spikesedge)	F	F	P	P
Eleocharis pauciflora (few-flowered spike-rush)	F	F	P	P
Elymus canadensis (Canada wildrye)	F	F	P	P
Elymus cinereus (basin wildrye)	G	F	F	F
Elymus glaucus (blue wildrye)	G	G	F	P
Glyceria borealis (northern mannagrass)	F	F	P	P
Glyceria grandis (American mannagrass)	F	F	P	P
Glyceria striata (fowl mannagrass)	F	F	P	P
Hordeum jubatum (foxtail barley)	P	P	P	P
Juncus balticus (Baltic rush)	F	P	P	P
Phalaris arundinacea (reed canarygrass)	G	F	F	F
Phleum pratense (common timothy)	F	F	F	P
Phragmites australis (common reed)	P	P	P	F
Poa palustris (fowl bluegrass)	G	G	G	F
Poa pratensis (Kentucky bluegrass)	G	F	G	F
Puccinellia nuttalliana (Nuttall alkaligrass)	G	F	P	F
Scirpus acutus (hardstem bulrush)	P	P	P	P
Scirpus maritimus (alkali bulrush)	P	P	P	P
Scirpus pungens (sharp bulrush)	F	P	P	P
Scirpus validus (softstem bulrush)	P	P	P	P
Spartina gracilis (alkali cordgrass)	P	P	P	P
Spartina pectinata (prairie cordgrass)	P	P	P	P
Stipa occidentalis (western needlegrass)	G	F	P	P
Trisetum spicatum (spike trisetum)	P	P	P	P
Trisetum wolfii (Wolf's trisetum)	P	P	P	P
FORBS				
Achillea millefolium (common yarrow)	P	P	P	P
Actaea rubra (baneberry)	F	F	F	P
Arnica cordifolia (heart-leaf arnica)	F	F	F	F
Aster foliaceus (leafy aster)	G	G	F	F
Cirsium arvense (Canada thistle)	P	F	P	P
Epilobium angustifolium (fireweed)	F	F	F	F
Equisetum arvense (field horsetail)	P	P	P	P
Equisetum laevigatum (smooth scouring-rush)	F	F	P	P
Fragaria virginiana (Virginia strawberry)	F	G	G	P
Galium boreale (northern bedstraw)	P	F	P	P
Geranium richardsonii (white geranium)	G	G	G	P
Geranium viscosissimum (sticky geranium)	G	G	G	P
Geum triflorum (old man's whiskers)	P	P	F	P
Glycyrrhiza lepidota (American licorice)	F	F	F	P
Heracleum lanatum (cow-parsnip)	G	G	G	P

Melilotus alba (white sweetclover)	G	F	F	F
Melilotus officinalis (yellow sweet-clover)	G	G	G	G
Mertensia ciliata (mountain bluebell)	P	P	P	P
Pedicularis groenlandica (elephant's head)	F	F	P	P
Polygonum amphibium (water smartweed)	P	P	P	P
Polygonum lapathifolium (willow weed)	P	P	P	P
Potentilla anserina (common silverweed)	F	G	F	P
Potentilla gracilis (slender cinquefoil)	P	P	P	P
Sagittaria cuneata (arumleaf arrowhead)	P	P	P	P
Senecio triangularis (arrowleaf groundsel)	G	F	F	P
Smilacina stellata (starry Solomon-plume)	P	F	F	P
Solidago canadensis (Canada goldenrod)	P	F	F	P
Taraxacum officinale (common dandelion)	G	F	F	G
Thalictrum occidentale (western meadowrue)	F	F	F	P
Trifolium repens (white clover)	G	G	G	G
Typha angustifolia (hybrid cattail)	P	P	P	P
Typha latifolia (common cattail)	P	P	P	P
Urtica dioica (stinging nettle)	P	P	P	P
Viola adunca (hook violet)	F	F	F	P

[1]Food Value—refers to the relish and degree of use shown by a wildlife species for a plant or plant part, as well as the plant's availability throughout its range.

A) Good (G)—readily to moderately available in the plant's range and consumed to a high degree.
B) Fair (F)—readily to moderately available in the plant's range but consumed only to a moderate degree.
C) Poor (P)—available but the plant is consumed to only a small degree or not at all.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 6. Food value or degree of use — upland game birds, waterfowl, small non-game birds, and small mammals

Species	Upland Game Bird Food Value[1]	Waterfowl Food Value[1]	Small Non-Game Bird Food Value[1]	Small Mammal Food Value[1]
TREES				
Abies lasiocarpa (subalpine fir)	F	P	P	F
Acer negundo (box-elder)	F	F	F	F
Elaeagnus angustifolia (Russian olive)	G	G	G	G
Fraxinus pennsylvanica (green ash)	P	P	F	F
Juniperus scopulorum (Rocky Mountain juniper)	F	P	G	P
Picea engelmannii (Engelmann spruce)	F	P	G	G
Picea glauca (white spruce)	F	P	G	G
Pinus contorta (lodgepole pine)	G	P	P	P

Pinus ponderosa (ponderosa pine)	G	P	G	G
Populus angustifolia (narrowleaf cottonwood)	F	P	F	G
Populus deltoides (Great Plains cottonwood)	F	P	G	G
Populus tremuloides (quaking aspen)	G	F	G	G
Populus trichocarpa (black cottonwood)	G	F	G	G
Pseudotsuga menziesii (Douglas fir)	G	P	P	F
Salix amygdaloides (peach-leaf willow)	F	F	F	F
SHRUBS				
Acer glabrum (Rocky Mountain maple)	F	P	F	F
Alnus incana (mountain alder)	F	P	G	F
Amelanchier alnifolia (western serviceberry)	F	P	F	F
Artemisia cana (silver sagebrush)	F	P	F	F
Betula glandulosa (bog birch)	F	P	F	F
Betula occidentalis (water birch)	G	F	F	G
Cornus stolonifera (red-osier dogwood)	F	F	F	F
Crataegus douglasii (black hawthorn)	F	P	F	F
Crataegus succulenta (succulent hawthorn)	F	P	F	F
Elaeagnus commutata (silverberry)	F	F	F	F
Lonicera utahensis (Utah honeysuckle)	F	F	G	F
Potentilla fruticosa (shrubby cinquefoil)	P	P	F	F
Prunus americana (wild plum)	G	P	G	F
Prunus virginiana (common chokecherry)	G	P	G	G
Rhus aromatica (fragrant sumac)	G	P	G	G
Ribes lacustre (swamp currant)	G	F	G	G
Ribes odoratum (buffalo currant)	F	P	F	F
Ribes setosum (Missouri gooseberry)	G	P	G	G
Rosa acicularis (prickly rose)	G	P	G	G
Rosa woodsii (woods rose)	G	P	G	G
Rubus parviflorus (thimbleberry)	F	P	F	F
Salix bebbiana (Bebb willow)	G	F	G	G
Salix boothii (Booth willow)	G	F	G	G
Salix drummondiana (Drummond willow)	G	F	F	F
Salix exigua (sandbar willow)	G	F	G	G
Salix geyeriana (Geyer willow)	G	F	G	G
Salix lutea (yellow willow)	G	F	G	G
Sarcobatus vermiculatus (black greasewood)	F	G	G	G
Shepherdia argentea (thorny buffaloberry)	F	F	F	F
Shepherdia canadensis (Canada buffaloberry)	G	F	F	G
Spiraea betulifolia (shiny-leaf spiraea)	P	P	P	P
Symphoricarpos albus (common snowberry)	F	F	F	F
Symphoricarpos occidentalis (western snowberry)	F	F	F	F
Vaccinium cespitosum (dwarf huckleberry)	F	P	F	G
Vaccinium scoparium (whortleberry)	F	P	P	P
GRAMINOIDS				
Agropyron caninum (bearded wheatgrass)	F	G	F	F
Agropyron repens (quackgrass)	G	G	G	F
Agropyron smithii (western wheatgrass)	P	G	P	P
Agrostis stolonifera (redtop)	F	F	F	F
Beckmannia syzigachne (American sloughgrass)	F	G	F	F

Bromus inermis (smooth brome)	G	F	G	G
Calamagrostis canadensis (bluejoint reedgrass)	P	G	P	P
Carex aquatilis (water sedge)	P	F	F	F
Carex atherodes (awned sedge)	P	F	F	F
Carex lanuginosa (woolly sedge)	F	F	F	F
Carex lasiocarpa (slender sedge)	F	F	F	F
Carex nebrascensis (Nebraska sedge)	P	G	G	G
Carex rostrata (beaked sedge)	F	F	G	G
Carex vesicaria (inflated sedge)	F	F	G	G
Deschampsia cespitosa (tufted hairgrass)	F	G	P	P
Distichlis spicata (inland saltgrass)	F	G	F	P
Eleocharis acicularis (needle spike-rush)	F	G	G	F
Eleocharis palustris (common spikesedge)	P	G	F	F
Eleocharis pauciflora (few-flowered spike-rush)	P	G	F	F
Elymus canadensis (Canada wildrye)	F	F	P	P
Elymus cinereus (basin wildrye)	F	F	P	P
Glyceria borealis (northern mannagrass)	G	G	F	G
Glyceria grandis (American mannagrass)	G	G	F	G
Glyceria striata (fowl mannagrass)	F	F	F	G
Juncus balticus (Baltic rush)	G	G	F	F
Phalaris arundinacea (reed canarygrass)	F	F	F	F
Phleum pratense (common timothy)	F	G	F	F
Phragmites australis (common reed)	G	G	G	G
Poa palustris (fowl bluegrass)	F	F	F	F
Poa pratensis (Kentucky bluegrass)	F	G	F	F
Puccinellia nuttalliana (Nuttall alkaligrass)	F	F	F	F
Scirpus acutus (hardstem bulrush)	G	G	G	F
Scirpus maritimus (alkali bulrush)	P	G	G	G
Scirpus pungens (sharp bulrush)	G	G	G	G
Scirpus validus (softstem bulrush)	G	G	G	G
Spartina gracilis (alkali cordgrass)	P	P	P	P
Spartina pectinata (prairie cordgrass)	P	P	F	F
FORBS				
Achillea millefolium (common yarrow)	P	P	P	P
Actaea rubra (baneberry)	P	P	F	F
Arnica cordifolia (heart-leaf arnica)	P	P	P	P
Aster foliaceus (leafy aster)	F	F	G	G
Cirsium arvense (Canada thistle)	F	P	F	P
Epilobium angustifolium (fireweed)	F	P	F	P
Equisetum arvense (field horsetail)	P	P	P	P
Equisetum laevigatum (smooth scouring-rush)	P	P	P	F
Fragaria virginiana (Virginia strawberry)	P	P	P	F
Galium boreale (northern bedstraw)	P	P	P	P
Galium trifidum (small bedstraw)	P	P	P	P
Galium triflorum (sweetscented bedstraw)	P	P	P	P
Geranium richardsonii (white geranium)	F	P	F	F
Geranium viscosissimum (sticky geranium)	F	P	F	F
Geum triflorum (old man's whiskers)	P	P	P	P

Glycyrrhiza lepidota (American licorice)	F	F	F	F
Heracleum lanatum (cow-parsnip)	F	F	P	P
Melilotus alba (white sweetclover)	F	G	F	F
Melilotus officinalis (yellow sweet-clover)	F	G	F	F
Mertensia ciliata (mountain bluebell)	F	P	F	F
Osmorhiza chilensis (mountain sweet-cicely)	F	F	G	G
Polygonum amphibium (water smartweed)	F	G	F	F
Polygonum lapathifolium (willow weed)	F	G	F	F
Potentilla anserina (common silverweed)	P	P	F	F
Potentilla gracilis (slender cinquefoil)	P	P	P	P
Sagittaria cuneata (arumleaf arrowhead)	P	P	P	P
Senecio triangularis (arrowleaf groundsel)	F	P	G	G
Smilacina stellata (starry Solomon-plume)	F	P	F	F
Solidago canadensis (Canada goldenrod)	F	P	F	F
Taraxacum officinale (common dandelion)	G	F	F	F
Trifolium repens (white clover)	G	F	F	F
Typha angustifolia (hybrid cattail)	G	G	G	F
Typha latifolia (common cattail)	G	G	G	F
Viola adunca (hook violet)	P	P	P	P

[1]Food Value—refers to the relish and degree of use shown by a wildlife species for a plant or plant part, as well as the plant's availability throughout its range.

A) Good (G)—readily to moderately available in the plant's range and consumed to a high degree.
B) Fair (F)—readily to moderately available in the plant's range but consumed only to a moderate degree.
C) Poor (P)—available but the plant is consumed to only a small degree or not at all.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 7. Potential biomass production, erosion control potential, short-term revegetation potential, and long-term revegetation potential

Species	Potential Biomass Production[1]	Erosion Control Potent.[2]	Short-Term Reveg. Potential[3]	Long-Term Reveg. Potential[4]
TREES				
Abies lasiocarpa (subalpine fir)	H	M	L	M
Acer negundo (box-elder)	M	M	L	L
Elaeagnus angustifolia (Russian olive)	H	M	L	H
Fraxinus pennsylvanica (green ash)	H	M	L	M
Juniperus scopulorum (Rocky Mountain juniper)	M	L	L	M
Picea engelmannii (Engelmann spruce)	H	M	L	M
Picea glauca (white spruce)	H	M	L	M
Pinus contorta (lodgepole pine)	H	L	L	M
Pinus ponderosa (ponderosa pine)	H	M	L	M

Populus angustifolia (narrowleaf cottonwood)	H	H	L	H
Populus deltoides (Great Plains cottonwood)	H	H	M	H
Populus tremuloides (quaking aspen)	M	H	L	H
Populus trichocarpa (black cottonwood)	H	H	L	M
Pseudotsuga menziesii (Douglas fir)	H	M	L	H
Salix amygdaloides (peach-leaf willow)	M	H	L	M
Thuja plicata (western red cedar)	H	M	L	M
SHRUBS				
Acer glabrum (Rocky Mountain maple)	M	M	L	M
Alnus incana (mountain alder)	M	H	L	M
Amelanchier alnifolia (western serviceberry)	M	M	L	M
Artemisia cana (silver sagebrush)	M	M	L	M
Betula glandulosa (bog birch)	M	H	L	H
Betula occidentalis (water birch)	M	H	L	M
Clematis ligusticifolia (western virgins-bower)	M	M	L	L
Cornus stolonifera (red-osier dogwood)	M	H	L	H
Crataegus douglasii (black hawthorn)	M	M	L	M
Crataegus succulenta (succulent hawthorn)	M	M	L	M
Elaeagnus commutata (silverberry)	M	M	L	M
Kalmia microphylla (small-leaved laurel)	L	M	L	M
Ledum glandulosum (Labrador tea)	L	M	L	M
Lonicera utahensis (Utah honeysuckle)	M	M	L	M
Potentilla fruticosa (shrubby cinquefoil)	H	M	L	M
Prunus americana (wild plum)	M	M	L	M
Prunus virginiana (common chokecherry)	H	M	L	H
Rhus aromatica (fragrant sumac)	M	M	L	M
Ribes lacustre (swamp currant)	M	M	L	M
Ribes odoratum (buffalo currant)	M	M	L	M
Ribes setosum (Missouri gooseberry)	M	M	L	M
Rosa acicularis (prickly rose)	M	H	L	M
Rosa woodsii (woods rose)	M	H	L	M
Rubus parviflorus (thimbleberry)	M	M	L	M
Salix bebbiana (Bebb willow)	M	H	L	M
Salix boothii (Booth willow)	H	H	L	M
Salix candida (hoary willow)	M	H	L	M
Salix commutata (undergreen willow)	M	H	L	M
Salix drummondiana (Drummond willow)	H	H	L	M
Salix exigua (sandbar willow)	M	H	L	M
Salix geyeriana (Geyer willow)	H	H	L	M
Salix lasiandra (Pacific willow)	H	H	L	M
Salix lutea (yellow willow)	H	H	L	M
Salix planifolia (planeleaf willow)	M	H	L	M
Salix wolfii (Wolf's willow)	M	H	L	M
Sarcobatus vermiculatus (black greasewood)	M	M	L	M
Shepherdia argentea (thorny buffaloberry)	H	M	L	M
Shepherdia canadensis (Canada buffaloberry)	H	M	L	M
Spiraea betulifolia (shiny-leaf spiraea)	M	M	L	M
Symphoricarpos albus (common snowberry)	M	M	L	M
Symphoricarpos occidentalis (western snowberry)	M	M	L	M

Vaccinium cespitosum (dwarf huckleberry)	M	M	L	M
Vaccinium scoparium (whortleberry)	M	M	L	M
GRAMINOIDS				
Agropyron caninum (bearded wheatgrass)	M	M	M	H
Agropyron repens (quackgrass)	M	H	M	H
Agropyron smithii (western wheatgrass)	M	H	M	H
Agrostis stolonifera (redtop)	M	H	H	H
Beckmannia syzigachne (American sloughgrass)	M	M	M	M
Bromus anomalus (nodding brome)	M	M	M	H
Bromus ciliatus (fringed brome)	M	M	M	H
Bromus inermis (smooth brome)	H	H	M	H
Calamagrostis canadensis (bluejoint reedgrass)	M	H	L	H
Calamagrostis rubescens (pinegrass)	M	M	L	M
Calamagrostis stricta (narrow-spiked reedgrass)	M	H	L	H
Carex aquatilis (water sedge)	H	H	M	M
Carex atherodes (awned sedge)	H	H	M	M
Carex buxbaumii (Buxbaum's sedge)	M	M	L	M
Carex lanuginosa (woolly sedge)	M	H	M	M
Carex lasiocarpa (slender sedge)	M	H	M	M
Carex lenticularis (lentil-fruit sedge)	H	H	M	M
Carex limosa (mud sedge)	M	M	L	M
Carex livida (pale sedge)	M	M	L	M
Carex nebrascensis (Nebraska sedge)	M	H	L	M
Carex rostrata (beaked sedge)	H	H	M	H
Carex scopulorum (Holm's Rocky Mountain sedge)	M	H	L	M
Carex vesicaria (inflated sedge)	H	H	M	H
Deschampsia cespitosa (tufted hairgrass)	M	M	L	M
Distichlis spicata (inland saltgrass)	M	M	L	M
Eleocharis acicularis (needle spike-rush)	L	H	M	L
Eleocharis palustris (common spikesedge)	M	H	H	M
Eleocharis pauciflora (few-flowered spike-rush)	M	H	H	M
Elymus canadensis (Canada wildrye)	H	M	M	M
Elymus cinereus (basin wildrye)	H	H	M	H
Elymus glaucus (blue wildrye)	M	M	M	H
Festuca idahoensis (Idaho fescue)	M	M	L	M
Glyceria borealis (northern mannagrass)	M	M	M	M
Glyceria grandis (American mannagrass)	H	M	M	M
Glyceria striata (fowl mannagrass)	L	M	L	M
Hordeum jubatum (foxtail barley)	M	L	M	L
Juncus balticus (Baltic rush)	M	M	L	M
Phalaris arundinacea (reed canarygrass)	H	H	M	H
Phleum alpinum (alpine timothy)	M	M	L	M
Phleum pratense (common timothy)	M	M	M	H
Phragmites australis (common reed)	H	H	M	H
Poa palustris (fowl bluegrass)	M	M	M	M
Poa pratensis (Kentucky bluegrass)	M	L	M	H
Puccinellia nuttalliana (Nuttall alkaligrass)	M	M	L	M
Scirpus acutus (hardstem bulrush)	H	M	M	M

Scirpus maritimus (alkali bulrush)	M	M	L	M
Scirpus pungens (sharp bulrush)	H	M	M	M
Scirpus validus (softstem bulrush)	H	M	M	M
Spartina gracilis (alkali cordgrass)	H	H	M	H
Spartina pectinata (prairie cordgrass)	H	H	M	H
Stipa occidentalis (western needlegrass)	M	M	M	H
Trisetum spicatum (spike trisetum)	M	M	L	M
FORBS				
Achillea millefolium (common yarrow)	L	L	H	M
Actaea rubra (baneberry)	M	L	L	L
Aralia nudicaulis (wild sarsaparilla)	M	M	L	M
Arnica cordifolia (heart-leaf arnica)	L	L	L	L
Arnica latifolia (broadleaf arnica)	L	L	L	L
Caltha leptosepala (elkslip marshmarigold)	M	M	L	L
Cirsium arvense (Canada thistle)	M	M	L	M
Epilobium angustifolium (fireweed)	H	L	H	M
Epilobium ciliatum (common willow-herb)	L	L	M	M
Equisetum arvense (field horsetail)	L	M	H	M
Equisetum fluviatile (water horsetail)	M	M	H	M
Equisetum laevigatum (smooth scouring-rush)	L	M	H	M
Fragaria virginiana (Virginia strawberry)	L	L	L	L
Galium boreale (northern bedstraw)	L	L	L	L
Galium trifidum (small bedstraw)	L	L	L	L
Galium triflorum (sweetscented bedstraw)	L	L	L	L
Geranium richardsonii (white geranium)	M	M	M	M
Geranium viscosissimum (sticky geranium)	M	M	L	L
Geum macrophyllum (large-leaved avens)	M	L	L	L
Geum triflorum (old man's whiskers)	M	L	L	L
Glycyrrhiza lepidota (American licorice)	M	M	L	L
Heracleum lanatum (cow-parsnip)	H	M	L	L
Melilotus alba (white sweetclover)	H	M	H	M
Melilotus officinalis (yellow sweet-clover)	H	M	H	M
Mertensia ciliata (mountain bluebell)	M	M	L	M
Mertensia paniculata (panicle bluebells)	M	M	L	M
Pedicularis groenlandica (elephant's head)	L	L	L	L
Polygonum amphibium (water smartweed)	M	M	M	M
Polygonum bistortoides (American bistort)	L	L	L	L
Polygonum lapathifolium (willow weed)	M	L	L	L
Potentilla anserina (common silverweed)	L	M	M	M
Potentilla diversifolia (diverse-leaved cinquefoil)	L	M	M	M
Potentilla gracilis (slender cinquefoil)	M	L	M	M
Sagittaria cuneata (arumleaf arrowhead)	M	L	L	L
Senecio hydrophilus (alkali-marsh butterweed)	M	M	L	L
Senecio triangularis (arrowleaf groundsel)	M	M	L	L
Smilacina stellata (starry Solomon-plume)	L	L	L	L
Solidago canadensis (Canada goldenrod)	M	M	M	M
Sparganium emersum (simplestem bur-reed)	M	M	L	L
Taraxacum officinale (common dandelion)	L	L	L	L

Thalictrum occidentale (western meadowrue)	M	L	L	L
Trifolium repens (white clover)	L	L	M	H
Triglochin maritimum (seaside arrow-grass)	M	L	L	L
Typha angustifolia (hybrid cattail)	H	H	L	H
Typha latifolia (common cattail)	H	H	L	H
Urtica dioica (stinging nettle)	H	M	L	L
Viola adunca (hook violet)	L	L	L	L
Viola orbiculata (round-leaved violet)	L	L	L	L

[1]Potential Biomass Production—refers to the relative genetic ability of a plant to produce plant material by weight on an annual basis ***compared to other members of the same lifeform*** (e.g., a grass is rated against other grasses). Species are rated as if they were growing on typical sites. Therefore, a plant may have a higher or lower biomass production than the rating given if it occurs on a site more favorable or less favorable than its normal site.

A) High (H)—plant possesses ability to produce a greater yield of dry plant material than most other species of the same lifeform.
B) Medium (M)—plant produces an average yield of dry plant material as compared to other species of the same lifeform.
C) Low (L)—plant produces a low yield of dry plant material as compared to other species of the same lifeform.
D) Very Low (V)—plant produces a very low yield of dry plant material as compared to other species of the same lifeform.

[2]Erosion Control Potential—refers to a plant that commonly exhibits growth habit, plant structure, biomass and/or root system that has the potential to reduce soil erosion.

A) High (H)—plant that has aggressive growth habits, persistent plant structure, high potential biomass, and/or good soil-binding root-rhizome-runner system in established stands.
B) Medium (M)—plant that has moderately aggressive growth, moderately persistent plant structure, moderate potential biomass, and/or moderate soil-binding root-rhizome-runner system in established stands.
C) Low (L)—plant that has poor growth, persistence, biomass, and/or soil-binding root system that makes it generally inadequate for erosion control.

[3]Short-Term Revegetation Potential—refers to the ability of a plant to become quickly established and exhibit rapid growth within 1 to 3 years (includes annuals).

A) High (H)—plant demonstrates rapid growth, good cover, and good reproduction.
B) Medium (M)—plant demonstrates moderately rapid growth, fair cover, and fair reproduction.
C) Low (L)—plant demonstrates slow growth, poor cover, and poor reproduction.

[4]Long-Term Revegetation Potential—refers to the ability of a plant to become established and persist over a period of more than 3 years.

A) High (H)—plant demonstrates good growth, cover, reproduction, and stand maintenance characteristics.
B) Medium (M)—plant demonstrates fair growth, cover, reproduction, and stand maintenance characteristics.
C) Low (L)—plant demonstrates poor growth, cover, reproduction, and stand maintenance characteristics.

Sources: Dittberner and Olson 1983. In addition, some species had no literature sources available. In those instances, the authors used professional experience or made an estimate using information available for species with similar morphological or physiological characteristics.

Appendix 8. Riparian and wetland indicator species of Montana

Scientific Name	Common Name	Six-Letter Code
TREES		
Abies grandis	grand fir	ABIGRA
Abies lasiocarpa	subalpine fir	ABILAS
Acer negundo	box-elder	ACENEG
Elaeagnus angustifolia	Russian olive	ELAANG
Fraxinus pennsylvanica	green ash	FRAPEN
Juniperus scopulorum	Rocky Mountain juniper	JUNSCO
Picea engelmannii	Engelmann spruce	PICENG
Picea glauca	white spruce	PICGLA
Pinus contorta	lodgepole pine	PINCON
Pinus ponderosa	ponderosa pine	PINPON
Populus angustifolia	narrowleaf cottonwood	POPANG
Populus deltoides	Great Plains cottonwood	POPDEL
Populus tremuloides	quaking aspen	POPTRE
Populus trichocarpa	black cottonwood	POPTRI
Pseudotsuga menziesii	Douglas fir	PSEMEN
Salix amygdaloides	peach-leaf willow	SALAMY
Thuja plicata	western redcedar	THUPLI
Tsuga heterophylla	western hemlock	TSUHET
Ulmus americana	American elm	ULMAME
SHRUBS		
Alnus incana	mountain alder	ALNINC
Alnus sinuata	sitka alder	ALNSIN
Amelanchier alnifolia	western serviceberry	AMEALN
Artemisia cana	silver sagebrush	ARTCAN
Berberis repens	creeping Oregongrape	BERREP
Betula glandulosa	bog birch	BETGLA
Betula occidentalis	water birch	BETOCC
Cornus canadensis	bunchberry	CORCAN
Cornus stolonifera	red-osier dogwood	CORSTO
Crataegus douglasii	black hawthorn	CRADOU
Crataegus succulenta	succulent hawthorn	CRASUC
Kalmia microphylla	small-leaved laurel	KALMIC
Ledum glandulosum	Labrador tea	LEDGLA
Menziesia ferruginea	fool's huckleberry	MENFER
Potentilla fruticosa	shrubby cinquefoil	POTFRU
Prunus virginiana	common chokecherry	PRUVIR
Oplopanax horridum	devil's club	OPLHOR
Rosa acicularis	prickly rose	ROSACI
Rosa woodsii	woods rose	ROSWOO
Salix bebbiana	Bebb willow	SALBEB
Salix boothii	Booth willow	SALBOO
Salix candida	hoary willow	SALCAN
Salix commutata	undergreen willow	SALCOM

Salix drummondiana	Drummond willow	SALDRU
Salix exigua	sandbar willow	SALEXI
Salix geyeriana	Geyer willow	SALGEY
Salix lasiandra	Pacific willow	SALLAS
Salix lutea	yellow willow	SALLUT
Salix planifolia	planeleaf willow	SALPLA
Salix wolfii	Wolf's willow	SALWOL
Sarcobatus vermiculatus	black greasewood	SARVER
Shepherdia argentea	thorny buffaloberry	SHEARG
Spiraea douglasii	Douglas's spiraea	SPIDOU
Symphoricarpos albus	common snowberry	SYMALB
Symphoricarpos occidentalis	western snowberry	SYMOCC
Tamarix chinensis	salt cedar	TAMCHI
Vaccinium cespitosum	dwarf huckleberry	VACCES
Vaccinium scoparium	whortleberry	VACSCO
GRAMINOIDS		
Agropyron smithii	western wheatgrass	AGRSMI
Agrostis stolonifera	redtop	AGRSTO
Bromus inermis	smooth brome	BROINE
Calamagrostis canadensis	bluejoint reedgrass	CALCAN
Calamagrostis rubescens	pinegrass	CALRUB
Calamagrostis stricta	narrow-spiked reedgrass	CALSTR
Carex aperta	Columbia sedge	CARAPE
Carex aquatilis	water sedge	CARAQU
Carex atherodes	awned sedge	CARATH
Carex buxbaumii	Buxbaum's sedge	CARBUX
Carex geyeri	elk sedge	CARGEY
Carex lanuginosa	woolly sedge	CARLAN
Carex lasiocarpa	slender sedge	CARLAS
Carex lenticularis	lentil-fruit sedge	CARLEN
Carex limosa	mud sedge	CARLIM
Carex nebrascensis	Nebraska sedge	CARNEB
Carex rostrata	beaked sedge	CARROS
Carex scopulorum	Holm's Rocky Mountain sedge	CARSCO
Carex simulata	short-beaked sedge	CARSIM
Carex vesicaria	inflated sedge	CARVES
Deschampsia cespitosa	tufted hairgrass	DESCES
Distichlis spicata	inland saltgrass	DISSPI
Eleocharis acicularis	needle spike-rush	ELEACI
Eleocharis palustris	common spikesedge	ELEPAL
Eleocharis pauciflora	few-flowered spike-rush	ELEPAU
Eleocharis rostellata	beaked spike-rush	ELEROS
Elymus glaucus	blue wildrye	ELYGLA
Festuca idahoensis	Idaho fescue	FESIDA
Glyceria borealis	northern mannagrass	GLYBOR
Hordeum jubatum	foxtail barley	HORJUB
Juncus balticus	Baltic rush	JUNBAL
Phalaris arundinacea	reed canarygrass	PHAARU
Phleum pratense	common timothy	PHLPRA

Phragmites australis	common reed	PHRCOM
Poa palustris	fowl bluegrass	POAPAL
Poa pratensis	Kentucky bluegrass	POAPRA
Scirpus acutus	hardstem bulrush	SCIACU
Scirpus americanus	American bulrush	SCIAME
Scirpus maritimus	alkali bulrush	SCIMAR
Scirpus pungens	sharp bulrush	SCIPUN
Scirpus validus	softstem bulrush	SCIVAL
Spartina gracilis	alkali cordgrass	SPAGRA
Spartina pectinata	prairie cordgrass	SPAPEC
FORBS		
Actaea rubra	baneberry	ACTRUB
Athyrium filix-femina	ladyfern	ATHFIL
Equisetum arvense	field horsetail	EQUARV
Equisetum fluviatile	water horsetail	EQUFLU
Galium triflorum	sweetscented bedstraw	GALTRI
Gymnocarpium dryopteris	oak-fern	GYMDRY
Glycyrrhiza lepidota	American licorice	GLYLEP
Heracleum lanatum	cow-parsnip	HERLAN
Ligusticum canbyi	Canby's licorice-root	LIGCAN
Linnaea borealis	twinflower	LINBOR
Lysichiton americanum	skunk cabbage	LYSAME
Melilotus alba	white sweet-clover	MELALB
Melilotus officinalis	yellow sweet-clover	MELOFF
Mitella breweri	Brewer's mitrewort	MITBRE
Mitella pentandra	five-stamened mitrewort	MITPEN
Osmorhiza occidentalis	western sweet-cicely	OSMOCC
Parnassia fimbriata	fringed grass-of-parnassus	PARFIM
Polygonum amphibium	water smartweed	POLAMP
Salicornia rubra	red glasswort	SALRUB
Senecio triangularis	arrowleaf groundsel	SENTRI
Streptopus amplexifolius	clasping-leaved twisted stalk	STRAMP
Trautvetteria caroliniensis	false bugbane	TRACAR
Typha angustifolia	narrow-leaved cattail	TYPANG
Typha latifolia	common cattail	TYPLAT
Viola canadensis	Canada violet	VIOCAN

Appendix 9. Riparian and wetland habitat types and community types of three geographical regions of Montana

Type	Number of Stands	Abundance[1] Region 1	Region 2	Region 3
CONIFEROUS TREE TYPES				
Abies grandis/Athyrium filix-femina Habitat Type	14	Minor	Incidental	—
Abies lasiocarpa/Actaea rubra Habitat Type	7	—	Major	—
Abies lasiocarpa/Calamagrostis canadensis Habitat Type				
Calamagrostis canadensis Phase	17	Major	Major	—
Ligusticum canbyi Phase	5	Minor	Minor	—
Vaccinium cespitosum Phase	5	Minor	Minor	—
Abies lasiocarpa/Galium trifolium Habitat Type	10	Incidental	Major	—
Abies lasiocarpa/Ledum glandulosum Habitat Type				
Calamagrostis canadensis Phase	9	Major	Incidental	—
Ledum glandulosum Phase	8	Major	Minor	—
Abies lasiocarpa/Oplopanax horridum Habitat Type	3	Incidental	—	—
Abies lasiocarpa/Streptopus amplexifolius Habitat Type				
Menziesia ferruginea Phase	8	Minor	Incidental	—
Streptopus amplexifolius Phase	45	Minor	Minor	—
Juniperus scopulorum/Cornus stolonifera Habitat Type	29	Minor	Minor	Minor
Picea/Calamagrostis canadensis Community Type	20	Minor	Minor	—
Picea/Cornus stolonifera Habitat Type	37	Major	Major	—
Picea/Equisetum arvense Habitat Type	16	Minor	Major	—
Picea/Galium triflorum Habitat Type	18	Incidental	Major	—
Picea/Lysichiton americanum Habitat Type	5	Incidental	—	—
Pinus ponderosa/Cornus stolonifera Habitat Type	29	Major	Major	Minor
Pinus ponderosa/Prunus virginiana Habitat Type	32	—	Incidental	Minor
Pseudotsuga menziesii/Cornus stolonifera Habitat Type	28	Major	Major	—
Thuja plicata/Athyrium filix-femina Habitat Type				
Athyrium filix-femina Phase	11	Incidental	Incidental	—
Thuja plicata/Gymnocarpium dryopteris Habitat Type	7	Minor	—	—
Thuja plicata/Oplopanax horridum Habitat Type	20	Incidental	—	—
Tsuga heterophylla/Gymnocarpium dryopteris Habitat Type	10	Minor	—	—
DECIDUOUS TREE TYPES				
Acer negundo/Prunus virginiana Habitat Type	17	—	—	Minor
Elaeagnus angustifolia Community Type	4	Incidental	Incidental	Minor
Fraxinus pennsylvanica/Prunus virginiana Habitat Type	104	—	—	Major
Populus angustifolia/Cornus stolonifera Community Type	13	—	Minor	Incidental
*Populus angustifolia/*Herbaceous Community Type	5	—	Major	Minor
*Populus angustifolia/*Recent Alluvial Bar Community Type	8	—	Major	Incidental
Populus angustifolia/Symphoricarpos occidentalis C. T.	5	—	Major	Minor
Populus deltoides/Cornus stolonifera Community Type	11	—	—	Major
*Populus deltoides/*Herbaceous Community Type	10	—	—	Major
*Populus deltoides/*Recent Alluvial Bar Community Type	42	—	—	Minor
Populus deltoides/Symphoricarpos occidentalis C.T.	19	—	—	Major
Populus tremuloides/Berberis repens Habitat Type	3	—	—	Incidental
Populus tremuloides/Calamagrostis canadensis Habitat Type	6	—	Minor	—

Populus tremuloides/Cornus stolonifera Habitat Type	75	—	Minor	—
Populus tremuloides/Osmorhiza occidentalis Habitat Type	15	—	Minor	—
Populus tremuloides/Poa pratensis Community Type	26	—	Minor	—
Populus trichocarpa/Cornus stolonifera Community Type	23	Minor	Minor	—
Populus trichocarpa/Herbaceous Community Type	12	Major	Major	—
Populus trichocarpa/Recent Alluvial Bar Community Type	21	Minor	Minor	—
Populus trichocarpa/Symphoricarpos occidentalis C. T.	21	Major	Major	—
Salix amygdaloides Community Type	21	—	—	Incidental
WILLOW SHRUB TYPES				
Salix bebbiana Community Type	27	Minor	Major	Minor
Salix candida/Carex rostrata Habitat Type	24	—	Incidental	—
Salix drummondiana/Calamagrostis canadensis H. T.	26	Minor	Incidental	—
Salix drummondiana/Carex rostrata Habitat Type	43	Major	Incidental	—
Salix drummondiana Community Type	2	Major	Incidental	—
Salix exigua Community Type	118	Major	Major	Major
Salix geyeriana/Calamagrostis canadensis Habitat Type	32	Incidental	Minor	—
Salix geyeriana/Carex rostrata Habitat Type	71	Incidental	Major	—
Salix geyeriana Community Type	71	Incidental	Major	—
Salix lasiandra Community Type	10	Incidental	Minor	—
Salix lutea/Calamagrostis canadensis Habitat Type	5	—	Minor	Minor
Salix lutea/Carex rostrata Habitat Type	14	—	Minor	Minor
Salix lutea Community Type	5	—	Minor	Minor
Salix planifolia/Carex aquatilis Habitat Type	57	—	Minor	—
Salix wolfii/Carex aquatilis Habitat Type	19	—	Major	—
Salix wolfii/Deschampsia cespitosa Habitat Type	20	—	Major	—
NON-WILLOW SHRUB TYPES				
Alnus incana Community Type	51	Major	Minor	—
Alnus sinuata Community Type	7	Minor	—	—
Artemisia cana/Agropyron smithii Habitat Type	43	—	—	Major
Artemisia cana/Festuca idahoensis Habitat Type	6	—	Incidental	—
Betula glandulosa/Carex rostrata Habitat Type	33	Minor	Incidental	—
Betula occidentalis Community Type	23	—	Minor	Incidental
Cornus stolonifera Community Type	16	Incidental	Incidental	—
Crataegus succulenta Community Type	22	Minor	Minor	Minor
Kalmia microphylla/Carex scopulorum Habitat Type	12	Incidental	Incidental	—
Potentilla fruticosa/Deschampsia cespitosa Habitat Type	76	Minor	Major	Incidental
Prunus virginiana Community Type	25	Incidental	Incidental	Incidental
Rosa woodsii Community Type	59	Incidental	Incidental	Minor
Sarcobatus vermiculatus/Agropyron smithii Habitat Type	11	—	Minor	Minor
Shepherdia argentea Community Type	18	—	Incidental	Minor
Spiraea douglasii Community Type	11	Minor	—	—
Symphoricarpos occidentalis Community Type	55	Incidental	Minor	Major
Tamarix chinensis Community Type	4	—	—	Incidental
SEDGE TYPES				
Carex aquatilis Habitat Type				
Carex aquatilis Phase	39	Minor	Minor	Minor
Deschampsia cespitosa Phase	29	Minor	Minor	Minor
Carex lasiocarpa Habitat Type	32	Minor	Minor	—
Carex limosa Habitat Type	15	Incidental	Incidental	—

Carex nebrascensis Community Type	7	Major	Major	Major
Carex rostrata Habitat Type				
Carex aquatilis Phase	45	Minor	Minor	Minor
Carex rostrata Phase	142	Major	Major	Major
Deschampsia cespitosa Phase	46	Minor	Minor	Minor
Carex scopulorum Habitat Type	20	Minor	Minor	—
Carex simulata Habitat Type	18	Minor	Minor	—
NON-SEDGE TYPES				
Agropyron smithii Habitat Type	32	—	—	Minor
Agrostis stolonifera Community Type	1	Incidental	Incidental	Incidental
Bromus inermis Community Type	2	Incidental	Incidental	Incidental
Calamagrostis canadensis Habitat Type	39	Minor	Minor	Incidental
Deschampsia cespitosa Habitat Type	35	Incidental	Minor	Incidental
Distichlis spicata Habitat Type	21	—	Incidental	Minor
Eleocharis palustris Habitat Type	57	Minor	Minor	Major
Eleocharis pauciflora Habitat Type	18	—	Minor	Minor
Equisetum fluviatile Habitat Type	16	Minor	Incidental	—
Glyceria borealis Habitat Type	9	Incidental	Incidental	—
Glycyrrhiza lepidota Community Type	3	—	—	Minor
Hordeum jubatum Community Type	11	—	—	Minor
Juncus balticus Community Type	9	Incidental	Minor	Major
Phalaris arundinacea Habitat Type	26	Major	Minor	Minor
Phragmites australis Habitat Type	5	—	—	Minor
Poa palustris Community Type	4	Incidental	Incidental	Incidental
Poa pratensis Community Type	12	Minor	Minor	Minor
Polygonum amphibium Community Type	5	—	—	Incidental
Salicornia rubra Community Type	4	—	—	Incidental
Scirpus acutus Habitat Type	58	Minor	Minor	Major
Scirpus maritimus Habitat Type	5	—	—	Minor
Scirpus pungens Habitat Type	16	—	—	Minor
Senecio triangularis Community Type	7	Incidental	—	—
Spartina pectinata Habitat Type	19	—	—	Minor
Typha latifolia Habitat Type	82	Major	Major	Major

[1]Indicates relative abundance of each type within three geographical regions of Montana. Region 1 = the Rocky Mountains, foothills, and intermountain valleys of northwestern Montana. Region 2 = the Rocky Mountains, foothills, intermountain valleys of southwestern Montana, and the isolated mountains of the northern Great Plains. Region 3 = the northern Great Plains.

Major—occupies extensive acreages in a least some portion of the riparian or wetland zone.

Minor—seldom occupies large acreages but may be common within the riparian or wetland zone.

Incidental—rarely occurs in the riparian or wetland zone.

The "dash" indicates that the type is essentially absent from that particular region of the state.

Appendix 10. First approximation of the habitat types and community types in Montana meeting the jurisdictional wetland criteria of the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987)

Type	JW[1]	TJW[2]	TW[3]	TNJW[4]	NJW[5]
CONIFEROUS TREE TYPES					
Abies grandis/Athyrium filix-femina Habitat Type				X	
Abies lasiocarpa/Actaea rubra Habitat Type				X	
Abies lasiocarpa/Calamagrostis canadensis Habitat Type					
Calamagrostis canadensis Phase		X			
Ligusticum canbyi Phase			X		
Vaccinium cespitosum Phase				X	
Abies lasiocarpa/Galium trifolium Habitat Type					X
Abies lasiocarpa/Ledum glandulosum Habitat Type					
Calamagrostis canadensis Phase		X			
Ledum glandulosum Phase			X		
Abies lasiocarpa/Oplopanax horridum Habitat Type	X				
Abies lasiocarpa/Streptopus amplexifolius Habitat Type					
Menziesia ferruginea Phase				X	
Streptopus amplexifolius Phase			X		
Juniperus scopulorum/Cornus stolonifera Habitat Type					X
Picea/Calamagrostis canadensis Community Type			X		
Picea/Cornus stolonifera Habitat Type			X		
Picea/Equisetum arvense Habitat Type	X				
Picea/Galium triflorum Habitat Type				X	
Picea/Lysichiton americanum Habitat Type	X				
Pinus ponderosa/Cornus stolonifera Habitat Type				X	
Pinus ponderosa/Prunus virginiana Habitat Type					X
Pseudotsuga menziesii/Cornus stolonifera Habitat Type				X	
Thuja plicata/Athyrium filix-femina Habitat Type					
Athyrium filix-femina Phase		X			
Thuja plicata/Gymnocarpium dryopteris Habitat Type			X		
Thuja plicata/Oplopanax horridum Habitat Type		X			
Tsuga heterophylla/Gymnocarpium dryopteris Habitat Type				X	
DECIDUOUS TREE TYPES					
Acer negundo/Prunus virginiana Habitat Type				X	
Elaeagnus angustifolia Community Type				X	
Fraxinus pennsylvanica/Prunus virginiana Habitat Type				X	
Populus angustifolia/Cornus stolonifera Community Type			X		
*Populus angustifolia/*Herbaceous Community Type				X	
*Populus angustifolia/*Recent Alluvial Bar Community Type		X			
Populus angustifolia/Symphoricarpos occidentalis C. T.				X	
Populus deltoides/Cornus stolonifera Community Type			X		
*Populus deltoides/*Herbaceous Community Type				X	
*Populus deltoides/*Recent Alluvial Bar Community Type		X			
Populus deltoides/Symphoricarpos occidentalis C.T.				X	
Populus tremuloides/Berberis repens Habitat Type				X	
Populus tremuloides/Calamagrostis canadensis Habitat Type			X		
Populus tremuloides/Cornus stolonifera Habitat Type			X		

Populus tremuloides/Osmorhiza occidentalis Habitat Type				X	
Populus tremuloides/Poa pratensis Community Type				X	
Populus trichocarpa/Cornus stolonifera Community Type			X		
Populus trichocarpa/Herbaceous Community Type				X	
Populus trichocarpa/Recent Alluvial Bar Community Type		X			
Populus trichocarpa/Symphoricarpos occidentalis C. T.				X	
Salix amygdaloides Community Type		X			
WILLOW SHRUB TYPES					
Salix bebbiana Community Type				X	
Salix candida/Carex rostrata Habitat Type	X				
Salix drummondiana/Calamagrostis canadensis H. T.		X			
Salix drummondiana/Carex rostrata Habitat Type	X				
Salix drummondiana Community Type				X	
Salix exigua Community Type		X			
Salix geyeriana/Calamagrostis canadensis Habitat Type		X			
Salix geyeriana/Carex rostrata Habitat Type	X				
Salix geyeriana Community Type				X	
Salix lasiandra Community Type			X		
Salix lutea/Calamagrostis canadensis Habitat Type		X			
Salix lutea/Carex rostrata Habitat Type	X				
Salix lutea Community Type				X	
Salix planifolia/Carex aquatilis Habitat Type	X				
Salix wolfii/Carex aquatilis Habitat Type	X				
Salix wolfii/Deschampsia cespitosa Habitat Type		X			
NON-WILLOW SHRUB TYPES					
Alnus incana Community Type			X		
Alnus sinuata Community Type			X		
Artemisia cana/Agropyron smithii Habitat Type				X	
Artemisia cana/Festuca idahoensis Habitat Type					X
Betula glandulosa/Carex rostrata Habitat Type	X				
Betula occidentalis Community Type			X		
Cornus stolonifera Community Type			X		
Crataegus succulenta Community Type				X	
Kalmia microphylla/Carex scopulorum Habitat Type		X			
Potentilla fruticosa/Deschampsia cespitosa Habitat Type				X	
Prunus virginiana Community Type					X
Rosa woodsii Community Type					X
Sarcobatus vermiculatus/Agropyron smithii Habitat Type				X	
Shepherdia argentea Community Type				X	
Spiraea douglasii Community Type			X		
Symphoricarpos occidentalis Community Type					X
Tamarix chinensis Community Type			X		
SEDGE TYPES					
Carex aquatilis Habitat Type					
Carex aquatilis Phase	X				
Deschampsia cespitosa Phase		X			
Carex lasiocarpa Habitat Type	X				
Carex limosa Habitat Type	X				

Carex nebrascensis Community Type		X			
Carex rostrata Habitat Type					
Carex aquatilis Phase	X				
Carex rostrata Phase	X				
Deschampsia cespitosa Phase		X			
Carex scopulorum Habitat Type	X				
Carex simulata Habitat Type	X				
NON-SEDGE TYPES					
Agropyron smithii Habitat Type				X	
Agrostis stolonifera Community Type		X			
Bromus inermis Community Type					X
Calamagrostis canadensis Habitat Type		X			
Deschampsia cespitosa Habitat Type		X			
Distichlis spicata Habitat Type		X			
Eleocharis palustris Habitat Type	X				
Eleocharis pauciflora Habitat Type	X				
Equisetum fluviatile Habitat Type	X				
Glyceria borealis Habitat Type		X			
Glycyrrhiza lepidota Community Type				X	
Hordeum jubatum Community Type		X			
Juncus balticus Community Type			X		
Phalaris arundinacea Habitat Type	X				
Phragmites australis Habitat Type	X				
Poa palustris Community Type			X		
Poa pratensis Community Type					X
Polygonum amphibium Community Type	X				
Salicornia rubra Community Type	X				
Scirpus acutus Habitat Type	X				
Scirpus maritimus Habitat Type	X				
Scirpus pungens Habitat Type	X				
Senecio triangularis Community Type				X	
Spartina pectinata Habitat Type		X			
Typha latifolia Habitat Type	X				

JW[1] — jurisdictional wetlands; refers to those types that almost always meet (estimated probability greater than 99%) the wetland criteria used in the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

TJW[2] — transitional jurisdictional wetlands; refers to those types that usually meet (estimated probability 67%-99%) the wetland criteria used in the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). They can occasionally be found in non-jurisdictional environments.

TW[3] — transitional wetlands; refers to those types that are equally likely to occur in jurisdictional wetlands and non-jurisdictional wetlands using the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

TNJW[4] — transitional non-jurisdictional wetlands; refers to those types that usually occur in non-jurisdictional wetlands (estimated probability 67%-99%) when using the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987). These types are occasionally found in jurisdictional wetlands (estimated probability 1%-33%).

NJW[5] — non-jurisdictional wetlands; refers to those types that almost always never meet (estimated probability greater than 99%) the wetland criteria used in the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

Appendix 11. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type Phase	ABIGRA/ ATHFIL H.T.	ABILAS/ ACTRUB H.T.	ABILAS/ CALCAN CALCAN H.T.	ABILAS/ CALCAN LIGCAN H.T.	ABILAS/ CALCAN VACCES H.T.	ABILAS/ GALTRI H.T.	ABILAS/ OPLHOR H.T.
No. Of Stands	14	7	17	5	5	10	3
Trees							
ABIGRA	100 (14)	—	—	—	—	—	—
ABILAS	43 (3)	100 (24)	100 (23)	80 (20)	100 (13)	100 (23)	100 (33)
BETPAP	29 (26)	—	—	—	—	—	—
DEADAF	7 (1)	—	—	—	—	—	—
LAROCC	36 (15)	14 (20)	—	—	—	—	67 (12)
PICEAX	64 (25)	86 (40)	94 (29)	80 (35)	60 (8)	100 (57)	100 (33)
PICENG	—	—	6 (40)	—	20 (1)	—	—
PINALB	—	—	18 (1)	—	20 (1)	—	—
PINCON	7 (10)	57 (20)	65 (26)	40 (27)	100 (56)	60 (34)	—
PINMON	—	—	—	—	—	—	33 (1)
PINPON	7 (20)	—	—	—	—	—	—
POPTRE	7 (30)	14 (1)	—	—	—	20 (12)	—
POPTRI	26 (16)	—	—	—	—	20 (12)	—
PSEMEN	50 (9)	71 (33)	—	—	20 (1)	30 (14)	67 (12)
Shrubs							
ACEGLA	79 (12)	29 (12)	—	—	—	10 (40)	100 (8)
ALNINC	57 (20)	—	24 (8)	20 (1)	—	—	33 (1)
ALNSIN	—	14 (1)	—	—	20 (1)	20 (1)	—
AMEALN	—	57 (2)	12 (1)	—	20 (1)	80 (2)	—
ARCUVA	—	—	6 (1)	—	20 (40)	10 (1)	—
BERREP	36 (2)	43 (1)	18 (1)	—	—	50 (9)	—
BETOCC	14 (3)	—	—	—	—	—	—
CHIMEN	14 (1)	—	—	—	—	—	—
CHIUMB	21 (1)	—	6 (1)	—	—	30 (1)	—
CLECOU	7 (1)	—	—	—	—	—	—
CLELIG	—	14 (1)	—	—	—	—	—
CLEOCC	—	—	—	—	—	10 (1)	—
CORCAN	29 (4)	29 (10)	12 (1)	20 (3)	—	20 (25)	33 (1)
CORNUT	—	—	—	—	—	—	—
CORSTO	57 (9)	29 (1)	6 (1)	—	—	40 (1)	67 (1)
CRADOU	21 (9)	—	—	—	—	10 (1)	—
GAUHUM	—	—	18 (1)	—	20 (1)	—	—
HOLDIS	14 (1)	—	—	—	—	—	—
JUNCOM	—	—	18 (1)	—	40 (2)	20 (1)	—
JUNHOR	—	—	6 (1)	—	—	—	—
LEDGLA	—	—	41 (2)	20 (3)	40 (2)	10 (3)	—
LINBOR	50 (13)	57 (2)	12 (30)	20 (3)	20 (3)	30 (15)	33 (20)
LONCIL	7 (1)	—	—	—	—	—	—
LONINV	—	57 (2)	47 (2)	40 (2)	20 (1)	50 (7)	—
LONUTA	—	71 (1)	35 (1)	20 (1)	60 (1)	60 (1)	67 (1)
MENFER	14 (2)	14 (1)	18 (1)	20 (1)	—	30 (2)	67 (10)
OPLHOR	—	—	—	—	—	—	100 (47)
PACMYR	14 (1)	29 (3)	6 (1)	—	—	—	33 (1)
PHILEW	21 (1)	—	—	—	—	—	—

PHYMAL	—	14 (1)	—	—	—	—	—
POTFRU	—	—	6 (3)	—	20 (1)	—	—
PRUVIR	7 (1)	—	—	—	—	20 (2)	—
RHAALN	7 (3)	—	—	20 (20)	—	10 (3)	—
RIBHUD	—	—	12 (1)	—	—	—	—
RIBLAC	29 (2)	100 (2)	47 (1)	60 (1)	20 (3)	70 (1)	33 (1)
ROSACI	14 (3)	29 (1)	12 (1)	—	20 (1)	40 (1)	—
ROSGYM	29 (1)	14 (1)	18 (1)	—	—	—	—
ROSWOO	14 (12)	—	6 (3)	—	20 (1)	10 (3)	—
RUBIDA	29 (1)	—	12 (1)	20 (1)	—	—	67 (1)
RUBPAR	71 (10)	71 (2)	12 (1)	—	—	50 (13)	100 (1)
SALBAR	—	14 (1)	—	20 (1)	—	—	—
SALBOO	—	14 (1)	—	—	—	—	—
SALBRA	7 (1)	—	—	—	—	—	—
SALDRU	—	—	6 (1)	2 (1)	—	—	—
SALIXX	7 (1)	—	—	—	—	10 (1)	—
SALLUT	—	—	6 (40)	—	—	—	—
SALSCO	7 (1)	29 (1)	18 (1)	20 (3)	—	—	—
SAMRAC	21 (1)	29 (1)	—	20 (1)	—	—	33 (1)
SHECAN	7 (1)	29 (1)	18 (2)	—	40 (1)	20 (2)	—
SOLDUL	7 (3)	—	—	—	—	—	—
SORSCO	21 (1)	43 (1)	6 (1)	—	20 (1)	20 (10)	—
SPIBET	21 (1)	71 (16)	35 (1)	—	40 (2)	70 (12)	33 (1)
SPIDOU	—	—	—	20 (10)	—	—	—
SPIPYR	—	—	6 (1)	—	—	—	—
SYMALB	79 (26)	71 (9)	6 (1)	—	—	80 (9)	67 (10)
SYMOCC	14 (12)	—	—	—	—	—	—
TAXBRE	21 (14)	—	—	—	—	—	100 (21)
VACCES	—	14 (1)	—	20 (1)	100 (25)	—	—
VACGLO	14 (7)	29 (12)	35 (5)	20 (1)	20 (1)	10 (20)	100 (1)
VACMYR	—	14 (1)	—	—	—	20 (12)	—
VACOCC	—	—	6 (1)	—	—	—	—
VACSCO	—	14 (3)	82 (21)	60 (5)	60 (27)	30 (8)	33 (1)
Graminoids							
AGROST	7 (1)	—	6 (1)	—	—	—	—
AGRREP	—	14 (10)	—	—	—	—	—
AGRSTO	29 (8)	—	—	20 (20)	—	—	—
BROANO	—	14 (1)	6 (3)	20 (1)	—	—	—
BROCAR	—	—	—	—	—	20 (2)	—
BROCIL	14 (1)	14 (10)	6 (1)	20 (1)	—	10 (1)	—
BROINE	—	—	—	—	—	10 (1)	—
BROVUL	21 (1)	71 (2)	12 (2)	—	20 (1)	60 (1)	67 (1)
CALCAN	—	—	88 (31)	100 (42)	100 (36)	10 (1)	—
CALRUB	—	14 (20)	18 (1)	—	40 (30)	60 (5)	—
CALSTR	—	—	12 (17)	—	—	—	—
CARBEB	7 (1)	—	—	—	—	—	—
CARCON	—	14 (1)	6 (1)	—	20 (1)	20 (1)	—
CARDIA	7 (1)	—	—	—	—	—	—
CARDIS	—	—	24 (5)	—	20 (1)	—	—
CAREXX	—	—	6 (3)	—	—	—	—
CARGEY	7 (1)	29 (12)	—	—	40 (10)	40 (1)	—
CARGRA	7 (1)	—	—	—	—	—	33 (1)
CARHOO	—	14 (1)	—	—	—	—	—
CARLAS	7 (1)	—	—	—	—	—	—
CARLEP	—	—	—	—	—	10 (1)	—
CARLUZ	—	—	—	20 (1)	—	—	—
CARROI	—	—	24 (1)	20 (1)	20 (1)	—	—

CARROS	—	—	6 (1)	20 (10)	—	—	—
CARSCO	—	—	18 (20)	—	—	—	—
CINLAT	43 (1)	—	—	—	—	—	—
DESCES	—	—	12 (2)	—	—	—	—
ELYGLA	43 (3)	14 (1)	24 (2)	20 (1)	40 (2)	60 (1)	33 (1)
FESIDA	—	—	—	—	20 (1)	—	—
FESOCC	—	29 (1)	—	—	—	30 (1)	—
FESSCA	—	—	—	—	20 (1)	—	—
GLYBOR	—	—	—	—	—	10 (1)	—
GLYELA	7 (1)	—	12 (3)	—	—	—	—
GLYSTR	7 (3)	—	—	20 (1)	—	—	—
JUNBAL	—	—	6 (3)	—	20 (1)	—	—
JUNCUS	—	—	6 (1)	20 (1)	—	—	—
LUZCAM	—	—	—	—	40 (1)	—	—
LUZHIT	—	—	6 (3)	—	—	—	—
LUZPAR	—	—	29 (1)	—	20 (1)	—	—
MELSUB	14 (2)	29 (2)	18 (1)	—	—	30 (2)	33 (1)
ORYASP	7 (1)	—	—	—	—	20 (3)	—
PHAARU	7 (1)	—	—	—	—	—	—
PHLALP	21 (10)	—	12 (1)	—	—	—	—
PHLPRA	—	—	6 (1)	20 (30)	—	—	—
POACOM	7 (1)	—	—	—	—	—	—
POAINT	—	—	6 (1)	—	20 (1)	—	—
POANER	—	—	—	—	20 (1)	—	—
POAPRA	29 (5)	—	—	—	—	—	—
POASCA	—	—	6 (1)	—	—	—	—
POAXXX	—	—	6 (1)	—	—	—	—
TRICAN	7 (1)	—	—	—	—	—	—
TRISPI	—	—	18 (1)	20 (1)	40 (1)	—	—
Forbs							
ACHMIL	—	—	18 (1)	—	40 (1)	—	—
ACOCOL	—	—	18 (1)	—	—	—	—
ACTRUB	21 (1)	100 (11)	6 (3)	20 (1)	—	90 (1)	100 (1)
ADEBIC	36 (5)	—	—	—	—	—	33 (3)
AGOGLA	—	—	—	—	20 (1)	—	—
ALLBRE	—	—	6 (1)	—	—	—	—
ALLCER	—	—	—	—	—	10 (1)	—
ANAMAR	—	14 (1)	6 (1)	20 (1)	—	—	—
ANEPIP	7 (1)	—	—	—	—	—	—
ANGARG	14 (1)	29 (2)	18 (7)	—	—	60 (1)	—
ANTMIC	—	—	6 (1)	—	20 (1)	—	—
ANTRAC	—	—	12 (1)	—	40 (1)	—	—
AQUFLA	—	43 (1)	18 (7)	—	—	40 (1)	—
ARANUD	57 (7)	—	6 (1)	—	—	—	67 (12)
ARCMIN	7 (10)	—	—	—	—	—	—
ARELAT	—	—	—	—	—	—	67 (12)
AREMAC	—	—	6 (1)	—	—	—	—
ARNCOR	14 (10)	43 (10)	24 (2)	20 (3)	60 (14)	50 (18)	—
ARNLAT	29 (18)	86 (17)	53 (16)	40 (1)	60 (2)	50 (26)	—
ARNMOL	—	—	6 (1)	20 (1)	—	—	—
ASTCAM	14 (1)	—	—	—	—	—	—
ASTCON	—	57 (10)	29 (9)	—	20 (1)	60 (8)	—
ASTENG	—	14 (1)	—	—	—	30 (1)	—
ASTERX	—	—	12 (2)	—	—	—	—
ASTFOL	7 (1)	29 (1)	24 (1)	20 (1)	—	10 (1)	—
ASTLAE	—	—	6 (1)	—	—	20 (1)	—

ASTMOD	—	—	—	20 (1)	—	10 (1)	—
ASTPER	—	—	—	20 (1)	—	—	—
ASTSUB	—	—	—	20 (1)	—	—	—
CALAPI	—	—	—	—	—	10 (1)	—
CALBUL	—	14 (1)	—	—	—	—	—
CALLEP	—	—	—	—	20 (1)	—	—
CAMPAR	—	—	—	—	—	10 (1)	—
CAMQUA	—	—	—	—	—	10 (1)	—
CAMROT	—	14 (1)	12 (1)	—	20 (1)	30 (1)	—
CASMIN	—	—	6 (1)	—	—	20 (1)	—
CASTIL	—	—	6 (3)	—	—	—	—
CENMAC	14 (5)	—	—	—	—	—	—
CERARV	—	—	—	—	—	10 (1)	—
CERVUL	7 (1)	—	—	—	—	—	—
CHRLEU	7 (1)	—	—	—	—	—	—
CIRALP	21 (1)	—	—	—	—	—	—
CIRARV	21 (1)	—	—	—	—	—	—
CIRVUL	7 (3)	—	—	—	—	—	—
CLALAN	7 (3)	—	—	—	—	—	—
CLIUNI	43 (6)	14 (3)	—	—	20 (1)	10 (1)	100 (9)
COLPAR	—	—	—	—	20 (1)	—	—
CONCAN	—	—	6 (20)	—	—	—	—
CORMAC	—	14 (1)	—	—	—	10 (1)	—
CORSTR	—	—	6 (1)	—	—	10 (1)	—
CORTRI	7 (1)	—	—	—	—	10 (1)	—
CYNOFF	7 (1)	—	—	—	—	—	—
DISHOO	7 (40)	—	—	—	—	—	33 (1)
DISPOR	—	—	—	—	—	—	33 (1)
DISTRA	14 (1)	29 (1)	—	—	20 (1)	50 (1)	—
DODCON	—	—	—	—	20 (3)	—	—
DODJEF	—	—	24 (2)	60 (9)	—	10 (1)	—
EPIALP	—	—	24 (1)	20 (1)	20 (1)	—	—
EPIANG	21 (1)	43 (1)	53 (1)	20 (1)	60 (1)	70 (1)	—
EPICIL	—	—	6 (1)	—	—	—	—
EPILOB	—	—	6 (1)	—	—	—	—
EPIPAN	—	—	6 (1)	—	—	—	—
ERYGRA	—	43 (1)	—	—	—	—	—
ERIPER	—	—	35 (4)	20 (1)	20 (1)	—	—
ERYGRA	—	—	35 (1)	40 (1)	40 (3)	10 (3)	—
FRAGAR	7 (1)	—	—	—	—	—	—
FRAVES	29 (3)	29 (1)	—	—	—	10 (1)	
FRAVIR	7 (1)	43 (1)	59 (2)	20 (1)	60 (1)	70 (1)	—
GALAPA	14 (1)	—	—	—	—	—	—
GALASP	—	—	6 (1)	—	—	—	—
GALBOR	21 (1)	29 (1)	18 (1)	20 (1)	20 (1)	60 (1)	—
GALTRI	71 (1)	86 (1)	12 (1)	40 (1)	—	100 (1)	67 (2)
GENAFF	—	—	6 (1)	—	—	—	—
GENCAL	—	—	6 (1)	20 (1)	20 (1)	—	—
GERANI	—	—	6 (3)	—	—	—	—
GERRIC	—	43 (1)	29 (1)	—	—	40 (1)	—
GERVIS	—	—	6 (1)	—	—	30 (1)	—
GEUMAC	14 (5)	—	—	40 (2)	—	10 (1)	—
GLYLEP	7 (1)	—	—	—	—	—	—
GOOOBL	36 (1)	57 (1)	6 (1)	20 (1)	—	60 (1)	67 (1)
HABDIL	7 (1)	14 (1)	—	—	20 (1)	—	—
HABOBT	—	—	12 (1)	—	—	—	—
HABORB	—	—	—	—	—	10 (1)	—

HABSAC	—	—	—	—	—	10 (1)	—
HAPLAN	7 (10)	—	—	—	—	—	—
HEDSUL	—	—	6 (1)	—	—	20 (1)	—
HERLAN	—	43 (1)	24 (1)	20 (1)	40 (1)	50 (1)	—
HIEALB	29 (1)	14 (1)	12 (1)	—	20 (1)	30 (1)	67 (1)
HIEGRA		—	12 (1)	—	20 (1)	—	—
HYDCAP	—	14 (1)	—	—	—	—	—
HYPPER	7 (1)	—	—	—	—	—	—
LATOCH	7 (1)	29 (1)	6 (1)	—	—	20 (1)	—
LIGCAN	7 (3)	—	18 (1)	100 (8)	20 (1)	—	—
LIGTEN	—	—	18 (7)	20 (1)	20 (3)	—	—
LISBOR	—	—	—	—	—	10 (1)	—
LISCAU	—	14 (1)	—	—	—	—	—
LISCOR	—	—	12 (1)	—	20 (1)	10 (3)	33 (1)
LOMTRI	—	—	—	—	20 (1)	10 (1)	—
LUPARG	—	—	—	60 (1)	—	—	—
LUPINU	—	—	12 (1)	—	20 (1)	—	—
LYSAME	7 (60)	—	—	—	—	—	—
MEDLUP	7 (1)	—	—	—	—	—	—
MELALB	—	14 (1)	—	—	—	—	—
MERCIL	—	—	6 (1)	20 (1)	—	—	—
MITBRE	—	—	6 (1)	20 (3)	—	—	—
MITNUD	14 (5)	—	—	—	—	10 (10)	—
MITPEN	—	—	29 (1)	20 (3)	20 (1)	—	—
MITSTA	7 (3)	14 (3)	12 (1)	—	—	20 (1)	—
MITTRI	—	14 (3)	—	—	—	—	—
MONSIB	7 (1)	—	—	—	—	—	—
MYOSYL	—	14 (1)	—	—	—	—	—
OSMCHI	64 (1)	86 (1)	53 (1)	20 (1)	20 (1)	100 (3)	67 (1)
OSMDEP	7 (3)	—	—	—	—	—	—
OSMOCC	—	14 (1)	—	20 (1)	—	30 (1)	—
PARFIM	7 (1)	—	6 (1)	20 (1)	—	—	—
PARNAS	—	—	6 (20)	—	—	—	—
PEDBRA	—	43 (1)	29 (1)	—	—	30 (1)	—
PEDCON	—	—	6 (1)	—	—	—	—
PEDGRO	—	—	6 (3)	20 (3)	—	—	—
PEDRAC	—	14 (1)	6 (1)	—	—	—	—
PENPRO	—	—	—	—	20 (1)	—	—
PETASI	7 (30)	—	—	—	—	—	—
POLOCC	—	—	—	20 (10)	—	—	—
POTDIV	—	—	—	—	40 (1)	—	—
POTFLA	—	—	6 (1)	—	—	—	—
POTGLA	—	—	6 (3)	—	—	—	—
POTRIV	—	14 (1)	—	—	—	—	—
PRESAG	—	—	6 (1)	—	—	—	—
PRUVUL	21 (4)	—	6 (1)	—	—	—	—
PTEAND	7 (1)	—	—	—	—	—	—
PYRASA	36 (2)	29 (1)	41 (1)	60 (1)	20 (1)	—	—
PYRCHL	21 (1)	29 (1)	—	—	—	30 (1)	—
PYRELL	—	—	6 (1)	—	—	—	—
PYRSEC	43 (1)	100 (1)	65 (1)	20 (1)	40 (1)	100 (1)	67 (1)
PYRUNI	14 (1)	29 (1)	24 (1)	—	—	20 (1)	—
RANACR	—	—	—	20 (3)	—	—	—
RANUNC	—	—	6 (1)	—	—	—	—
RANUNI	7 (1)	—	18 (1)	—	20 (1)	—	—
RORPAL	—	14 (1)	—	—	—	—	—

RUBPED	—	—	—	20 (1)	—	—	—
RUBPUB	14 (2)	—	6 (1)	—	—	10 (1)	—
SANMAR	7 (1)	—	—	—	—	—	—
SAXARG	—	—	12 (10)	20 (3)	20 (1)	—	—
SENHYD	—	—	—	—	—	10 (1)	—
SENPSE	14 (3)	29 (1)	35 (1)	—	20 (1)	30 (1)	—
SENTRI	29 (1)	—	53 (8)	60 (14)	20 (1)	40 (1)	—
SMIRAC	21 (1)	43 (1)	—	—	—	50 (1)	33 (1)
SMISTE	71 (4)	71 (1)	18 (1)	—	20 (1)	80 (1)	100 (8)
SOLGIG	—	—	—	—	20 (1)	—	—
STECRI	—	—	—	—	20 (1)	—	—
STEOCC	—	—	—	—	—	20 (1)	—
STRAMP	57 (1)	29 (1)	47 (1)	60 (1)	20 (3)	30 (1)	33 (1)
TAROFF	29 (2)	14 (1)	6 (1)	—	40 (1)	20 (1)	—
THALIC	7 (3)	—	—	—	—	—	—
THAOCC	36 (1)	100 (8)	65 (5)	40 (12)	40 (2)	90 (14)	100 (1)
THAVEN	7 (3)	—	6 (1)	—	—	10 (1)	—
TIATRI	64 (4)	29 (1)	6 (1)	—	—	—	100 (14)
TRACAR	—	—	6 (1)	20 (10)	—	—	—
TRILON	—	—	12 (1)	—	20 (1)	—	—
TRIMIC	7 (1)	—	—	—	—	—	—
TRIOVA	14 (1)	29 (1)	18 (1)	20 (1)	—	10 (1)	33 (1)
TROLAX	—	—	29 (4)	40 (2)	20 (3)	—	—
URTDIO	—	14 (1)	—	—	—	—	—
VALDIO	—	29 (40)	—	—	—	—	—
VALOCC	—	—	—	—	—	10 (1)	—
VALSIT	—	—	35 (1)	20 (1)	60 (9)	30 (1)	—
VERAME	7 (1)	—	6 (1)	20 (1)	—	—	—
VERVIR	7 (1)	43 (1)	24 (2)	—	40 (2)	40 (1)	100 (1)
VICAME	7 (1)	29 (1)	—	—	—	—	—
VIGMUL	—	—	6 (1)	—	—	—	—
VIOADU	—	29 (1)	24 (2)	20 (1)	40 (1)	20 (1)	—
VIOCAN	14 (1)	—	6 (3)	—	—	50 (2)	67 (2)
VIOLAX	—	14 (1)	—	20 (1)	—	—	—
VIOMAC	—	—	6 (3)	—	—	—	—
VIOORB	29 (1)	71 (3)	47 (1)	40 (2)	40 (2)	60 (1)	100 (2)
XERTEN	—	14 (1)	29 (4)	—	20 (2)	10 (1)	33 (1)
ZIGELE	—	14 (1)	18 (1)	—	40 (1)	30 (1)	—
Ferns and Allies							
ATHFIL	50 (13)	14 (1)	12 (1)	—	20 (1)	—	100 (20)
BOTVIR	7 (1)	—	—	—	—	20 (1)	—
EQUARV	36 (2)	29 (25)	41 (6)	20 (1)	40 (1)	60 (17)	—
EQUHYE	29 (3)	14 (1)	—	—	—	10 (1)	—
EQUISE	—	—	—	—	—	10 (1)	—
EQULAE	14 (1)	—	—	—	—	—	—
EQUPRA	7 (3)	14 (1)	6 (3)	40 (5)	—	—	—
EQUSYL	—	—	—	20 (1)	—	—	—
EQUVAR	—	—	6 (3)	—	—	—	—
GYMDRY	14 (2)	—	—	—	20 (1)	—	100 (14)
LYCANN	—	—	6 (1)	—	—	—	33 (1)
LYCOPO	7 (1)	—	—	—	—	—	—
PTEAQU	7 (1)	—	—	—	—	—	—

Appendix 12. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type Phase	ABILAS/ LEDGLA CALCAN H.T.	ABILAS/ LEDGLA LEDGLA H.T.	ABILAS/ STRAMP MENFER H.T.	ABILAS/ STRAMP STRAMP H.T.	PICEA/ CALCAN C.T.	PICEA/ CORSTO H.T.	PICEA/ EQUARV H.T.
No. Of Stands	9	8	8	45	20	37	16
Trees							
ABILAS	100 (20)	100 (10)	100 (38)	100 (21)	10 (1)	22 (1)	6 (1)
BETPAP	—	—	—	4 (15)	—	8 (24)	—
DEADLP	—	—	—	—	5 (10)	3 (10)	—
JUNSCO	11 (1)	—	—	—	—	5 (5)	—
LARLYA	—	—	—	—	—	3 (80)	—
LAROCC	—	13 (1)	—	11 (25)	—	16 (7)	13 (5)
PICEAX	100 (27)	88 (29)	38 (40)	91 (36)	100 (32)	100 (27)	100 (56)
PICENG	—	13 (40)	63 (36)	—	—	—	—
PINALB	11 (1)	50 (11)	—	—	—	3 (1)	—
PINCON	78 (19)	88 (34)	—	31 (18)	15 (50)	22 (31)	31 (6)
PINMON	—	—	—	4 (3)	—	—	—
PINPON	—	—	—	4 (10)	—	14 (3)	—
POPANG	—	—	—	—	5 (20)	3 (3)	—
POPTRE	—	—	—	2 (40)	—	30 (28)	19 (1)
POPTRI	—	—	—	7 (50)	5 (60)	32 (16)	13 (10)
PSEMEN	11 (1)	13 (1)	13 (20)	24 (14)	—	38 (10)	31 (7)
THUPLI	—	—	—	2 (1)	5 (1)	—	—
TSUHET	—	—	13 (1)	—	—	3 (1)	—
TSUMER	—	—	13 (3)	—	—	—	—
Shrubs							
ACEGLA	—	—	13 (20)	31 (9)	—	27 (9)	13 (5)
ACERXX	—	—	—	—	—	—	6 (1)
ALNINC	—	—	—	31 (23)	5 (3)	27 (23)	13 (20)
ALNSIN	—	—	13 (1)	22 (33)	5 (30)	—	—
ALNUSX		—	—	—	—	—	6 (20)
AMEALN	11 (1)	—	—	38 (3)	10 (2)	54 (2)	19 (4)
ARCUVA	11 (10)	—	—	—	10 (32)	14 (1)	—
BERREP	—	—	—	13 (1)	—	35 (1)	31 (4)
BETGLA	22 (15)	—	—	—	5 (3)	8 (18)	—
BETOCC	—	—	—	—	5 (20)	24 (25)	6 (20)
CASMER	—	—	—	2 (1)	—	3 (40)	—
CHIUMB	11 (1)	—	—	24 (1)	—	8 (2)	—
CLELIG	—	—	—	—	—	3 (3)	—
CLEOCC	—	—	—	2 (1)	—	11 (1)	—
CORCAN	44 (2)	13 (3)	—	20 (5)	10 (5)	32 (6)	13 (2)
CORSTO	—	—	—	44 (4)	—	86 (12)	44 (3)
ELACOM	—	—	—	—	—	3 (50)	—
GAUHUM	—	50 (12)	—	—	—	—	—
JUNCOM	11 (10)	13 (1)	—	2 (1)	5 (20)	11 (1)	6 (1)
LEDGLA	100 (42)	100 (45)	25 (1)	7 (1)	—	—	—
LINBOR	56 (9)	13 (20)	—	33 (12)	—	41 (14)	19 (2)
LONCAE	11 (1)	13 (1)	—	—	—	—	—
LONCIL	—	—	—	—	—	5 (1)	—
LONINV	33 (7)	13 (1)	—	36 (4)	20 (2)	24 (3)	50 (2)

LONUTA	11 (3)	13 (1)	50 (5)	33 (1)	—	8 (1)	—
MENFER	—	—	100 (64)	20 (1)	5 (1)	—	6 (1)
PACMYR	11 (1)	13 (1)	—	24 (8)	—	5 (1)	—
PHILEW	—	—	—	—	—	3 (10)	6 (30)
PHYEMP	11 (1)	38 (7)	13 (1)	2 (1)	—	3 (3)	—
PHYGLA	—	—	—	—	—	3 (1)	—
PHYMAL	—	—	—	—	—	3 (1)	—
POTFRU	11 (20)	—	—	—	20 (7)	11 (6)	6 (1)
PRUVIR	—	—	—	—	—	14 (13)	—
RHAALN	—	—	—	13 (17)	—	24 (5)	25 (2)
RHAPUR	—	—	—	—	—	3 (10)	—
RHOALB	—	—	—	—	—	—	—
RIBESX	—	—	—	2 (1)	25 (1)	16 (7)	6 (1)
RIBHUD	—	—	—	4 (1)	—	5 (5)	13 (1)
RIBIRR	—	—	—	—	—	5 (1)	—
RIBLAC	—	—	63 (1)	78 (3)	5 (1)	30 (4)	31 (1)
RIBMON	—	—	—	—	—	3 (1)	—
RIBVIS	—	—	—	4 (2)	—	—	—
ROSACI	—	—	—	18 (1)	10 (12)	32 (3)	44 (2)
ROSAXX	—	—	—	4 (1)	—	24 (7)	—
ROSGYM	—	—	—	11 (3)	—	8 (2)	—
ROSWOO	11 (1)	—	13 (1)	4 (1)	25 (5)	8 (15)	31 (5)
RUBIDA	—	—	—	20 (1)	—	16 (1)	19 (1)
RUBLAC	—	—	—	—	—	3 (3)	—
RUBLEU	—	—	—	—	—	3 (10)	—
RUBPAR	—	—	13 (3)	56 (8)	10 (1)	30 (7)	—
SALBAR	—	—	—	2 (1)	—	—	—
SALBEB	—	—	—	—	10 (1)	8 (9)	6 (20)
SALBOO	11 (1)	—	—	—	30 (8)	19 (8)	—
SALBRA	11 (20)	—	—	—	—	3 (30)	—
SALCAN	—	—	—	—	—	8 (1)	—
SALDRU	—	—	—	7 (2)	30 (4)	11 (15)	6 (50)
SALEXI	—	—	—	—	—	5 (12)	—
SALGEY	11 (20)	—	—	—	10 (20)	3 (20)	—
SALIXX	—	—	—	—	—	8 (1)	25 (1)
SALLAS	—	—	—	—	—	3 (1)	—
SALLUT	—	—	—	—	5 (3)	5 (1)	—
SALNIV	—	—	—	—	—	3 (1)	—
SALPLA	—	—	—	—	5 (20)	3 (30)	—
SALPSE	—	—	—	—	—	3 (1)	—
SALSCO	11 (1)	—	—	7 (1)	—	5 (3)	6 (1)
SALTWE	—	—	—	2 (80)	—	3 (10)	—
SALWOL	—	—	—	—	10 (10)	—	—
SAMRAC	—	—	—	2 (1)	—	3 (1)	—
SARVER	—	—	—	—	—	3 (10)	—
SHECAN	—	—	—	4 (2)	—	35 (4)	6 (1)
SORBUS	—	—	—	2 (1)	—	—	—
SORSCO	—	—	25 (12)	22 (1)	—	8 (1)	—
SPIBET	11 (1)	25 (1)	—	36 (5)	5 (1)	24 (15)	13 (2)
SYMALB	—	—	—	38 (6)	—	54 (15)	38 (1)
SYMOCC	—	—	—	2 (1)	—	8 (41)	6 (1)
SYMPHO	—	—	—	—	—	3 (10)	—
TAXBRE	—	—	—	9 (1)	—	3 (1)	—
VACCES	33 (4)	—	—	2 (1)	10 (30)	5 (1)	—
VACGLO	—	25 (12)	100 (15)	40 (6)	10 (1)	3 (1)	—
VACMEM	—	—	—	2 (1)	—	—	—
VACMYR	22 (40)	—	—	7 (1)	—	—	—

VACOCC	11 (20)	—	—	—	—	—	—
VACSCO	78 (16)	100 (40)	13 (1)	24 (5)	10 (12)	5 (2)	6 (1)
Graminoids							
AGRCAN	—	—	—	—	10 (2)	—	—
AGREXA	—	—	—	2 (1)	—	—	6 (1)
AGROPY	—	—	—	—	15 (3)	3 (3)	6 (3)
AGROST	—	—	13 (1)	—	—	—	—
AGRREP	—	—	—	4 (1)	5 (1)	11 (1)	—
AGRSCA	11 (1)	—	—	—	—	—	6 (1)
AGRSTO	—	—	—	4 (1)	—	16 (7)	25 (8)
AGRTEN	—	—	—	2 (1)	—	3 (20)	—
AGRTHU	—	—	—	2 (1)	10 (2)	—	6 (3)
ALOALP	—	—	—	—	5 (1)	—	6 (1)
BROANO	—	—	—	4 (2)	—	—	—
BROCAR	—	—	—	7 (1)	—	5 (1)	6 (1)
BROCIL	—	—	—	4 (2)	50 (2)	8 (4)	25 (1)
BROINE	11 (3)	—	—	2 (3)	—	3 (3)	—
BROMOL	—	—	—	—	—	—	6 (1)
BROMUS	—	—	—	2 (1)	—	—	—
BROSEC	—	—	—	2 (1)	—	—	—
BROVUL	—	—	25 (2)	33 (8)	—	14 (1)	13 (1)
CALCAN	89 (22)	50 (2)	38 (2)	27 (1)	85 (23)	19 (16)	31 (24)
CALPUR	—	—	—	—	—	3 (1)	—
CALRUB	22 (3)	25 (5)	—	13 (4)	—	16 (6)	19 (1)
CALSTR	22 (2)	—	—	—	20 (26)	3 (10)	—
CARAQU	—	—	—	—	10 (22)	—	—
CARATH	—	—	—	2 (20)	—	3 (1)	—
CARAUR	11 (1)	—	—	—	—	—	—
CARBRE	11 (1)	13 (1)	—	—	—	—	—
CARCAN	—	—	—	—	—	3 (1)	6 (3)
CARCAP	11 (10)	—	—	2 (1)	—	—	6 (3)
CARCON	11 (1)	—	13 (1)	7 (1)	—	3 (1)	—
CARDEW	—	—	—	—	—	3 (3)	—
CARDIO	11 (10)	—	—	—	—	3 (10)	—
CARDIS	11 (1)	—	—	7 (1)	5 (1)	5 (10)	6 (1)
CAREXX	—	—	—	9 (1)	—	14 (2)	—
CARGEY	—	25 (1)	—	13 (4)	—	—	—
CARHOO	—	—	—	—	—	3 (1)	—
CARILL	11 (10)	13 (20)	—	—	—	—	—
CARINT	11 (20)	—	—	—	—	3 (1)	—
CARLAE	—	—	—	—	—	3 (1)	—
CARLAN	—	—	—	2 (1)	—	—	—
CARLEN	—	—	—	—	—	3 (1)	—
CARLEP	—	—	—	—	—	3 (1)	—
CARLIM	—	—	—	2 (10)	—	3 (1)	—
CARMIC	11 (3)	13 (3)	—	2 (1)	15 (1)	—	—
CARNEB	11 (10)	—	—	—	—	—	—
CARNIG	—	—	—	2 (1)	—	—	—
CARPAC	11 (1)	—	—	—	—	—	13 (1)
CARROI	—	13 (1)	—	4 (1)	—	3 (20)	13 (1)
CARROS	—	—	—	4 (2)	25 (28)	3 (30)	19 (10)
CARRUP	—	—	—	—	—	3 (20)	—
CARSCO	22 (22)	25 (20)	—	2 (1)	5 (1)	—	—
CARSPE	—	—	—	—	—	3 (1)	—
CATAQU	—	—	—	—	—	3 (1)	—
CINLAT	—	—	—	9 (5)	5 (1)	5 (32)	19 (4)

DACGLO	—	—	—	—	—	5 (5)	—
DANINT	—	—	—	—	—	3 (1)	—
DANSPI	—	—	—	—	—	3 (1)	—
DESATR	—	—	13 (1)	—	—	—	—
DESCES	22 (5)	13 (1)	—	—	5 (1)	3 (10)	—
ELECOM	—	—	—	—	—	3 (1)	—
ELEPAU	11 (10)	—	—	—	—	—	—
ELYCAN	—	—	—	—	5 (1)	3 (20)	—
ELYCIN	—	—	—	—	—	5 (2)	—
ELYGLA	11 (20)	13 (3)	—	31 (1)	—	38 (7)	31 (2)
FESIDA	—	—	—	2 (60)	—	—	—
FESOCC	11 (1)	13 (1)	—	7 (1)	—	5 (1)	—
FESTUC	—	—	—	—	—	3 (1)	—
GLYELA	—	—	—	4 (1)	—	—	19 (4)
GLYGRA	—	—	—	—	5 (80)	3 (1)	—
GLYSTR	—	—	—	—	5 (20)	11 (4)	6 (1)
JUNBAL	11 (40)	—	—	—	5 (3)	11 (1)	—
JUNCUS	—	—	—	—	—	—	—
JUNENS	11 (20)	—	—	—	—	—	—
JUNDRU	33 (1)	25 (3)	—	2 (1)	—	3 (1)	—
JUNMER	—	13 (1)	—	—	—	—	—
JUNTEN	—	—	—	—	—	—	6 (1)
JUNTRA	—	—	—	2 (3)	—	—	—
LUZCAM	—	—	—	—	—	3 (1)	—
LUZHIT	—	—	50 (1)	2 (20)	—	3 (3)	—
LUZPAR	22 (1)	13 (1)	—	16 (1)	20 (1)	—	13 (1)
LUZPIP	—	—	—	2 (3)	—	—	—
MELBUL	—	—	—	2 (1)	—	—	—
MELSUB	11 (10)	—	—	9 (1)	—	8 (2)	6 (1)
ORYASP	—	—	—	2 (1)	—	19 (4)	—
PHAARU	—	—	—	—	—	3 (80)	—
PHLALP	—	—	—	2 (1)	—	—	—
PHLPRA	11 (1)	—	—	—	30 (5)	24 (5)	6 (1)
POAALP	—	—	—	2 (1)	—	—	—
POAINT	—	—	—	4 (1)	—	—	—
POANER	—	13 (1)	—	4 (1)	—	—	—
POAPAL	—	—	—	—	5 (1)	8 (7)	—
POAPRA	—	—	—	—	15 (1)	16 (9)	—
POAXXX	—	—	—	4 (1)	10 (2)	3 (3)	6 (1)
SCHPUR	—	—	—	—	—	5 (1)	—
STIOCC	—	—	—	—	5 (1)	—	—
TRICAN	11 (1)	—	—	2 (3)	—	—	—
TRISPI	—	13 (1)	—	7 (1)	—	3 (1)	—
TRIWOL	—	—	—	—	—	3 (1)	6 (20)
Forbs							
ACHMIL	11 (10)	13 (1)	—	7 (1)	20 (1)	22 (1)	6 (1)
ACOCOL	—	—	—	2 (3)	—	—	—
ACTRUB	—	—	13 (3)	31 (3)	25 (3)	24 (2)	31 (1)
ADEBIC	—	—	—	13 (1)	—	11 (1)	—
AGOAUR	—	—	—	—	—	3 (1)	—
ALLBRE	—	—	—	2 (1)	10 (1)	5 (1)	—
ALLCER	—	—	—	—	—	3 (1)	—
ALLIUM	—	—	—	—	15 (1)	3 (1)	6 (1)
ALLTEX	—	—	—	2 (1)	—	—	—
ANAMAR	—	—	13 (1)	2 (3)	5 (1)	5 (1)	—
ANEPIP	—	—	—	2 (1)	—	5 (1)	—
ANGARG	11 (10)	13 (1)	—	22 (4)	5 (1)	30 (1)	25 (1)

ANGDAW	—	—	—	4 (2)	—	—	—
ANGELI	—	—	—	—	5 (1)	—	—
ANTANA	—	—	—	—	—	3 (1)	—
ANTLAN	—	—	—	—	—	3 (3)	—
ANTMIC	—	13 (1)	—	—	—	—	—
ANTNEG	—	—	—	—	—	—	6 (1)
ANTRAC	—	13 (1)	—	—	—	3 (1)	—
AQUFLA	—	25 (1)	—	18 (2)	—	3 (1)	—
ARANUD	—	—	—	16 (22)	—	22 (11)	13 (10)
ARANUT	—	—	—	—	—	3 (40)	—
ARELAT	—	—	—	—	—	—	6 (1)
AREMAC	—	—	—	9 (1)	—	5 (1)	—
ARENUT	—	—	—	—	—	3 (30)	—
AREOBT	—	—	—	—	—	3 (3)	—
ARNCHA	—	—	—	2 (1)	—	5 (2)	—
ARNCOR	22 (2)	13 (20)	—	18 (4)	10 (2)	5 (15)	19 (1)
ARNICA	—	—	—	4 (10)	—	—	—
ARNLAT	67 (10)	75 (11)	50 (28)	53 (19)	15 (8)	16 (7)	6 (3)
ARNLON	—	—	—	2 (1)	—	—	—
ARNMOL	33 (8)	13 (3)	—	2 (3)	—	—	—
ARNPAR	—	—	—	2 (1)	—	—	—
ARTLUD	—	—	—	—	—	5 (1)	—
ASACAU	—	—	13 (1)	—	—	—	—
ASTALP	—	—	—	2 (1)	—	—	—
ASTCON	—	—	—	29 (1)	—	11 (1)	6 (1)
ASTEAT	11 (1)	—	—	—	—	—	—
ASTENG	—	13 (1)	—	4 (2)	—	5 (1)	—
ASTERX	11 (1)	13 (1)	—	—	10 (12)	3 (1)	19 (1)
ASTFAL	—	—	—	—	—	3 (1)	—
ASTFOL	—	—	—	4 (1)	15 (1)	5 (5)	31 (6)
ASTHES	—	—	—	—	—	3 (1)	—
ASTINT	—	—	—	2 (1)	—	—	—
ASTLAE	11 (10)	25 (1)	—	7 (1)	—	19 (1)	—
ASTMIS	—	—	—	—	—	3 (10)	6 (1)
ASTMOD	—	—	—	4 (5)	—	3 (1)	6 (10)
ASTOCC	—	—	—	2 (1)	40 (11)	19 (9)	6 (3)
ASTPER	—	—	—	—	—	—	6 (1)
ASTRAG	—	—	—	2 (1)	15 (2)	—	6 (1)
ASTSUB	—	—	—	4 (1)	—	—	—
BALSAG	—	—	—	2 (1)	—	—	—
BOYMAJ	—	—	13 (20)	—	—	—	—
CACPLA	—	—	—	—	—	3 (3)	—
CALBUL	—	—	13 (1)	2 (1)	—	—	—
CALLEP	—	—	13 (3)	—	—	3 (3)	—
CAMPAR	—	13 (1)	—	—	—	—	—
CAMQUA	—	—	—	—	—	3 (1)	—
CAMROT	33 (1)	—	—	7 (1)	—	8 (1)	6 (1)
CASHIS	—	—	—	—	—	3 (1)	—
CASMIN	—	—	—	7 (1)	—	8 (1)	—
CASRHE	—	38 (1)	—	2 (1)	—	—	—
CENMAC	—	—	—	—	—	3 (3)	—
CERARV	—	—	—	—	—	3 (1)	—
CHEALB	—	—	—	—	—	3 (1)	—
CHENOP	—	—	—	—	5 (1)	—	—
CHITWE	—	—	—	—	—	3 (3)	—
CHRLEU	—	—	—	—	—	3 (1)	—

CICMAC	—	—	—	—	5 (1)	3 (1)	—
CIRALP	—	—	—	7 (10)	—	8 (1)	—
CIRARV	—	—	—	—	—	19 (1)	25 (4)
CIRFOL	—	—	—	—	—	—	13 (1)
CIRHOO	11 (10)	—	—	—	—	—	—
CIRSCA	—	—	—	—	15 (1)	3 (3)	—
CIRSIU	—	—	—	2 (1)	—	—	—
CIRUND	—	—	—	—	—	—	6 (1)
CIRVUL	—	—	—	—	—	—	6 (1)
CLALAN	—	—	—	2 (1)	—	3 (1)	—
CLIUNI	22 (2)	13 (1)	50 (11)	24 (14)	—	14 (5)	—
CONMAC	—	—	—	—	5 (1)	—	—
COPOCC	11 (3)	—	25 (2)	13 (20)	—	—	6 (1)
CORMAC	—	—	—	7 (1)	—	3 (1)	—
CORSTR	—	—	—	—	—	8 (7)	—
CORTRI	—	—	—	2 (1)	—	3 (1)	—
DISHOO	—	—	9 (2)	—	3 (1)	—	—
DISPOR	—	—	—	—	—	3 (3)	—
DISTRA	—	—	—	13 (1)	—	22 (1)	6 (1)
DODCON	—	—	—	2 (1)	—	3 (1)	—
DODECA	11 (10)	—	—	—	—	—	—
DODJEF	33 (5)	38 (8)	25 (10)	4 (2)	—	5 (1)	6 (1)
DODPUL	—	—	—	2 (1)	—	—	—
EPIALP	22 (1)	13 (1)	—	9 (1)	—	—	13 (2)
EPIANG	22 (1)	63 (1)	13 (1)	22 (1)	70 (5)	16 (3)	44 (1)
EPICIL	—	—	—	2 (1)	20 (1)	—	13 (1)
EPIGLA	—	—	—	—	—	—	6 (1)
EPILOB	—	—	—	—	5 (1)	—	—
ERIPER	33 (1)	50 (1)	13 (1)	16 (1)	10 (1)	3 (1)	13 (1)
ERISIM	—	—	—	—	—	3 (1)	—
ERISPE	—	—	—	—	—	—	6 (1)
ERYGRA	22 (2)	50 (1)	13 (1)	11 (9)	—	11 (7)	—
FRAGAR	—	—	—	—	—	3 (1)	—
FRASPE	—	—	—	2 (1)	—	—	—
FRAVES	11 (10)	—	—	13 (1)	10 (2)	11 (1)	—
FRAVIR	67 (4)	25 (1)	—	29 (3)	45 (5)	57 (4)	44 (1)
GALAPA	—	—	—	2 (1)	—	5 (1)	—
GALBOR	—	—	—	16 (1)	15 (1)	43 (1)	38 (1)
GALTRF	—	—	—	—	—	3 (1)	6 (1)
GALTRI	11 (1)	—	13 (3)	82 (2)	20 (2)	49 (4)	50 (1)
GENAFF	—	—	—	2 (1)	—	5 (1)	—
GENCAL	—	13 (1)	13 (1)	—	—	—	—
GENDET	—	—	—	—	5 (1)	—	—
GERANI	—	—	—	—	15 (1)	—	—
GERRIC	—	—	—	13 (1)	30 (3)	14 (1)	44 (1)
GERVIS	—	—	—	2 (1)	10 (2)	11 (4)	—
GEUMAC	11 (1)	—	—	7 (1)	30 (1)	19 (2)	38 (1)
GEURIV	—	—	—	—	—	3 (1)	6 (1)
GEUTRI	—	—	—	—	—	—	13 (1)
GOOOBL	11 (1)	—	13 (1)	24 (1)	—	16 (1)	—
HABDIL	33 (1)	13 (1)	—	7 (1)	—	8 (1)	6 (1)
HABHYP	11 (10)	—	—	—	—	8 (1)	—
HABOBT	—	—	—	2 (1)	—	—	6 (1)
HABORB	—	—	—	—	—	3 (1)	—
HABSAC	11 (1)	—	—	13 (1)	5 (1)	—	—
HACFLO	—	—	—	2 (1)	—	—	—
HAPLAN	11 (1)	—	—	—	—	—	—

HEDSUL	—	—	—	2 (3)	—	5 (2)	—
HERLAN	11 (1)	—	13 (1)	38 (3)	30 (5)	24 (6)	25 (1)
HEUCYL	—	—	—	—	—	3 (1)	—
HIEALB	11 (1)	13 (1)	—	22 (1)	—	—	—
HIEGRA	—	25 (1)	—	7 (1)	—	—	—
HIEUMB	11 (1)	—	—	—	—	3 (1)	—
HYDCAP	—	—	—	2 (1)	—	—	—
IPOAGG	—	—	—	—	—	3 (1)	—
LATOCH	—	—	—	—	—	8 (1)	—
LIGCAN	11 (1)	13 (1)	50 (1)	2 (1)	—	—	—
LIGFIL	—	—	—	—	—	—	—
LIGTEN	22 (2)	38 (1)	13 (3)	7 (1)	5 (1)	5 (2)	—
LIGUST	—	—	—	2 (3)	—	—	—
LIGVER	—	—	—	2 (10)	—	—	—
LISBOR	—	—	—	2 (1)	—	—	—
LISCAU	—	—	13 (1)	4 (1)	—	3 (1)	—
LISCON	11 (1)	—	—	—	—	—	—
LISCOR	11 (1)	—	13 (3)	11 (1)	—	—	—
LOMGRA	—	—	—	—	—	3 (20)	—
LUPARG	22 (1)	13 (1)	—	—	—	—	—
LUPINU	22 (1)	38 (1)	—	2 (1)	—	—	—
LYSAME	—	—	—	—	—	3 (1)	—
MEDLUP	—	—	—	—	—	3 (1)	—
MEDSAT	—	—	—	—	—	5 (2)	—
MELALB	—	—	—	—	—	3 (10)	—
MELOFF	—	—	—	—	—	3 (1)	—
MENARV	—	—	—	2 (1)	—	5 (5)	6 (1)
MERCIL	—	—	—	16 (3)	25 (2)	8 (1)	6 (3)
MERPAN	—	—	—	2 (1)	—	—	—
MIMLEW	—	—	—	2 (1)	5 (1)	—	—
MITBRE	11 (1)	13 (1)	50 (2)	7 (1)	—	—	—
MITELL	11 (1)	—	—	4 (1)	—	3 (1)	13 (1)
MITNUD	11 (3)	—	—	—	—	11 (1)	—
MITPEN	11 (1)	13 (1)	25 (2)	22 (2)	5 (1)	3 (1)	13 (2)
MITSTA	—	—	—	11 (1)	—	3 (1)	—
MONCHA	11 (1)	—	—	—	—	—	—
MONTIA	—	—	—	2 (3)	—	—	—
MYOSYL	—	—	—	4 (1)	—	—	—
OSMCHI	11 (1)	25 (2)	13 (1)	62 (4)	10 (2)	49 (5)	38 (1)
OSMDEP	—	—	—	—	—	3 (1)	—
OSMOCC	—	—	—	7 (8)	—	14 (6)	—
OSMPUR	—	—	13 (1)	—	—	—	—
PARFIM	—	—	—	11 (11)	—	—	6 (1)
PARNAS	—	—	—	2 (3)	—	—	—
PEDBRA	—	38 (1)	—	11 (4)	—	14 (5)	—
PEDCON	—	25 (1)	—	—	5 (1)	3 (1)	—
PEDGRO	33 (4)	—	13 (1)	—	5 (3)	5 (1)	—
PEDRAC	—	—	13 (1)	4 (1)	—	—	—
PENPRO	—	—	—	—	—	3 (1)	—
PENWIL	—	—	—	2 (1)	—	—	—
PHAHAS	—	—	—	2 (1)	—	—	—
PLAMAJ	—	—	—	—	—	—	6 (1)
POLBIS	—	—	—	4 (1)	—	—	—
POLOCC	—	—	—	—	5 (1)	—	—
POTDIV	—	—	—	2 (1)	—	5 (1)	—
POTFLA	—	—	13 (1)	—	—	—	—

POTGRA	—	—	—	2 (1)	—	8 (1)	13 (1)
PRESAG	—	—	—	7 (1)	—	3 (20)	—
PRIPAR	—	—	—	—	—	3 (1)	—
PRUVUL	—	—	—	—	5 (1)	11 (1)	—
PSOESC	—	—	—	—	—	3 (1)	—
PYRASA	22 (1)	13 (1)	—	27 (2)	10 (1)	19 (1)	38 (1)
PYRCHL	—	13 (1)	—	22 (1)	5 (1)	8 (1)	19 (1)
PYRMIN	22 (1)	13 (1)	—	2 (3)	—	5 (1)	6 (1)
PYROLA	11 (1)	—	—	2 (1)	5 (1)	—	6 (1)
PYRSEC	33 (1)	13 (1)	—	53 (1)	10 (10)	16 (1)	38 (1)
PYRUNI	—	—	—	29 (1)	—	—	19 (1)
RANESC	—	—	—	2 (1)	—	—	—
RANUNC	11 (1)	—	—	—	—	—	—
RANUNI	11 (1)	—	—	7 (1)	—	5 (1)	19 (1)
RANVER	—	—	—	2 (1)	—	—	—
RUBPED	—	—	25 (2)	—	—	—	—
RUBPUB	—	—	—	—	10 (1)	11 (3)	6 (3)
RUDBEC	—	—	—	—	—	3 (1)	—
RUDOCC	—	—	—	—	—	3 (20)	—
RUMACE	—	—	—	—	—	—	6 (1)
SANMAR	—	—	—	—	—	5 (1)	—
SAUAME	11 (1)	—	—	—	—	—	—
SAXARG	11 (1)	—	—	24 (6)	10 (2)	8 (10)	13 (1)
SAXIFR	—	—	—	—	—	—	6 (1)
SCUGAL	—	—	—	—	—	3 (1)	—
SENCYM	—	—	—	2 (1)	—	—	—
SENECI	—	—	—	—	—	3 (3)	—
SENFOE	—	—	—	—	—	5 (2)	—
SENPAP	—	—	—	2 (1)	5 (20)	—	—
SENPSE	11 (1)	—	—	22 (4)	5 (1)	27 (2)	44 (1)
SENTRI	44 (1)	63 (1)	50 (2)	73 (7)	20 (4)	16 (2)	13 (1)
SIBPRO	—	—	—	—	—	3 (1)	—
SILMEN	—	—	—	2 (1)	—	11 (3)	6 (1)
SILENE	—	—	—	—	—	3 (1)	—
SMIRAC	—	—	—	13 (1)	—	16 (1)	6 (1)
SMISTE	—	—	—	53 (3)	35 (4)	70 (2)	63 (5)
SOLCAN	—	—	—	—	15 (14)	14 (3)	—
SOLGIG	—	—	—	—	—	3 (1)	—
SOLIDA	—	—	—	—	—	—	6 (1)
SOLMIS	—	—	—	—	—	3 (3)	—
SOLMUL	—	—	—	—	—	3 (1)	—
SOLSPE	—	—	—	—	—	3 (10)	—
SONCHU	—	—	—	2 (1)	—	3 (3)	—
STAPAL	—	—	—	—	—	3 (1)	—
STELLA	—	—	—	2 (1)	—	—	—
STEOCC	—	—	—	—	—	5 (1)	—
STRAMP	33 (1)	—	75 (1)	67 (3)	15 (1)	8 (1)	31 (1)
SWEPER	11 (30)	—	—	—	—	—	—
TARCER	—	—	—	—	5 (1)	—	—
TAROFF	11 (1)	—	—	20 (1)	45 (1)	27 (4)	31 (1)
THAFEN	—	—	—	—	25 (2)	—	6 (3)
THALIC	11 (10)	—	—	2 (3)	10 (1)	—	—
THAOCC	—	13 (1)	13 (1)	84 (7)	5 (3)	43 (8)	50 (1)
THAVEN	22 (2)	—	—	2 (3)	—	—	—
TIATRI	33 (1)	—	88 (11)	29 (4)	—	5 (2)	—
TRACAR	—	—	13 (20)	—	—	—	—
TRADUB	—	—	—	—	—	3 (1)	—

TRIAGR	—	—	—	—	—	3 (1)	6 (3)
TRIDUB	—	—	—	—	—	3 (10)	—
TRIHYB	—	—	—	—	—	3 (10)	—
TRILON	11 (1)	—	—	2 (1)	5 (1)	—	6 (1)
TRIOVA	11 (1)	—	13 (1)	18 (1)	—	14 (1)	—
TRIPRA	—	—	—	—	5 (20)	—	—
TRIREP	—	—	—	—	5 (1)	8 (5)	—
TROLAX	44 (2)	50 (1)	—	11 (5)	5 (1)	—	—
URTDIO	—	—	—	9 (1)	20 (1)	11 (1)	13 (1)
VACPYR	—	—	—	—	—	—	6 (1)
VALDIO	—	—	—	—	—	3 (3)	—
VALERI	11 (10)	—	—	—	—	—	—
VALSIT	22 (1)	63 (1)	—	9 (1)	5 (1)	8 (1)	6 (3)
VERAME	—	—	—	—	—	—	13 (1)
VERONI	—	—	—	—	5 (1)	—	6 (1)
VERTHA	—	—	—	—	—	—	6 (1)
VERVIR	11 (3)	38 (14)	25 (1)	40 (2)	—	5 (10)	6 (1)
VERWOR	11 (1)	25 (1)	—	7 (1)	5 (1)	—	
VICAME	—	—	—	9 (4)	—	22 (1)	—
VICIAX	—	—	—	—	—	5 (1)	6 (1)
VIOADU	—	13 (1)	—	4 (1)	—	8 (1)	19 (1)
VIOCAN	—	—	13 (1)	13 (7)	—	24 (6)	13 (1)
VIOGLA	—	—	13 (1)	2 (1)	—	3 (1)	—
VIOLAX	—	13 (3)	—	4 (1)	15 (1)	14 (9)	13 (1)
VIOMAC	11 (30)	13 (3)	—	—	—	—	—
VIONEP	—	—	—	—	—	3 (3)	—
VIOORB	56 (2)	25 (2)	—	47 (2)	—	11 (6)	6 (1)
XERTEN	—	25 (30)	25 (2)	20 (4)	—	3 (1)	—
ZIGELE	11 (20)	—	—	2 (1)	—	—	6 (1)
ZIZAPT	11 (20)	—	—	—	—	3 (1)	6 (1)
Ferns and Allies							
ATHFIL	—	—	38 (1)	20 (2)	5 (1)	16 (1)	—
BOTVIR	—	—	—	2 (1)	—	—	—
CYSFRA	—	—	—	4 (2)	—	—	—
EQUARV	33 (4)	13 (1)	—	20 (10)	60 (9)	35 (5)	100 (44)
EQUFLU	—	—	—	2 (1)	—	3 (1)	—
EQUHYE	11 (10)	—	—	7 (1)	—	19 (5)	6 (1)
EQUISE	—	—	—	—	—	3 (3)	—
EQULAE	—	—	—	2 (1)	10 (1)	8 (1)	—
EQUPAL	—	—	—	—	—	3 (10)	—
EQUPRA	22 (2)	—	13 (3)	13 (2)	15 (18)	8 (1)	6 (1)
EQUSCI	—	—	—	2 (3)	—	5 (1)	6 (60)
EQUSYL	—	—	—	2 (1)	5 (1)	—	—
FERNXX	—	—	—	2 (1)	—	—	—
GYMDRY	—	—	38 (4)	31 (15)	5 (1)	3 (1)	—
LYCANN	11 (1)	—	—	16 (13)	—	—	—
LYCSIT	11 (3)	—	—	—	—	—	—

Appendix 13. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type Phase	PICEA/ GALTRI H.T.	PICEA/ LYSAME H.T.	THUPLI/ ATHFIL ATHFIL H.T.	THUPLI/ GYMDRY H.T.	THUPLI/ OPLHOR H.T.	TSUHET/ GYMDRY H.T.
No. Of Stands	18	5	11	7	20	10
Trees						
ABIGRA	—	20 (1)	73 (17)	86 (28)	40 (6)	60 (21)
ABILAS	50 (7)	—	55 (10)	14 (20)	50 (7)	20 (22)
BETPAP	—	40 (7)	9 (50)	14 (20)	20 (7)	10 (3)
JUNSCO	6 (1)	—	—	—	—	—
LAROCC	—	—	27 (4)	29 (7)	10 (2)	30 (15)
PICEAX	100 (48)	100 (27)	27 (8)	29 (12)	55 (10)	10 (40)
PICENG	—	—	36 (6)	43 (2)	—	20 (1)
PINALB	17 (1)	—		—	—	—
PINCON	39 (8)	—	—	—	—	—
PINMON	—	—	45 (1)	43 (1)	25 (2)	30 (14)
PINPON	11 (20)	—		—		—
POPTRE	17 (7)	—	—	—	—	10 (1)
POPTRI	—	—	27 (15)	29 (5)	15 (1)	10 (3)
PSEMEN	39 (34)	40 (2)	36 (4)	43 (2)	25 (6)	20 (2)
THUPLI	6 (1)	—	91 (55)	100 (53)	75 (38)	50 (48)
TSUHET	—	—	55 (26)	14 (80)	100 (34)	100 (60)
TSUMER	—	—	9 (1)	—	—	—
Shrubs						
ACEGLA	6 (3)	60 (2)	36 (11)	43 (7)	65 (4)	80 (9)
ALNINC	17 (1)	60 (30)	9 (40)	—	5 (1)	—
ALNSIN	11 (45)	—		—	5 (1)	10 (3)
AMEALN	39 (1)	20 (3)	9 (3)	57 (1)	10 (1)	60 (1)
ARCUVA	—	—	—	—	5 (1)	—
BERREP	56 (2)	20 (1)	—	—	—	20 (1)
BETOCC	—	60 (5)	—	—	5 (1)	—
CHIMEN	—	—	—	—	5 (1)	—
CHIUMB	6 (1)	—	—	29 (2)	—	20 (1)
CLEOCC	6 (1)	—	—	14 (1)	—	—
CORCAN	6 (3)	40 (5)	18 (10)	29 (10)	5 (1)	20 (1)
CORNUT	—	—	9 (3)	—	—	—
CORSTO	—	100 (3)	18 (7)	14 (1)	35 (4)	10 (1)
JUNCOM	22 (1)	—	—	—	—	—
LINBOR	28 (22)	40 (1)	36 (4)	57 (12)	20 (1)	70 (9)
LONCAE	—	—	—	—	—	—
LONCIL	—	—	—	14 (1)	—	20 (1)
LONINV	33 (4)	—	9 (3)	—	—	—
LONTAT	—	—	—	—	5 (10)	—
LONUTA	28 (5)	—	9 (1)	57 (1)	15 (1)	70 (1)
MENFER	6 (1)	—	36 (2)	14 (1)	30 (1)	30 (1)
OPLHOR	—	—	9 (1)	29 (2)	100 (28)	20 (3)
PACMYR	11 (1)	—	9 (3)	29 (2)	20 (1)	50 (9)
PHILEW	—	—	9 (3)	—	—	—
POTFRU	6 (1)	—	—	—	—	—
PRUEMA	—	—	—	—	5 (1)	—

PRUVIR	6 (1)	—	—	—	—	—
RHAALN	11 (5)	—	—	—	—	—
RHAPUR	—	—	—	14 (1)	—	—
RHUSXX	—	—	—	—	5 (1)	—
RIBESX	6 (1)	20 (1)	—	—	—	—
RIBHUD	11 (3)	—	—	—	10 (1)	—
RIBLAC	67 (1)	—	36 (4)	14 (1)	50 (1)	10 (20)
ROSACI	50 (4)	60 (1)	—	14 (1)	—	—
ROSGYM	6 (1)	—	27 (1)	29 (2)	10 (1)	50 (2)
ROSWOO	11 (3)	—	—	—	—	—
RUBIDA	33 (1)	20 (3)	9 (20)	—	30 (4)	—
RUBLAC	6 (1)	—	—	—	—	—
RUBLEU	—	—	—	—	5 (1)	—
RUBPAR	39 (4)	40 (2)	64 (3)	57 (10)	55 (9)	70 (4)
RUBUSX	—	—	9 (3)	—	—	—
SALBOO	6 (3)	—	—	—	—	—
SALDRU	6 (1)	—	—	—	—	—
SALIXX	—	20 (1)	—	—	—	—
SALSCO	17 (1)	—	—	—	5 (1)	—
SAMRAC	6 (1)	—	18 (1)	—	15 (1)	—
SHECAN	28 (5)	—	—	—	—	—
SOLDUL	—	40 (2)	—	—	—	—
SORSIT	—	—	—	—	—	10 (1)
SORSCO	11 (1)	—	—	—	15 (1)	—
SPIBET	39 (3)	—	—	—	5 (1)	10 (1)
SYMALB	61 (7)	60 (1)	45 (6)	43 (1)	35 (1)	20 (10)
SYMOCC	—	20 (60)	9 (20)	14 (1)	—	—
TAXBRE	—	—	18 (15)	57 (1)	55 (14)	30 (9)
VACGLO	11 (1)	—	36 (2)	29 (12)	35 (1)	—
VACMEM	—	—	9 (20)	14 (20)	15 (1)	—
VACSCO	—	—	—	—	5 (1)	10 (1)
Graminoids						
AGRCAN	6 (3)	—	—	—	—	—
AGROST	—	—	9 (1)	—	—	—
AGRREP	6 (1)	20 (1)	—	—	—	—
AGRSTO	—	—	9 (10)	—	—	—
BROANO	11 (3)	—	—	—	—	—
BROCAR	17 (1)	—	—	—	—	—
BROCIL	11 (2)	—	—	—	—	—
BROCOM	—	—	—	—	5 (1)	—
BROINE	—	—	9 (20)	—	—	—
BROMOL	—	—	9 (1)	—	—	—
BROVUL	28 (2)	20 (1)	18 (1)	29 (1)	40 (1)	40 (1)
CALCAN	33 (17)	—	—	—	—	—
CALRUB	39 (13)	—	—	—	—	—
CALSTR	6 (60)	—	—	—	—	—
CARAQU	—	—	—	—	5 (1)	—
CARCAN	—	20 (1)	—	—	—	—
CARDEW	—	—	—	—	5 (1)	—
CARDIS	28 (9)	20 (1)	—	—	—	—
CAREXX	—	—	18 (1)	—	5 (1)	—
CARGEY	17 (2)	—	—	—	—	—
CARHOO	6 (3)	—	—	—	—	—
CARLAE	—	—	—	—	5 (3)	—
CARMIC	11 (1)	—	—	—	—	—
CARPRA	—	—	9 (1)	—	—	—
CARROI	6 (1)	—	—	—	—	—

CARROS	6 (1)	20 (1)	—	—	—	—
CINLAT	11 (2)	60 (2)	18 (1)	—	10 (3)	—
DESCES	6 (1)	—	—	—	5 (3)	—
DESELO	—	—	—	—	5 (1)	—
ELYGLA	22 (1)	20 (1)	—	—	—	—
FESOCC	6 (1)	—	—	—	—	—
FESSUB	—	—	—	—	10 (2)	—
GLYELA	6 (3)	—	9 (1)	—	—	—
GLYGRA	6 (80)	—	—	—	—	—
GLYSTR	—	20 (3)	—	—	—	—
KOECRI	6 (1)	—	—	—	—	—
LUZCAM	—	—	—	—	—	10 (1)
LUZPAR	28 (1)	—	—	—	—	—
MELSUB	17 (2)	—	—	29 (1)	25 (1)	10 (1)
ORYASP	11 (2)	—	—	—	—	—
PHAARU	—	—	9 (3)	—	—	—
PHLPRA	11 (1)	—	—	—	—	—
POAINT	6 (1)	—	—	—	—	—
POANER	11 (1)	—	—	—	—	—
POAPAL	—	—	9 (10)	—	—	—
POAPRA	6 (1)	20 (70)	9 (1)	—	—	—
POAXXX	17 (1)	—	—	—	—	—
TRICER	—	—	9 (1)	—	15 (2)	—
Forbs						
ACHMIL	22 (1)	—	—	—	—	—
ACOCOL	—	—	18 (1)	—	5 (1)	—
ACTRUB	94 (1)	—	27 (1)	29 (1)	65 (1)	30 (1)
ADEBIC	6 (1)	20 (3)	45 (2)	29 (3)	65 (5)	30 (14)
ALLBRE	11 (1)	—	—	—	—	—
ANAMAR	6 (1)	—	9 (1)	—	5 (1)	—
ANEPIP	—	—	—	14 (1)	10 (1)	—
ANGARG	22 (1)	20 (1)	9 (1)	—	—	—
ANGPIN	6 (1)	—	—	—	—	—
ANTRAC	22 (1)	—	—	—	—	—
AQUFLA	11 (2)	—	9 (1)	—	—	—
AQUILE	—	—	—	—	5 (10)	—
ARAHOL	6 (1)	—	—	—	—	—
ARANUD	6 (1)	20 (3)	27 (11)	43 (2)	50 (3)	40 (11)
ARANUT	—	20 (30)	—	—	—	—
ARELAT	6 (1)	—	—	—	10 (2)	—
ARNCOR	22 (17)	—	—	—	—	10 (3)
ARNICA	6 (10)	—	—	—	—	—
ARNLAT	28 (15)	—	—	14 (1)	—	10 (20)
ASACAU	—	—	45 (3)	29 (10)	20 (12)	10 (3)
ASTALP	6 (1)	—	—	—		—
ASTCAM	—	—	9 (1)	—	—	—
ASTCON	50 (10)	—	—	—	—	—
ASTENG	17 (1)	—	—	—	—	—
ASTFOL	22 (2)	—	—	—	—	—
ASTLAE	6 (1)	—	—	—	—	—
ASTMIS	11 (1)	—	—	—	—	—
ASTOCC	11 (22)	—	—	—	—	—
CALBUL	6 (1)	—	—	—	—	—
CAMROT	17 (1)	—	—	—	—	—
CARNUT	—	20 (1)	—	—	—	—
CASMIN	11 (1)	—	—	—	—	—

CERVUL	—	—	9 (1)	—	—	—
CHEALB	—	20 (1)	—	—	—	—
CHRLEU	—	—	9 (1)	—	—	—
CICMAC	6 (1)	20 (3)	—	—	—	—
CIRALP	—	20 (3)	27 (1)	14 (1)	45 (5)	20 (10)
CIRARV	6 (1)	20 (1)	—	—	—	—
CIRSIU	—	—	—	—	5 (1)	—
CLIUNI	—	—	27 (1)	100 (7)	85 (9)	90 (7)
COLPAR	6 (1)	—	—	—	—	—
COPOCC	—	—	9 (20)	43 (20)	15 (8)	30 (33)
CORALL	—	—	9 (1)	—	—	—
CORMER	—	—	—	14 (1)	—	—
CORSTR	6 (1)	—	—	—	5 (1)	—
CORTRI	6 (1)	—	—	—	—	—
CYNOFF	—	20 (3)	—	—	—	—
DISHOO	—	—	27 (1)	43 (9)	30 (4)	40 (2)
DISPOR	—	—	—	29 (1)	25 (1)	10 (1)
DISTRA	33 (1)	20 (1)	9 (1)	—	10 (2)	—
EPIANG	50 (1)	—	9 (1)	—	5 (1)	—
EPIGLA	6 (1)	—	—	—	—	—
EPILOB	6 (1)	—	—	—	—	—
ERIPER	6 (1)	—	—	—	—	—
ERYGRA	17 (7)	—	—	—	—	—
FRAGAR	—	—	—	—	10 (1)	10 (1)
FRAVES	33 (1)	—	—	—	—	—
FRAVIR	72 (1)	—	9 (3)	—	5 (3)	—
GALAPA	—	40 (1)	9 (1)	—	—	—
GALBOR	33 (1)	—	—	—	—	—
GALTRI	94 (1)	40 (2)	36 (4)	57 (1)	80 (3)	60 (1)
GENAMA	6 (1)	—	—	—	—	—
GERANI	—	20 (3)	—	—	—	—
GERCAR	—	—	—	—	5 (1)	—
GERRIC	56 (6)	—	—	—	—	—
GERVIS	17 (1)	—	—	—	—	—
GEUMAC	33 (1)	60 (1)	9 (1)	—	—	—
GLYLEP	—	20 (1)	—	—	—	—
GOOOBL	22 (1)	—	18 (1)	43 (1)	25 (1)	70 (1)
HABDIL	—	20 (1)	—	—	—	—
HABOBT	6 (1)	—	—	—	—	—
HABORB	6 (1)	—	—	—	—	10 (1)
HABSAC	11 (1)	—	—	—	—	—
HAPLAN	—	—	9 (1)	—	—	—
HEDSUL	6 (1)	—	—	—	—	—
HERLAN	61 (3)	—	9 (3)	14 (1)	10 (2)	—
HEUCYL	—	20 (1)	—	—	—	—
HIEALB	17 (1)	—	—	29 (1)	20 (1)	30 (1)
IMPAUR	—	20 (1)	—	—	—	—
LATOCH	6 (1)	—	—	—	—	—
LIGCAN	—	—	9 (1)	—	—	—
LIGTEN	6 (1)	—	—	—	—	—
LISBOR	6 (1)	—	—	14 (1)	—	10 (1)
LISCAU	—	—	—	14 (1)	—	10 (1)
LISCON	—	—	9 (1)	—	—	—
LISCOR	11 (1)	—	—	—	—	—
LYSAME	—	100 (35)	—	—	—	—
LYSTHY	—	20 (1)	—	—	—	—
MEDFAL	—	—	9 (1)	—	—	—

MERCIL	28 (2)	—	—	—	—	—
MERPAN	6 (3)	—	—	—	—	—
MIMLEW	6 (1)	—	—	—	—	—
MITBRE	—	—	—	—	5 (1)	—
MITELL	—	20 (10)	9 (1)	—	—	—
MITNUD	—	—	9 (1)	—	—	—
MITPEN	6 (1)	—	—	—	—	—
MITSTA	—	—	9 (1)	14 (1)	—	—
MITTRI	6 (1)	—	—	—	—	—
MONCOR	—	—	9 (1)	14 (1)	—	—
MONPER	—	—	—	14 (1)	—	10 (1)
MONSIB	—	—	9 (3)	—	—	—
MONTIA	—	—	—	—	5 (3)	—
MONUNF	—	—	—	—	—	10 (1)
MYOSYL	6 (1)	—	—	—	—	—
NASOFF	—	20 (1)	—	—	—	—
OSMCHI	78 (2)	40 (2)	36 (1)	43 (1)	80 (1)	60 (1)
OSMOCC	11 (2)	—	—	—	—	—
PARFIM	—	—	9 (1)	—	5 (1)	—
PEDBRA	17 (1)	—	—	—	—	—
PEDRAC	—	—	—	14 (1)	—	—
PETSAG	—	—	9 (1)	—	—	—
PLAMAJ	—	20 (3)	—	—	—	—
POLAMP	—	20 (3)	—	—	—	—
POTDIV	6 (1)	—	—	—	—	—
POTGRA	11 (1)	20 (3)	—	—	—	—
PRUVUL	6 (1)	—	18 (1)	—	—	—
PTEAND	6 (1)	—	—	—	—	—
PYRASA	17 (1)	—	9 (1)	43 (1)	15 (1)	60 (1)
PYRCHL	44 (1)	20 (1)	—	29 (1)	5 (1)	10 (1)
PYRMIN	6 (1)	20 (1)	—	—	—	—
PYROLA	—	—	9 (10)	—	—	—
PYRSEC	67 (2)	—	9 (1)	29 (1)	15 (1)	30 (1)
PYRUNI	—	—	—	14 (1)	5 (1)	10 (1)
RANUNI	6 (3)	—	—	—	10 (1)	—
RUBPED	—	—	—	—	5 (20)	10 (40)
RUBPUB	11 (1)	20 (1)	—	—	—	—
RUMEXX	—	20 (1)	—	—	—	—
SAXARG	17 (1)	—	—	—	—	—
SAXIFR	—	—	9 (10)	—	—	—
SENECI	—	20 (3)	9 (1)	—	—	—
SENPSE	28 (1)	—	—	—	—	—
SENSTR	6 (1)	—	—	—	—	—
SENTRI	39 (3)	20 (1)	27 (1)	43 (1)	15 (1)	—
SMIRAC	39 (1)	—	—	29 (1)	15 (1)	10 (1)
SMISTE	67 (2)	40 (2)	73 (6)	57 (7)	75 (13)	60 (2)
SOLCAN	6 (1)	20 (1)	—	—	—	—
STEJAM	6 (1)	—	—	—	—	—
STELLA	—	—	9 (1)	—	—	—
STRAMP	44 (1)	—	45 (1)	14 (3)	40 (1)	10 (1)
TARCER	6 (1)	—	—	—	—	—
TAROFF	61 (1)	80 (1)	—	—	5 (1)	—
THAFEN	11 (1)	—	—	—	—	—
THAOCC	67 (6)	—	9 (1)	57 (1)	50 (7)	40 (1)
THAVEN	—	—	9 (1)	—	—	—
TIATRI	6 (3)	—	82 (11)	71 (10)	85 (22)	50 (6)

TRACAR	—	—	36 (7)	14 (1)	5 (1)	—
TRILON	11 (1)	—		—	—	—
TRIOVA	6 (1)	—	45 (1)	57 (1)	65 (1)	40 (1)
TROLAX	—	—	—	—	5 (1)	—
TYPLAT	—	20 (1)		—	—	—
URTDIO	28 (1)	—	9 (1)	—	20 (1)	10 (1)
VALDIO	6 (1)	—	—	—	—	—
VALERI	—	—	—	—	5 (1)	—
VALSIT	6 (1)	—	—	—	—	—
VERAME	—	20 (1)	—	—	—	—
VERVIR	11 (1)	—	18 (2)	—	35 (1)	—
VICAME	6 (1)	—	—	—	—	—
VIOADU	6 (1)	—	—	—	—	—
VIOCAN	11 (1)	20 (1)	9 (1)	43 (1)	10 (3)	—
VIOGLA	—	—	9 (1)	14 (1)	35 (7)	30 (1)
VIOLAX	6 (1)	—	9 (1)	—	—	—
VIOMAC	6 (1)	—	—	—	—	—
VIOORB	6 (3)	—	9 (1)	57 (2)	55 (2)	50 (2)
XERTEN	—	—	—	10 (1)	—	10 (1)
Ferns and Allies						
ADIPED	—	—	9 (3)	29 (1)	—	—
ATHFIL	11 (1)	60 (5)	100 (20)	57 (1)	95 (24)	50 (2)
BOTVIR	6 (1)	—	9 (1)	—	10 (1)	10 (1)
CYSFRA	6 (1)	—	—	—	10 (2)	20 (1)
DRYCRI	—	—	—	—	5 (20)	—
DRYFIL	—	—	—	—	10 (1)	10 (3)
DRYSPI	—	—	9 (1)	14 (1)	25 (17)	10 (1)
EQUARV	28 (2)	60 (1)	9 (1)	—	20 (1)	—
EQUFLU	—	40 (1)	—	—	—	—
EQUHYE	6 (1)	—	—	—	—	—
EQUISE	—	20 (3)	—	—	5 (1)	—
EQULAE	—	20 (1)	—	—	—	—
EQUPRA	17 (18)	—	18 (10)	—	—	—
EQUSYL	6 (1)	—	9 (1)	—	—	—
GYMDRY	6 (1)	—	75 (14)	100 (16)	85 (33)	100 (12)
LYCANN	—	—	—	—	30 (1)	—
POLLON	—	—	—	—	—	10 (1)
POLMUN	—	—	9 (1)	14 (1)	5 (1)	30 (2)
PTEAQU	6 (1)	—	9 (1)	29 (1)	5 (3)	40 (1)

Appendix 14. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	PSEMEN/ CORSTO H.T.	JUNSCO/ CORSTO H.T.	PINPON/ CORSTO H.T.	PINPON/ PRUVIR H.T.	FRAPEN/ PRUVIR H.T.	ACENEG/ PRUVIR H.T.	ELAANG C.T.	SALAMY C.T.
No. Of Stands	28	29	29	32	104	17	4	21
Trees								
ABIGRA	4 (1)	—	—	—	—	—	—	—
ABILAS	4 (3)	—	—	—	—	—	—	—
ACENEG	—	—	—	—	32 (25)	100 (52)	—	10 (12)
BETPAP	7 (15)	—	10 (38)	—	—	—	—	5 (10)
ELAANG	—	—	—	—	8 (15)	—	100 (75)	—
FRAPEN	—	3 (3)	—	19 (4)	100 (50)	6 (3)	—	14 (1)
JUNSCO	32 (10)	100 (31)	21 (9)	25 (1)	19 (6)	—	—	—
LAROCC	7 (30)	—	—	—	—	—	—	—
PICEAX	11 (1)	10 (1)	—	—	—	—	—	—
PINCON	4 (3)	—	3 (3)	—	—	—	—	—
PINFLE	11 (1)	—	—	—	—	—	—	—
PINMON	4 (1)	—	—	—	—	—	—	—
PINPON	21 (20)	10 (1)	100 (22)	100 (27)	1 (1)	—	—	—
POPANG	11 (47)	28 (53)	3 (60)	—	1 (40)	—	—	10 (3)
POPDEL	—	3 (60)	—	—	29 (36)	24 (40)	25 (60)	14 (3)
POPTRE	29 (18)	3 (3)	24 (25)	6 (10)	4 (46)	—	—	—
POPTRI	50 (43)	28 (29)	79 (38)	—	1 (40)	—	—	5 (10)
PSEMEN	100 (21)	—	3 (1)	—	—	—	—	—
SALAMY	4 (1)	7 (3)	7 (20)	—	12 (22)	18 (47)	—	100 (63)
THUPLI	7 (2)	—	—	—	—	—	—	—
ULMAME	—	—	—	—	26 (28)	—	—	—
Shrubs								
ACEGLA	18 (10)	—	3 (20)	19 (14)	—	—	—	—
ALNINC	11 (10)	3 (3)	3 (1)	—	—	—	—	—
AMEALN	39 (13)	7 (5)	55 (10)	100 (11)	34 (10)	6 (1)	—	10 (15)
AMEHUM	—	—	—	—	5 (3)	—	—	—
AMELAN	4 (1)	—	3 (1)	—	1 (3)	—	—	—
ARCUVA	18 (3)	10 (7)	14 (2)	22 (15)	—	—	—	—
ARTCAN	—	7 (7)	—	—	12 (6)	6 (3)	—	—
ARTEMI	—	—	—	3 (1)	—	—	—	—
ARTFRI	—	7 (1)	—	—	4 (1)	—	—	—
ARTTRI	—	3 (3)	—	—	—	—	—	—
BERREP	39 (5)	3 (1)	31 (8)	97 (20)	10 (20)	6 (20)	—	—
BETGLA	7 (5)	—	—	—	—	—	—	—
BETOCC	32 (11)	24 (29)	10 (8)	—	3 (3)	6 (40)	—	—
CELSCA	—	—	—	—	1 (20)	—	—	—
CLELIG	18 (13)	28 (21)	14 (7)	—	9 (7)	18 (2)	25 (3)	5 (20)
CLEMAT	—	—	—	—	2 (1)	—	—	—
CLEOCC	7 (1)	3 (1)	3 (1)	—	—	—	—	—
CORCAN	11 (1)	—	—	3 (20)	—	—	—	—
CORSTO	43 (13)	28 (15)	59 (21)	9 (27)	25 (9)	47 (15)	—	33 (16)
CRACOL	—	—	—	—	3 (5)	—	—	—
CRADOU	11 (3)	3 (30)	28 (12)	47 (10)	2 (1)	—	—	14 (1)
CRASUC	4 (20)	—	3 (20)	3 (1)	8 (9)	6 (3)	—	—
DRYDRU	7 (22)	—	—	—	—	—	—	—

ELACOM	4 (1)	3 (1)	—	—	—	—	—	—
JUNCOM	11 (1)	—	14 (1)	6 (1)	9 (4)	—	—	—
JUNHOR	7 (2)	—	—	—	—	—	—	—
KALMIC	—	—	—	6 (1)	—	—	—	—
LINBOR	7 (3)	—	10 (5)	6 (12)	—	—	—	—
LONDIO	—	—	—	—	1 (3)	—	—	—
LONINV	—	3 (1)	—	—	—	—	—	—
LONTAT	—	—	—	—	1 (3)	—	—	—
PACMYR	4 (1)	—	—	—	—	—	—	—
PARQUI	—	—	—	—	7 (5)	—	—	—
PARVIT	—	—	—	—	5 (1)	—	—	—
PHILEW	4 (3)	—	3 (80)	—	—	—	—	—
PHYMAL	4 (3)	—	—	—	—	—	—	—
POTFRU	14 (10)	3 (1)	—	—	—	—	—	—
PRUAME	—	—	—	—	15 (12)	12 (12)	—	—
PRUPEN	—	—	—	3 (1)	—	—	—	—
PRUVIR	43 (9)	24 (1)	38 (16)	100 (30)	67 (35)	53 (28)	25 (90)	5 (40)
RHUARO	4 (20)	28 (23)	—	19 (1)	11 (5)	—	—	—
RHUSXX	—	—	—	3 (3)	—	—	—	—
RIBAME	—	—	—	—	3 (2)	—	—	5 (3)
RIBCER	—	—	—	3 (1)	—	—	—	—
RIBESX	25 (1)	21 (1)	17 (1)	—	16 (5)	18 (2)	25 (1)	14 (2)
RIBLAC	7 (12)	—	—	—	—	—	—	5 (1)
RIBMIS	—	—	—	13 (2)	11 (3)	6 (3)	—	5 (10)
RIBMON	—	—	—	9 (1)	—	—	—	—
RIBODO	—	10 (14)	—	3 (1)	13 (8)	24 (11)	—	19 (7)
RIBSET	11 (8)	3 (3)	—	38 (1)	12 (3)	6 (20)	—	—
RIBVIS	—	—	—	3 (1)	—	—	—	—
ROSACI	14 (15)	7 (40)	10 (14)	3 (3)	—	—	—	10 (42)
ROSAXX	4 (1)	7 (40)	28 (17)	3 (20)	—	—	—	5 (40)
ROSGYM	4 (20)	—	—	—	—	—	—	—
ROSWOO	61 (12)	79 (13)	34 (15)	78 (10)	56 (13)	76 (31)	75 (28)	62 (24)
RUBIDA	18 (1)	3 (3)	3 (1)	13 (2)	3 (1)	—	—	5 (1)
RUBPAR	14 (7)	—	—	9 (7)	—	—	—	—
RUBUSX	—	—	—	—	—	—	—	5 (20)
SALBEB	25 (4)	7 (10)	17 (10)	—	1 (1)	—	—	—
SALBOO	7 (5)	10 (37)	—	—	—	—	—	—
SALERI	—	—	—	—	—	6 (20)	—	5 (40)
SALEXI	11 (1)	7 (30)	7 (45)	—	9 (35)	12 (20)	25 (60)	43 (19)
SALGEY	—	3 (3)	—	—	—	—	—	—
SALLAS	—	—	—	—	—	6 (30)	—	5 (3)
SALLUT	7 (3)	17 (3)	7 (2)	—	8 (4)	—	—	10 (50)
SALSCO	—	—	3 (10)	—	—	—	—	—
SAMBUC	4 (1)	—	—	—	—	—	—	—
SHEARG	—	14 (35)	—	—	12 (6)	—	25 (60)	5 (3)
SHECAN	43 (3)	3 (3)	21 (21)	41 (10)	—	—	—	—
SOLDUL	—	7 (5)	—	—	—	—	—	10 (1)
SPIBET	25 (9)	3 (3)	14 (12)	47 (22)	—	—	—	—
SYMALB	39 (17)	3 (3)	28 (30)	97 (12)	5 (13)	—	—	10 (12)
SYMOCC	29 (8)	66 (20)	45 (18)	3 (1)	77 (23)	47 (27)	75 (15)	43 (21)
SYMPHO	4 (20)	—	—	—	—	—	—	—
TAMCHI	—	—	—	—	—	—	25 (20)	5 (3)
TAXBRE	—	—	—	3 (1)	—	—	—	—
TOXRYD	7 (2)	17 (14)	24 (6)	53 (8)	28 (11)	6 (20)	—	5 (1)
VITRIP	—	—	—	—	5 (13)	6 (20)	—	5 (1)
VITVUL	—	—	—	—	2 (3)	—	—	—

Graminoids

AGRCAN	18 (2)	10 (2)	7 (2)	22 (7)	14 (14)	—	50 (22)	5 (1)
AGRCRI	—	3 (1)	—	—	1 (20)	—	—	5 (20)
AGRELO	—	—	—	—	—	—	—	5 (20)
AGRINT	—	3 (1)	—	—	—	—	—	—
AGROPY	4 (1)	10 (1)	7 (2)	—	2 (2)	—	—	—
AGROST	—	—	—	3 (1)	1 (3)	—	—	—
AGRREP	11 (7)	21 (7)	14 (8)	—	13 (19)	12 (20)	25 (20)	38 (12)
AGRSCA	—	—	3 (1)	41 (4)	—	—	—	—
AGRSMI	4 (3)	7 (10)	—	3 (1)	16 (20)	29 (34)	25 (20)	5 (10)
AGRSPI	4 (1)	3 (1)	3 (1)	6 (10)	—	—	—	—
AGRSTO	39 (16)	55 (25)	24 (9)	—	4 (26)	6 (1)	50 (30)	33 (26)
ALOPRA	—	—	—	—	—	—	25 (20)	—
BOUGRA	—	—	—	—	2 (7)	—	—	—
BROCAR	—	10 (9)	—	—	2 (3)	—	—	—
BROCIL	11 (1)	3 (1)	7 (1)	6 (2)	1 (20)	—	—	—
BROINE	14 (5)	21 (14)	17 (2)	—	32 (32)	29 (19)	50 (45)	43 (37)
BROJAP	—	—	—	—	13 (11)	24 (13)	25 (60)	5 (1)
BROKAL	—	—	—	—	2 (10)	—	—	—
BROMOL	—	—	—	—	1 (1)	—	—	—
BROTEC	4 (1)	3 (20)	—	3 (1)	10 (17)	18 (11)	—	—
BROVUL	4 (1)	—	—	—	—	—	—	—
CALAMA	4 (3)	—	—	—	—	—	—	—
CALCAN	7 (1)	—	3 (3)	—	—	—	—	—
CALPUR	—	—	—	—	—	—	—	—
CALRUB	7 (2)	—	—	3 (1)	—	—	—	—
CALSTR	4 (1)	—	—	—	—	—	—	—
CARDOU	—	—	—	—	—	—	—	5 (1)
CAREXX	11 (1)	10 (1)	17 (1)	—	1 (1)	6 (60)	—	—
CARGRA	—	—	—	—	7 (2)	—	—	—
CARHEL	—	—	—	22 (20)	—	—	—	—
CARHOO	—	—	3 (1)	9 (1)	2 (1)	—	—	—
CARLAN	—	—	3 (1)	—	1 (3)	—	—	14 (8)
CARMIC	4 (1)	—	—	—	—	—	—	—
CARNEB	—	—	—	—	—	—	—	5 (20)
CARPAC	4 (1)	—	—	—	—	—	—	—
CARPET	—	—	—	3 (1)	—	—	—	—
CARPRI	—	—	7 (2)	—	—	—	—	—
CARROI	—	—	—	22 (1)	—	—	—	—
CARROS	7 (2)	3 (1)	—	—	1 (3)	—	—	—
CARSPR	—	—	—	—	31 (31)	12 (70)	—	—
CARSTR	—	—	3 (1)	—	—	—	—	—
CARXER	—	—	—	—	1 (3)	—	—	—
CINLAT	4 (1)	—	—	—	—	—	—	—
DACGLO	7 (2)	10 (10)	7 (1)	—	1 (20)	—	50 (30)	—
DANINT	—	—	—	3 (20)	—	—	—	—
DANSPI	—	—	—	9 (2)	—	—	—	—
DANTHO	4 (1)	—	—	—	—	—	—	—
DANUNI	—	—	—	3 (1)	—	—	—	—
DICACU	—	7 (7)	—	—	—	—	—	—
ELECOM	4 (3)	7 (12)	—	—	—	—	—	—
ELEPAL	—	—	—	—	—	—	—	5 (10)
ELYCAN	—	7 (12)	—	6 (3)	19 (10)	—	—	10 (10)
ELYCIN	4 (1)	7 (3)	—	—	—	—	—	5 (10)
ELYGLA	21 (1)	—	24 (2)	—	7 (10)	6 (1)	—	—
ELYVIR	4 (20)	7 (20)	—	6 (1)	25 (23)	12 (40)	—	5 (3)
FESIDA	—	—	—	44 (1)	—	—	—	—

FESOCC	—	—	—	3 (1)	—	—	—	—
FESRUB	—	—	3 (20)	—	—	—	—	—
FESSCA	—	3 (3)	—	—	—	—	—	—
FESTUC	4 (3)	—	—	—	—	—	—	—
GLYSTR	7 (3)	—	—	—	—	—	—	—
HORBRA	—	3 (1)	—	—	—	—	—	—
HORJUB	—	—	—	—	7 (7)	6 (20)	—	10 (5)
JUNACU	—	—	3 (1)	—	—	—	—	—
JUNBAL	4 (20)	14 (16)	3 (1)	—	—	—	—	5 (3)
JUNTEN	—	—	3 (1)	—	—	—	—	—
KOECRI	4 (1)	—	—	—	—	—	—	—
LEUKIN	—	—	3 (3)	—	—	—	—	—
LUZPAR	4 (1)	—	—	—	—	—	—	—
MELSUB	11 (2)	—	—	—	—	—	—	—
MUHASP	—	—	—	—	1 (1)	—	—	—
MUHCUS	—	—	—	3 (1)	—	—	—	—
MUHRAC	—	—	—	—	5 (3)	6 (40)	—	—
ORYASP	7 (2)	—	10 (2)	—	—	—	—	—
ORYMIC	—	—	—	3 (1)	15 (11)	—	—	—
PHAARU	—	—	7 (1)	—	—	—	25 (3)	19 (18)
PHLPRA	43 (14)	28 (4)	28 (4)	—	1 (10)	6 (20)	25 (10)	5 (10)
POABUL	—	—	—	—	—	6 (30)	—	—
POACOM	—	17 (6)	17 (15)	3 (3)	3 (11)	—	—	10 (1)
POAFEN	—	—	—	3 (20)	—	—	—	—
POAINT	—	3 (60)	3 (1)	6 (12)	—	—	—	—
POAJUN	—	—	—	3 (1)	—	—	—	—
POANER	—	—	—	3 (1)	—	—	—	—
POAPAL	7 (1)	7 (2)	14 (11)	—	6 (4)	6 (3)	50 (25)	38 (17)
POAPRA	36 (10)	66 (26)	52 (9)	28 (6)	56 (41)	35 (17)	50 (50)	67 (29)
POASAN	—	—	—	3 (1)	—	—	—	—
POASCA	—	—	—	3 (1)	—	—	—	—
POAXXX	—	—	—	—	6 (9)	—	—	—
POLMON	—	—	—	—	1 (1)	—	—	—
SCHPUR	—	—	—	28 (6)	—	—	—	—
SCIPUN	—	—	—	—	1 (1)	—	—	—
SPAGRA	—	—	—	—	1 (10)	—	—	—
SPAPEC	—	—	—	—	—	—	—	10 (30)
STICOM	—	—	—	—	3 (10)	18 (14)	—	—
STIOCC	—	—	—	13 (6)	—	—	—	5 (1)
STISPA	—	—	—	3 (3)	—	—	—	—
STIVIR	4 (3)	7 (2)	3 (1)	3 (1)	10 (3)	—	—	—
Forbs								
ACHMIL	21 (1)	14 (1)	21 (1)	69 (1)	14 (1)	24 (2)	—	—
ACTRUB	25 (5)	3 (3)	—	3 (1)	—	—	—	—
ADEBIC	4 (1)	—	—	—	—	—	—	—
AGAURT	4 (1)	—	—	—	—	—	—	—
AGOGLA	—	—	—	3 (1)	—	—	—	—
AGRSTR	—	—	3 (3)	—	—	—	—	—
ALLBRE	4 (1)	3 (1)	—	—	—	—	—	—
ALLCER	7 (1)	—	3 (1)	—	—	—	—	—
ALLSCH	—	7 (1)	3 (1)	—	—	—	—	—
AMBPSI	—	—	—	—	1 (1)	—	50 (10)	—
AMBTRI	—	—	—	—	1 (3)	—	—	5 (10)
ANAMAR	—	—	—	3 (1)	—	—	—	—
ANEMUL	4 (1)	—	3 (1)	—	—	—	—	—
ANEPAT	4 (1)	—	—	3 (1)	—	—	—	—
ANGARG	11 (1)	—	—	—	—	—	—	—

ANTMIC	—	—	—	22 (1)	—	—	—	—
ANTNEG	—	—	3 (1)	19 (1)	—	—	—	—
ANTPAL	—	—	—	3 (1)	—	—	—	—
ANTRAC	4 (1)	—	—	9 (7)	—	—	—	—
APOAND	7 (2)	3 (40)	7 (1)	50 (4)	4 (7)	—	—	5 (20)
APOCAN	4 (1)	—	—	—	1 (1)	—	—	5 (20)
ARAHIR	—	—	—	3 (1)	—	—	—	—
ARANUD	7 (40)	—	—	—	—	—	—	—
ARCLAP	—	—	—	—	2 (20)	18 (7)	—	—
ARCMIN	—	7 (2)	—	—	8 (9)	18 (28)	—	—
ARCTIU	—	—	—	—	—	—	—	5 (1)
ARNCHA	—	3 (1)	—	—	—	—	—	—
ARNCOR	4 (1)	—	3 (3)	72 (14)	—	—	—	—
ARNLAT	4 (3)	—	3 (10)	—	—	—	—	—
ARNLOC	—	—	3 (1)	—	—	—	—	—
ARTDRA	4 (3)	3 (1)	—	—	—	—	—	5 (1)
ARTLIN	—	7 (2)	—	—	—	—	—	—
ARTLUD	7 (2)	10 (1)	10 (1)	16 (1)	6 (4)	—	—	—
ASCSPE	4 (1)	—	—	—	2 (1)	12 (2)	—	5 (1)
ASPOFF	—	7 (1)	3 (1)	—	3 (1)	—	—	5 (3)
ASPPRO	—	3 (3)	—	—	—	6 (40)	—	—
ASTCAM	—	—	3 (1)	—	—	—	—	—
ASTCHI	—	—	3 (1)	—	—	—	—	—
ASTCIL	—	—	17 (9)	—	—	—	—	—
ASTCON	11 (1)	3 (20)	7 (10)	22 (1)	—	—	—	—
ASTDRU	—	—	—	3 (1)	—	—	—	—
ASTERI	—	3 (3)	—	—	3 (2)	—	—	—
ASTERX	14 (1)	14 (7)	7 (1)	3 (1)	—	6 (1)	—	14 (9)
ASTFOL	14 (7)	—	7 (2)	13 (1)	—	—	—	—
ASTHES	—	—	—	—	—	—	—	5 (3)
ASTINF	4 (1)	—	—	—	—	—	—	—
ASTLAE	11 (1)	10 (2)	7 (1)	19 (1)	—	—	—	—
ASTMIS	—	3 (3)	—	9 (1)	—	—	—	5 (3)
ASTMOD	4 (3)	—	—	—	—	—	—	—
ASTOCC	21 (2)	3 (3)	—	—	—	—	—	—
ASTPAN	—	3 (1)	—	—	1 (3)	—	—	5 (1)
ASTRAG	—	3 (1)	—	—	—	—	—	—
BALSAG	4 (1)	—	3 (3)	38 (3)	—	—	—	—
BESRUB	—	—	—	3 (1)	—	—	—	—
CALSEP	—	—	—	—	3 (1)	—	—	—
CAMMIC	—	—	—	—	—	6 (1)	—	—
CAMROT	7 (1)	—	7 (1)	56 (1)	3 (1)	—	—	—
CAPBUR	—	—	—	—	1 (1)	—	—	—
CASLUT	—	—	3 (1)	—	—	—	—	—
CASMIN	4 (1)	—	—	—	—	—	—	—
CASTIL	4 (1)	—	—	—	—	—	—	—
CENMAC	4 (3)	14 (4)	34 (9)	—	—	—	—	—
CERARV	—	—	3 (1)	38 (1)	1 (1)	—	—	—
CHEALB	—	14 (1)	—	—	5 (1)	—	—	—
CHELEP	—	—	3 (1)	—	—	—	—	—
CHRVIL	4 (1)	—	—	—	—	—	—	—
CICMAC		—	—	—	—	—	—	10 (20)
CIRARV	4 (1)	28 (7)	14 (1)	—	13 (12)	29 (21)	75 (9)	62 (16)
CIRSCA	—	3 (1)	—	—	—	—	—	—
CIRVUL	—	—	3 (1)	—	1 (20)	6 (1)	—	5 (1)
CLIUNI	4 (3)	—	—	—	—	—	—	—

COLLIN	—	—	—	6 (1)	3 (17)	6 (10)	—	—
COLPAR	—	—	—	9 (1)	—	—	—	—
COMAND	—	3 (1)	—	—	—	—	—	—
COMUMB	11 (2)	—	—	—	—	—	—	—
CONARV	—	—	—	—	6 (1)	—	—	—
CONCAN	—	—	3 (1)	—	—	—	—	—
CONVOL	—	—	—	—	—	6 (1)	—	—
CREACU	—	—	—	3 (1)	—	—	—	—
CYMBIP	—	—	3 (3)	—	—	—	—	—
CYNOFF	—	3 (10)	—	—	1 (40)	12 (2)	—	5 (3)
DELBIC	—	—	—	13 (1)	—	—	—	—
DELOCC	—	—	—	3 (1)	—	—	—	—
DESSOP	—	—	—	—	1 (20)	6 (1)	—	—
DESPIN	—	3 (3)	—	—	—	—	—	—
DIAARM	—	3 (1)	—	—	—	—	—	—
DISPOR	4 (1)	—	—	—	—	—	—	—
DISTRA	25 (3)	—	7 (1)	69 (2)	5 (1)	—	—	—
ECHLOB	—	—	—	—	1 (1)	—	—	—
EPIANG	18 (2)	10 (1)	14 (1)	13 (1)	—	—	—	—
EPICIL	11 (1)	—	—	—	—	—	—	—
EPIGLA	—	—	—	3 (1)	—	—	—	—
EPILOB	—	—	3 (3)	—	—	—	—	—
EPIPAN	—	—	—	3 (1)	—	—	—	—
ERIFIL	—	3 (1)	—	—	—	—	—	—
ERIGRA	4 (1)	—	—	—	—	—	—	—
ERISPE	—	—	3 (1)	—	—	—	—	—
ERYCHE	—	—	—	—	1 (3)	—	—	—
ERYGRA	4 (3)	—	—	—	—	—	—	—
EUPESU	—	3 (20)	3 (1)	—	3 (2)	—	—	—
FILARV	—	3 (1)	—	—	—	—	—	—
FRAGAR	4 (3)	—	—	3 (1)	—	—	—	—
FRASER	—	—	—	—	7 (5)	—	—	—
FRAVES	7 (2)	3 (1)	10 (1)	—	—	—	—	—
FRAVIR	29 (4)	14 (12)	7 (1)	59 (2)	3 (2)	—	—	—
FRIATR	—	—	—	6 (1)	—	—	—	—
GALAPA	—	—	—	—	20 (8)	—	—	—
GAIARI	—	10 (1)	—	3 (1)	—	—	—	—
GALAPA	7 (1)	10 (14)	3 (1)	3 (1)	—	6 (3)	—	—
GALBOR	29 (1)	7 (2)	17 (1)	91 (2)	24 (10)	—	—	—
GALTRF	4 (3)	—	—	—	—	—	—	—
GALTRI	21 (1)	7 (1)	7 (1)	22 (1)	1 (20)	—	—	5 (3)
GERANI	—	10 (1)	—	3 (1)	—	—	—	5 (3)
GERCAR	—	—	—	3 (1)	—	—	—	—
GERRIC	21 (2)	3 (1)	7 (1)	—	—	—	—	—
GERVIS	4 (3)	—	3 (1)	38 (1)	—	—	—	—
GEUALE	—	3 (1)	—	—	—	—	—	—
GEUCAN	—	—	—	—	1 (1)	—	—	—
GEUMAC	4 (1)	7 (2)	3 (1)	9 (1)	1 (1)	12 (1)	—	10 (2)
GEUTRI	—	—	—	19 (1)	—	—	—	—
GLYLEP	7 (12)	17 (13)	10 (2)	—	14 (15)	12 (5)	75 (2)	29 (23)
GOOOBL	4 (1)	—	—	3 (1)	—	—	—	—
GRISQU	—	—	—	—	2 (2)	6 (10)	—	—
HABDIL	4 (1)	—	—	—	—	—	—	—
HABENA	7 (1)	—	3 (1)	—	—	—	—	—
HACDEF	—	—	—	—	8 (3)	—	—	—
HACFLO	—	3 (1)	—	—	2 (3)	—	—	—
HELPET	—	—	—	—	1 (1)	—	—	—

HELUNI	—	—	—	—	—	—	—	5 (20)
HERLAN	14 (1)	10 (2)	7 (5)	—	—	6 (70)	—	—
HESMAT	—	—	—	—	1 (40)	—	—	—
HEURIC	—	—	—	25 (1)	2 (2)	—	—	—
HIEALB	4 (1)	—	—	16 (1)	—	—	—	—
HIEUMB	—	—	—	3 (1)	—	—	—	—
HUMLUP	—	—	—	—	1 (20)	6 (20)	—	—
HYPPER	—	14 (1)	—	—	—	—	—	—
IRIMIS	4 (1)	14 (1)	—	—	—	—	—	—
KOCSCO	—	3 (3)	—	—	1 (3)	—	—	—
LACOBL	—	—	—	—	4 (1)	—	—	—
LACSER	—	10 (7)	3 (1)	—	2 (12)	6 (20)	—	19 (1)
LAPRED	—	—	—	—	1 (1)	—	—	—
LATOCH	7 (2)	—	3 (1)	—	—	—	—	—
LEPIDI	—	—	—	—	—	6 (10)	—	—
LIGFIL	—	—	—	6 (1)	—	—	—	—
LINPER	7 (1)	—	—	3 (1)	—	—	—	—
LINVUL	—	—	3 (3)	—	—	—	—	5 (3)
LITRUD	4 (1)	—	3 (3)	6 (1)	—	—	—	—
LOTCOR	—	3 (3)	—	—	—	—	—	—
LUPARG	7 (1)	—	—	—	—	—	—	—
LUPINU	—	—	7 (1)	3 (1)	—	—	—	—
LYCASP	—	—	—	—	—	—	—	5 (20)
LYSCIL	—	—	7 (7)	—	11 (6)	—	—	—
MEDHIS	4 (1)	—	—	—	—	—	—	—
MEDLUP	—	21 (1)	7 (1)	—	6 (4)	—	—	5 (1)
MEDSAT	—	—	—	—	1 (1)	—	—	5 (1)
MELALB	4 (1)	17 (7)	7 (12)	—	7 (5)	—	25 (30)	14 (34)
MELOFF	4 (1)	24 (2)	7 (1)	—	13 (15)	6 (10)	—	14 (34)
MENARV	4 (1)	3 (20)	—	—	5 (9)	12 (5)	25 (3)	24 (4)
MERCIL	—	3 (10)	—	—	—	—	—	—
MEROBL	—	—	—	3 (1)	—	—	—	—
MITSTA	4 (1)	—	—	—	—	—	—	—
MONFIS	—	3 (1)	—	31 (1)	17 (4)	6 (3)	—	—
MONNUT	—	3 (1)	—	—	—	—	—	—
NEMBRE	—	—	—	3 (1)	—	—	—	—
NEPCAT	—	—	—	—	3 (1)	6 (3)	—	—
OENALB	—	—	—	—	1 (3)	—	—	—
OPUPOL	—	—	—	—	2 (2)	—	—	—
ORCROT	—	—	3 (1)	—	—	—	—	—
OSMCHI	21 (5)	3 (20)	7 (1)	28 (1)	2 (3)	6 (3)	—	—
OSMCLA	—	—	—	—	1 (1)	—	—	—
OSMLON	—	—	—	3 (1)	8 (7)	—	—	—
OSMOCC	11 (5)	—	—	3 (1)	—	—	—	—
OXYTRO	7 (3)	—	—	3 (1)	—	—	—	—
PARPEN	—	—	—	—	9 (2)	6 (3)	—	5 (3)
PEDBRA	4 (1)	—	—	—	—	—	—	—
PENSTE	4 (1)	—	—	—	—	—	—	—
PERGAI	—	—	—	6 (1)	—	—	—	—
PHYPAR	—	—	3 (1)	—	—	—	—	—
PLAMAJ	—	—	—	—	1 (1)	—	—	—
POLAMP	—	—	—	—	—	—	25 (30)	5 (20)
POLBIF	—	—	—	—	1 (1)	—	—	—
POLBIS	4 (1)	—	—	—	—	—	—	—
POLDOU	—	—	—	3 (1)	—	—	—	—
POLRAM	—	—	—	—	1 (3)	—	—	—

POLPUL	—	3 (1)	—	—	—	—	—	—
POTENT	—	—	—	—	—	6 (1)	—	5 (20)
POTGLA	—	—	3 (1)	9 (1)	—	—	—	—
POTGRA	—	7 (1)	—	3 (1)	1 (1)	—	—	—
PRUVUL	4 (1)	3 (1)	—	—	—	—	—	—
PSOESC	—	—	—	—	—	—	—	—
PTEAND	—	—	7 (1)	13 (1)	—	—	—	—
PYRASA	4 (1)	—	7 (1)	—	—	—	—	—
PYRCHL	4 (1)	—	—	—	—	—	—	—
PYRDEN	—	—	3 (1)	3 (1)	—	—	—	—
PYRMIN	—	—	—	3 (1)	—	—	—	—
PYRSEC	—	—	7 (1)	13 (1)	—	—	—	—
RANABO	—	—	—	—	3 (1)	—	—	—
RANARV	—	—	—	3 (1)	—	—	—	—
RANCYM	—	—	—	—	1 (1)	—	—	—
RANPEN	—	—	3 (1)	—	—	—	—	—
RORSIN	—	—	—	—	3 (2)	—	—	—
RUDOCC	—	—	—	—	—	—	—	5 (1)
RUMCRI	—	—	3 (1)	—	2 (3)	6 (3)	—	10 (7)
SANMAR	14 (1)	—	10 (1)	22 (1)	14 (6)	—	—	—
SENHYD	—	—	—	—	1 (10)	—	—	—
SENPSE	14 (3)	—	3 (1)	—	—	—	—	—
SENSER	7 (1)	—	3 (1)	—	—	—	—	—
SILMEN	4 (3)	—	3 (3)	—	—	—	—	—
SISALT	—	3 (3)	—	—	—	—	—	—
SISLOE	—	—	—	—	1 (3)	—	—	5 (1)
SMIHER	—	—	—	3 (1)	5 (2)	6 (3)	—	—
SMIRAC	7 (2)	3 (1)	14 (1)	59 (2)	1 (20)	—	—	
SMISTE	50 (2)	45 (9)	41 (3)	56 (1)	28 (9)	6 (20)	—	14 (1)
SOLANU	—	—	—	—	1 (3)	—	—	—
SOLCAN	14 (5)	10 (8)	14 (5)	—	9 (12)	6 (1)	—	5 (1)
SOLGIG	7 (1)	—	14 (3)	3 (3)	1 (1)	—	—	—
SOLIDA	4 (1)	10 (14)	10 (1)	—	—	—	—	5 (1)
SOLMIS	—	—	—	3 (1)	1 (3)	—	—	10 (3)
SOLMOL	—	—	—	3 (1)	—	—	—	—
SOLMUL	—	—	—	9 (1)	—	—	—	—
SOLOCC	—	3 (3)	—	—	—	—	—	—
SOLRIG	—	—	—	—	1 (1)	—	—	—
SONARV	4 (3)	3 (20)	—	—	—	—	—	—
SONASP	—	—	—	—	1 (1)	—	—	5 (1)
STELLA	—	—	—	3 (1)	—	—	—	—
STRAMP	—	—	3 (1)	—	—	—	—	—
TANVUL	4 (1)	—	17 (7)	—	—	—	—	—
TARLAE	—	—	—	—	3 (7)	—	—	—
TAROFF	21 (4)	38 (6)	14 (1)	16 (1)	21 (8)	6 (1)	—	19 (1)
THADAS	4 (3)	—	—	3 (3)	28 (4)	6 (40)	—	—
THALIC	4 (1)	10 (1)	—	—	—	—	—	—
THAOCC	25 (12)	3 (3)	17 (2)	22 (1)	—	12 (2)	—	—
THAVEN	4 (1)	—	—	—	5 (1)	—	—	—
THEMON	—	7 (1)	—	19 (1)	—	—	—	—
THERHO	—	—	—	3 (1)	—	—	—	—
THLARV	—	—	—	—	2 (2)	6 (3)	—	—
TRACAR	—	—	—	—	—	—	—	5 (1)
TRADUB	7 (1)	10 (1)	7 (1)	6 (1)	3 (1)	—	—	—
TRIFOL	4 (20)	—	—	—	1 (1)	—	—	—
TRIHYB	4 (1)	—	—	—	—	—	—	—
TRIOVA	4 (1)	—	—	—	—	—	—	—

TRIPRA	14 (5)	3 (10)	—	—	1 (20)	—	—	—
TRIREP	4 (40)	10 (7)	—	—	—	—	—	—
TYPLAT	—	—	—	—	—	6 (80)	—	5 (20)
URTDIO	4 (1)	3 (3)	3 (1)	3 (1)	4 (2)	24 (1)	—	14 (2)
VALDIO	4 (1)	—	—	—	—	—	—	—
VERTHA	4 (1)	3 (1)	—	—	1 (1)	—	—	—
VICAME	21 (1)	14 (2)	14 (1)	16 (1)	1 (3)	6 (1)	—	—
VICIAX	—	—	3 (1)	—	—	—	—	—
VIOADU	7 (1)	—	—	3 (1)	1 (1)	—	—	—
VIOCAN	18 (9)	—	17 (5)	25 (1)	7 (10)	—	—	—
VIOLAX	7 (12)	—	—	—	7 (5)	—	—	—
VIONUT	—	—	—	3 (1)	1 (1)	—	—	—
VIOORB	4 (3)	—	—	—	—	—	—	—
XANSTR	—	3 (1)	—	—	2 (1)	—	—	5 (1)
ZIGVEN	—	—	—	3 (1)	—	—	—	—
Ferns and Allies								
CYSFRA	4 (1)	—	—	38 (1)	3 (7)	—	—	—
EQUARV	25 (22)	17 (9)	7 (1)	—	2 (1)	—	—	5 (40)
EQUHYE	7 (30)	3 (1)	14 (5)	—	—	—	25 (3)	—
EQULAE	4 (1)	10 (7)	17 (13)	—	—	—	—	5 (10)

Appendix 15. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	POPTRI/ RAB C.T.	POPTRI/ CORSTO C.T.	POPTRI/ SYMOCC C.T.	POPTRI/ HERB C.T.	POPTRE/ BERREP H.T.	POPTRE/ CALCAN H.T.	POPTRE/ CORSTO H.T.	POPTRE/ OSMOCC H.T.	POPTRE/ POAPRA C.T.
No. Of Stands	21	23	21	12	3	6	75	15	26
Trees									
ABILAS	5 (1)	—	10 (2)	—	—	—	4 (1)	—	—
BETPAP	5 (1)	4 (20)	5 (3)	—	—	—	5 (55)	—	—
DEADCW	—	—	—	—	—	—	1 (3)	—	—
DEADQA	—	—	—	—	—	—	1 (3)	—	—
JUNSCO	14 (1)	—	5 (1)	—	—	—	20 (3)	7 (1)	19 (5)
LAROCC	5 (1)	—	—	—	—	—	—	—	—
PICEAX	10 (2)	9 (2)	5 (1)	—	—	17 (1)	11 (1)	7 (1)	12 (1)
PINALB	—	—	5 (3)	—	—	—	—	—	—
PINCON	10 (1)	—	—	—	—	—	3 (7)	—	15 (2)
PINFLE	—	9 (1)	—	—	—	—	4 (8)	—	—
PINMON	5 (1)	—	—	—	—	—	—	—	—
PINPON	10 (2)	—	—	17 (1)	67 (2)	—	5 (1)	—	8 (1)
POPANG	—	4 (20)	5 (20)	—	—	—	—	—	—
POPTRE	—	13 (2)	14 (1)	17 (2)	100 (86)	100 (42)	100 (55)	100 (75)	100 (50)
POPTRI	100 (47)	100 (56)	100 (60)	100 (43)	33 (20)	—	20 (39)	27 (45)	8 (7)
PSEMEN	5 (1)	9 (2)	10 (2)	—	—	—	9 (1)	7 (1)	4 (3)
Shrubs									
ACEGLA	—	13 (1)	—	—	—	—	4 (5)	—	—
ALNINC	14 (20)	22 (14)	14 (10)	—	—	17 (20)	9 (20)	—	12 (24)
ALNSIN	19 (5)	—	—	—	—	—	4 (18)	—	—
AMEALN	19 (1)	13 (18)	43 (10)	8 (3)	33 (40)	33 (1)	39 (10)	47 (2)	4 (3)
AMEHUM	—	—	—	—	67 (2)	—	—	—	—
ARCUVA	—	9 (1)	5 (1)	—	—	17 (3)	5 (9)	—	15 (11)
ARTTSV	—	—	—	—	—	—	—	—	4 (1)
BERREP	—	9 (3)	—	8 (1)	100 (53)	—	24 (6)	27 (6)	15 (1)
BETGLA	—	—	5 (10)	—	—	—	5 (15)	—	—
BETOCC	5 (3)	30 (19)	14 (8)	17 (1)	—	—	12 (18)	—	15 (16)
BETULA	—	—	—	—	—	—	1 (10)	—	—
CLECOU	—	—	—	8 (1)	—	—	1 (1)	—	—
CLELIG	10 (1)	17 (5)	5 (3)	—	—	—	5 (2)	—	4 (1)
CLEMAT	—	—	—	8 (3)	—	—	—	—	—
CLEOCC	—	4 (1)	10 (1)	—	—	—	4 (1)	—	—
CORCAN	5 (40)	—	5 (40)	—	—	—	4 (1)	—	—
CORSTO	29 (10)	100 (36)	24 (1)	17 (2)	—	—	63 (22)	13 (2)	4 (1)
CRACOL	—	4 (10)	—	—	—	—	3 (25)	—	—
CRADOU	14 (2)	17 (1)	19 (33)	—	—	—	11 (9)	7 (1)	8 (10)
CRASUC	—	—	5 (20)	—	—	—	—	—	—
CRATAE	—	—	—	—	—	—	1 (3)	—	—
DRYDRU	—	—	—	—	—	—	1 (3)	—	—
ELACOM	—	4 (1)	5 (3)	—	—	—	3 (2)	—	—
JUNCOM	5 (1)	9 (1)	—	—	—	—	5 (1)	7 (1)	4 (1)
JUNHOR	—	4 (1)	—	—	—	—	5 (9)	—	—
LINBOR	—	—	—	—	—	—	4 (18)	—	4 (3)
LONINV	—	—	10 (1)	—	33 (1)	—	8 (3)	7 (20)	4 (1)
LONUTA	—	—	—	—	—	—	1 (1)	—	—

PACMYR	—	—	—	—	—	—	1 (1)	—	—
POTFRU	10 (2)	9 (1)	5 (1)	—	—	17 (3)	11 (12)	—	31 (6)
PRUVIR	5 (1)	22 (26)	24 (5)	17 (3)	67 (3)	—	35 (15)	—	4 (3)
RHAALN	10 (30)	4 (10)	—	—	—	—	4 (27)	—	—
RIBAME	—	4 (20)	—	—	—	—	—	—	—
RIBCER	—	4 (20)	—	—	—	—	—	7 (1)	—
RIBESX	5 (1)	22 (2)	24 (2)	8 (1)	—	17 (3)	27 (4)	27 (3)	19 (1)
RIBHUD	—	4 (1)	—	—	—	—	5 (7)	—	4 (10)
RIBINE	—	—	—	8 (1)	—	—	—	—	—
RIBLAC	—	—	—	8 (3)	—	—	5 (5)	13 (1)	4 (1)
RIBMIS	—	—	—	—	67 (3)	—	3 (2)	—	—
RIBODO	—	—	—	17 (3)	—	—	—	—	—
RIBSET	—	—	10 (10)	—	—	—	4 (7)	13 (2)	8 (2)
ROSACI	10 (40)	13 (20)	5 (20)	—	—	17 (10)	24 (11)	20 (1)	23 (5)
ROSAXX	5 (1)	26 (9)	5 (1)	—	33 (1)	—	11 (11)	7 (1)	—
ROSGYM	5 (1)	—	—	—	—	—	3 (2)	—	—
ROSWOO	10 (2)	61 (19)	71 (22)	50 (2)	—	67 (13)	47 (18)	27 (20)	50 (15)
RUBIDA	—	9 (15)	10 (1)	—	67 (3)	17 (1)	21 (5)	—	4 (1)
RUBPAR	—	—	14 (14)	—	—	—	9 (12)	13 (40)	—
SALBEB	10 (12)	26 (10)	19 (6)	8 (3)	—	17 (1)	32 (10)	—	23 (1)
SALBOO	10 (7)	9 (12)	10 (2)	17 (5)	—	—	16 (14)	—	19 (1)
SALCAN	—	—	—	—	—	—	1 (1)	—	—
SALDRU	33 (22)	—	—	—	—	—	13 (23)	—	—
SALEXI	38 (12)	9 (15)	19 (2)	17 (2)	—	—	—	—	—
SALGEY	—	—	—	—	—	—	3 (7)	—	12 (1)
SALIXX	—	—	—	8 (10)	—	—	—	13 (10)	4 (20)
SALLAS	5 (1)	—	10 (12)	—	—	—	1 (3)	—	—
SALLUT	14 (2)	13 (2)	5 (20)	8 (1)	—	—	11 (7)	7 (1)	8 (2)
SALPLA	5 (1)	4 (3)	—	—	—	—	5 (9)	—	—
SALPSE	—	—	10 (7)	—	—	—	7 (32)	—	—
SALSCO	5 (3)	—	5 (10)	—	—	—	9 (10)	—	8 (1)
SALSER	—	—	—	—	—	—	1 (1)	—	—
SAMCER	5 (1)	—	—	—	—	—	—	—	—
SAMRAC	—	—	—	—	—	—	1 (1)	—	—
SHEARG	5 (3)	4 (3)	—	—	—	—	—	—	—
SHECAN	5 (1)	9 (5)	19 (2)	—	33 (1)	—	16 (6)	7 (1)	12 (8)
SOLDUL	—	13 (4)	—	8 (1)	—	—	1 (20)	—	—
SORSCO	—	—	5 (1)	—	—	—	—	—	—
SPIBET	—	4 (1)	14 (7)	—	—	—	19 (7)	7 (1)	8 (2)
SPIDOU	—	4 (40)	—	—	—	—	—	7 (1)	—
SYMALB	5 (20)	17 (16)	19 (8)	—	100 (14)	33 (20)	36 (22)	67 (24)	19 (3)
SYMOCC	14 (1)	26 (30)	52 (18)	17 (7)	33 (3)	—	35 (25)	33 (25)	19 (10)
SYMPHO	—	17 (18)	—	8 (1)	—	—	3 (15)	—	—
TOXRYD	10 (1)	4 (10)	10 (5)	—	67 (2)	—	5 (6)	—	4 (60)
VACCES	—	—	—	—	—	—	1 (1)	—	—
Graminoids									
AGRCAN	5 (3)	9 (2)	24 (2)	—	67 (10)	17 (3)	11 (2)	27 (7)	15 (2)
AGRDAS	—	—	—	—	—	—	—	—	8 (2)
AGREXA	—	—	—	—	—	—	3 (1)	—	—
AGRINT	—	—	—	—	—	—	—	—	4 (1)
AGROPY	—	—	10 (2)	—	—	17 (3)	1 (1)	—	4 (1)
AGROST	—	4 (20)	5 (3)	8 (10)	—	—	1 (1)	—	4 (3)
AGRREP	38 (7)	13 (14)	5 (1)	42 (18)	—	—	15 (4)	13 (1)	15 (5)
AGRSCA	—	—	—	—	—	—	1 (1)	7 (1)	4 (1)
AGRSMI	5 (1)	—	10 (15)	8 (10)	—	—	1 (1)	7 (1)	8 (40)
AGRSPI	5 (1)	—	—	—	—	—	—	—	—
AGRSTO	38 (19)	52 (10)	29 (24)	17 (1)	—	—	31 (21)	7 (20)	23 (16)

ALOALP	—	—	—	—	—	17 (20)	4 (4)	—	—
ALOPRA	—	—	—	—	—	—	1 (1)	—	—
BROANO	—	—	5 (1)	—	—	—	—	7 (10)	8 (1)
BROCAR	—	4 (20)	5 (1)	8 (10)	—	—	1 (1)	20 (2)	—
BROCIL	5 (1)	—	24 (6)	8 (1)	—	50 (2)	16 (4)	7 (20)	31 (2)
BROCOM	—	—	—	—	—	—	—	—	—
BROINE	10 (7)	—	5 (1)	33 (18)	—	17 (10)	13 (8)	13 (20)	8 (2)
BROJAP	—	—	—	—	—	—	—	—	4 (1)
BROMUS	—	—	5 (3)	—	—	—	—	7 (1)	—
BROSEC	—	—	5 (3)	—	—	—	—	—	—
BROVUL	—	—	—	—	33 (1)	—	5 (1)	40 (1)	8 (1)
CALAMA	—	—	—	—	—	—	1 (3)	—	—
CALCAN	10 (20)	13 (10)	19 (11)	8 (10)	33 (1)	100 (38)	20 (22)	13 (2)	4 (3)
CALRUB	—	—	—	—	—	—	7 (9)	27 (16)	4 (80)
CALSTR	—	—	—	—	—	—	9 (11)	—	12 (1)
CARAQU	—	—	—	—	—	17 (20)	4 (4)	—	—
CARARC	—	—	—	—	—	17 (10)	1 (1)	—	—
CARAUR	—	—	—	—	—	—	7 (1)	—	—
CARBAC	—	—	—	—	—	—	1 (10)	—	—
CARBEB	—	4 (3)	—	—	—	—	—	—	—
CARBRE	—	—	—	—	—	—	1 (10)	—	—
CARCAP	—	—	—	—	—	—	1 (10)	—	—
CARCON	—	—	—	—	—	—	1 (1)	—	—
CARCUS	—	—	—	—	—	—	1 (1)	—	—
CARDEW	—	4 (20)	—	—	—	—	—	—	—
CARDIS	—	—	—	8 (1)	—	—	3 (5)	—	4 (3)
CAREXX	5 (1)	9 (2)	—	—	—	17 (3)	9 (1)	—	12 (8)
CARGEY	—	—	5 (1)	—	—	—	—	7 (1)	—
CARGRA	—	—	—	—	33 (3)	—	—	—	—
CARHOO	—	4 (1)	—	—	—	—	1 (1)	7 (1)	—
CARINT	—	—	—	—	—	—	5 (3)	—	—
CARLAE	—	—	—	—	—	—	—	—	—
CARLAN	—	—	—	—	—	17 (10)	3 (1)	7 (1)	4 (3)
CARLEN	—	—	—	—	—	—	1 (1)	—	—
CARLEP	—	—	—	—	—	—	1 (1)	—	—
CARLIM	—	—	—	—	—	—	1 (10)	—	—
CARMIC	—	—	—	—	—	—	1 (1)	—	4 (1)
CARNEB	—	—	—	—	—	—	1 (20)	—	—
CARPAC	5 (1)	—	5 (1)	—	—	—	7 (2)	7 (1)	8 (1)
CARPRI	5 (3)	4 (3)	5 (10)	—	—	—	—	—	—
CARRAY	—	—	—	—	—	—	—	7 (1)	—
CARROS	—	4 (3)	5 (1)	—	—	17 (1)	12 (14)	—	8 (30)
CARSCI	—	—	—	—	—	—	1 (3)	—	—
CARSPR	—	—	—	8 (1)	33 (20)	—	—	—	—
CARSTI	—	4 (3)	—	—	—	—	1 (20)	—	—
CARSTR	—	—	—	—	—	—	—	—	—
CARVES	—	4 (20)	—	—	—	17 (20)	—	—	—
CINLAT	—	—	—	—	—	—	3 (10)	—	—
DACGLO	10 (10)	—	10 (2)	17 (1)	—	—	3 (2)	7 (1)	—
DANINT	—	—	—	—	—	—	—	—	8 (3)
DANSPI	—	—	—	—	33 (1)	—	—	—	—
DANTHO	—	—	—	—	—	—	1 (1)	—	—
DESCES	—	4 (1)	5 (3)	—	—	—	3 (10)	—	4 (3)
DESELO	—	—	—	—	—	—	—	—	4 (1)
DICACU	10 (2)	—	—	—	—	—	—	—	—
ELECOM	—	4 (1)	5 (3)	—	—	—	3 (2)	—	—

ELEPAL	—	—	—	—	—	—	3 (5)	—	—
ELYCAN	—	—	—	—	67 (2)	17 (3)	3 (2)	—	4 (1)
ELYCIN	—	—	—	—	—	—	1 (1)	7 (1)	8 (1)
ELYFLA	—	—	—	—	—	—	—	7 (1)	—
ELYGLA	10 (1)	22 (6)	14 (8)	8 (1)	—	17 (3)	24 (9)	33 (7)	4 (3)
ELYVIR	—	—	—	—	33 (3)	—	3 (10)	—	—
FESIDA	—	—	5 (1)	—	—	—	—	—	12 (2)
FESSCA	—	—	—	—	—	—	1 (1)	—	—
FESSUB	—	—	—	8 (1)	—	—	—	—	—
FESTUC	—	—	—	—	—	—	3 (2)	—	—
GLYCER	—	—	—	—	—	—	1 (3)	—	—
GLYELA	—	4 (20)	—	—	—	—	—	—	—
GLYGRA	—	—	—	—	—	—	3 (10)	7 (1)	4 (3)
GLYSTR	—	—	—	—	—	—	9 (4)	—	12 (17)
HIEODO	—	—	5 (1)	—	—	—	—	—	—
HORJUB	—	—	—	8 (10)	—	—	—	—	4 (1)
JUNBAL	—	—	—	8 (1)	—	33 (7)	8 (3)	—	23 (4)
JUNCON	—	—	—	—	—	—	3 (1)	—	—
KOECRI	—	—	—	—	—	—	1 (1)	—	—
LUZPAR	—	—	5 (1)	—	—	—	—	—	—
MELSPE	—	—	—	—	—	—	1 (1)	13 (7)	—
MELSUB	—	—	—	—	33 (3)	—	1 (1)	27 (6)	—
MUHFIL	—	—	—	—	—	—	—	—	4 (3)
ORYASP	—	—	—	—	—	—	1 (3)	—	—
PHAARU	—	4 (10)	—	8 (3)	—	—	1 (10)	—	—
PHLALP	—	—	—	—	—	—	—	13 (2)	—
PHLPRA	43 (13)	35 (6)	48 (17)	58 (19)	33 (3)	83 (13)	31 (13)	47 (14)	73 (17)
POACOM	33 (19)	13 (7)	—	8 (3)	—	—	4 (10)	—	—
POACUS	—	4 (1)	5 (1)	—	—	—	1 (3)	—	—
POAPAL	29 (37)	22 (7)	19 (7)	17 (15)	—	50 (5)	13 (5)	—	27 (17)
POAPRA	14 (7)	52 (12)	67 (12)	67 (17)	67 (50)	50 (5)	45 (15)	33 (3)	85 (22)
POATRI	—	—	—	—	—	—	3 (5)	—	—
POAXXX	—	—	—	—	33 (1)	—	—	13 (1)	4 (1)
SCHPUR	—	—	—	—	67 (20)	—	—	—	—
STICOM	—	—	5 (20)	—	—	—	1 (30)	—	4 (1)
STIOCC	—	—	5 (1)	—	—	—	—	—	12 (10)
STIRIC	—	—	—	—	—	—	—	—	15 (10)
STIVIR	—	—	—	—	—	17 (1)	1 (3)	—	—
TRICAN	—	—	—	—	—	—	—	7 (1)	—
TRICER	—	—	—	—	—	—	—	20 (2)	—
TRIWOL	—	—	—	—	—	—	3 (1)	7 (1)	—
Forbs									
ACHMIL	10 (1)	22 (3)	29 (2)	17 (1)	67 (1)	33 (2)	17 (3)	53 (3)	35 (1)
ACOCOL	—	—	—	—	—	—	1 (10)	—	—
ACTRUB	5 (3)	13 (14)	14 (3)	17 (1)	33 (1)	17 (20)	25 (5)	67 (7)	8 (2)
ADEBIC	—	—	—	—	—	—	1 (1)	—	—
AGAURT	—	9 (2)	5 (1)	—	—	—	—	7 (3)	—
AGOGLA	—	—	—	—	—	—	1 (1)	7 (1)	8 (1)
AGRSTR	—	—	5 (3)	—	—	—	3 (5)	—	—
ALLBRE	—	—	—	8 (10)	—	—	—	7 (1)	8 (3)
ALLCER	10 (2)	9 (1)	5 (1)	—	—	—	1 (1)	—	4 (1)
ALLIUM	—	—	—	—	—	17 (1)	—	—	—
ALLSCH	5 (1)	—	—	—	—	—	3 (5)	—	4 (1)
AMARAN	5 (1)	—	—	—	—	—	—	—	—
ANAMAR	5 (1)	4 (1)	—	—	—	—	—	—	—
ANEMON	—	4 (1)	5 (1)	—	—	—	—	—	—
ANEMUL	—	—	5 (1)	—	—	—	4 (1)	—	—

ANEPAT	—	—	—	—	—	—	1 (1)	—	—
ANGARG	5 (1)	9 (7)	19 (9)	17 (2)	33 (1)	17 (10)	19 (6)	47 (8)	12 (1)
ANTANA	—	—	—	—	—	—	3 (1)	—	4 (1)
ANTENN	—	—	—	—	—	17 (3)	1 (3)	—	—
ANTMIC	—	—	—	—	—	—	—	—	4 (20)
APOAND	5 (3)	—	—	—	67 (2)	—	1 (60)	—	—
APOCAN	5 (3)	9 (1)	—	—	—	—	1 (3)	—	4 (1)
AQUFLA	—	—	—	—	—	—	3 (1)	—	—
ARANUD	—	—	—	—	—	—	1 (10)	—	—
ARCLAP	—	4 (1)	—	—	—	—	—	—	—
ARCMIN	10 (15)	4 (1)	—	—	—	—	8 (2)	—	—
ARCTIU	—	—	—	—	—	—	3 (1)	—	—
ARELAT	—	—	—	8 (1)	—	—	—	—	—
AREMAC	—	—	—	—	—	—	4 (1)	13 (1)	—
ARENAR	—	—	—	—	—	—	—	—	4 (1)
ARNCHA	5 (1)	4 (3)	—	—	—	17 (10)	—	—	—
ARNCOR	—	—	5 (3)	—	—	—	3 (20)	—	—
ARNICA	—	—	—	—	—	—	1 (3)	—	—
ARNLAT	—	—	5 (1)	—	—	—	4 (7)	7 (1)	—
ARNLOC	5 (1)	—	—	—	—	—	—	—	4 (1)
ARTABS	—	—	5 (1)	—	—	—	—	—	—
ARTCAM	—	—	5 (3)	—	—	—	—	—	—
ARTLIN	10 (1)	—	—	—	—	—	3 (10)	—	—
ARTLON	5 (1)	—	—	—	—	—	—	—	—
ARTLUD	14 (1)	4 (1)	5 (1)	—	—	—	1 (1)	—	—
ASCLEP	—	—	—	8 (1)	—	—	—	—	—
ASCSPE	5 (1)	—	—	—	—	—	1 (3)	—	—
ASPOFF	—	—	—	—	—	—	1 (1)	—	—
ASTCAN	—	—	—	—	—	—	—	—	4 (3)
ASTCHI	—	—	—	—	—	—	1 (20)	—	4 (3)
ASTCIL	—	—	—	—	—	—	7 (2)	—	—
ASTCON	—	4 (1)	5 (20)	—	33 (1)	—	13 (9)	13 (1)	8 (2)
ASTEAT	—	—	—	—	—	—	1 (1)	—	4 (3)
ASTENG	—	4 (1)	—	—	—	—	5 (1)	13 (1)	—
ASTERX	—	9 (2)	19 (2)	—	—	17 (3)	7 (2)	7 (3)	19 (3)
ASTFAL	—	—	—	—	—	—	—	—	—
ASTFOL	10 (3)	—	14 (3)	8 (1)	—	—	8 (11)	13 (2)	4 (3)
ASTLAE	5 (1)	—	—	—	33 (1)	—	9 (1)	20 (1)	8 (2)
ASTLAT	—	—	—	—	—	—	—	7 (1)	—
ASTMOD	10 (12)	—	10 (2)	17 (2)	—	—	11 (8)	7 (1)	4 (10)
ASTOCC	5 (1)	13 (8)	14 (1)	17 (1)	—	67 (4)	21 (4)	13 (12)	42 (4)
ASTRAG	5 (1)	—	5 (1)	—	—	—	—	7 (1)	4 (1)
ASTSUB	—	—	5 (3)	—	—	—	—	—	—
ATRIPL	—	—	5 (1)	—	—	—	—	—	—
BARORT	—	4 (3)	—	—	—	—	—	—	—
BUPAME	—	—	—	—	—	—	—	7 (1)	—
CAMQUA	—	—	—	—	—	—	—	7 (1)	—
CAMROT	—	4 (1)	—	8 (1)	33 (1)	—	—	13 (1)	8 (1)
CAPBUR	—	—	5 (1)	—	—	—	—	—	—
CARBRW	—	—	—	—	—	17 (1)	—	—	—
CARNUT	—	—	—	—	—	—	—	—	4 (1)
CASMIN	—	—	10 (2)	8 (1)	—	—	5 (1)	7 (1)	—
CASTIL	5 (1)	—	5 (1)	—	—	—	3 (1)	—	4 (1)
CENMAC	19 (5)	4 (1)	—	42 (5)	—	—	3 (1)	—	—
CERARV	—	—	—	—	—	—	3 (1)	7 (1)	—
CERNUT	—	—	—	—	—	17 (1)	—	—	—

CHEALB	5 (10)	—	—	—	—	—	1 (1)	—	—
CHEGLA	—	4 (1)	—	—	—	—	—	—	—
CHENOP	5 (1)	—	—	—	—	—	—	—	—
CHRLEU	14 (1)	—	5 (1)	—	—	—	—	—	—
CICMAC	—	—	—	8 (1)	—	—	1 (20)	—	4 (1)
CIRARV	14 (14)	9 (2)	14 (8)	8 (1)	—	17 (20)	19 (7)	7 (1)	19 (5)
CIRCAN	—	—	—	—	—	—	1 (3)	—	—
CIRHOO	—	—	—	—	—	—	1 (1)	—	—
CIRSCA	—	—	—	—	—	33 (2)	3 (1)	—	23 (1)
CIRSIU	—	4 (1)	10 (1)	—	—	—	1 (1)	—	—
CIRVUL	5 (1)	4 (1)	—	—	—	—	4 (10)	7 (1)	4 (1)
CLIUNI	—	—	—	—	—	—	3 (1)	—	—
COLPAR	—	—	—	—	—	—	—	7 (1)	—
COMUMB	—	—	—	—	—	—	1 (3)	—	—
CONARV	—	—	—	—	—	—	1 (1)	—	—
CORSTR	—	—	—	—	—	—	—	7 (1)	—
CORTIN	5 (1)	—	—	—	—	—	—	—	—
CORTRI	—	—	—	—	—	—	—	—	4 (1)
CRUVUL	—	—	—	—	—	—	1 (1)	—	—
CYNOFF	—	—	5 (3)	17 (2)	—	—	3 (1)	—	—
CYPCAL	—	—	—	—	—	—	1 (1)	—	—
CYPMON	—	—	—	—	—	—	3 (1)	—	—
DELGLA	—	—	—	—	—	—	1 (1)	7 (1)	4 (1)
DESSOP	—	—	5 (1)	8 (1)	—	—	—	—	—
DISHOO	—	—	—	—	—	—	1 (60)	7 (1)	—
DISTRA	—	9 (1)	—	8 (1)	33 (1)	—	12 (1)	13 (10)	—
DODECA	—	—	—	—	—	—	3 (5)	—	—
DODJEF	—	—	—	—	—	—	1 (1)	7 (1)	—
EPIANG	10 (3)	—	19 (2)	8 (1)	—	33 (2)	19 (3)	27 (2)	27 (1)
EPICIL	—	—	5 (1)	—	—	17 (10)	13 (2)	7 (1)	12 (4)
EPIPAL	10 (2)	—	—	—	—	—	—	—	—
ERIGER	—	—	5 (1)	—	—	—	—	—	—
ERIGLA	—	—	—	—	—	—	1 (1)	—	—
ERIPER	—	4 (1)	—	—	—	—	1 (1)	—	—
ERISPE	—	—	5 (1)	—	—	17 (1)	—	—	—
ERYGRA	—	—	—	—	33 (20)	—	3 (3)	33 (11)	—
ERYSIM	—	—	—	—	—	—	1 (1)	—	—
EUPESU	10 (1)	—	5 (1)	8 (10)	—	—	—	—	—
FILARV	—	—	5 (1)	—	—	—	—	—	—
FRAVES	5 (3)	—	—	—	—	—	5 (4)	7 (1)	8 (1)
FRAVIR	14 (9)	22 (2)	29 (1)	17 (1)	67 (1)	83 (2)	48 (8)	87 (3)	46 (8)
FRIATR	—	—	—	—	—	—	—	—	4 (1)
GAIARI	5 (1)	—	—	—	—	—	—	—	—
GALAPA	—	4 (20)	5 (1)	—	33 (3)	—	12 (6)	—	—
GALASP	—	—	—	—	—	17 (3)	—	—	—
GALBOR	—	13 (5)	14 (1)	8 (3)	100 (2)	17 (1)	36 (6)	67 (1)	50 (1)
GALPAL	5 (1)	—	—	—	—	—	—	—	—
GALTET	—	—	5 (10)	—	—	—	—	—	—
GALTRF	—	—	—	—	—	17 (10)	5 (1)	—	4 (3)
GALTRI	5 (1)	35 (5)	24 (1)	8 (1)	—	17 (1)	33 (6)	27 (1)	12 (1)
GENAFF	—	—	—	—	—	—	—	—	4 (1)
GENAMA	—	—	—	—	—	—	1 (1)	—	—
GERANI	—	—	5 (1)	—	—	50 (2)	3 (1)	13 (1)	12 (3)
GERRIC	5 (10)	4 (3)	10 (5)	17 (2)	33 (3)	—	31 (3)	53 (4)	31 (8)
GERVIS	5 (3)	4 (1)	5 (1)	—	33 (1)	—	11 (2)	47 (3)	31 (3)
GEUMAC	—	9 (1)	5 (1)	8 (1)	—	33 (2)	28 (2)	47 (1)	15 (2)
GEUMXX	—	—	—	—	—	—	1 (1)	—	—

GEURIV	—	—	—	—	—	—	3 (2)	—	—
GLYLEP	—	—	—	8 (1)	—	—	—	—	—
HABDIL	—	—	10 (1)	—	—	—	—	—	4 (1)
HABENA	—	—	—	—	—	—	1 (1)	—	—
HABHYP	—	—	—	—	—	—	5 (1)	—	—
HABUNA	—	—	—	—	—	—	1 (1)	—	—
HABVIR	—	—	—	—	—	—	1 (1)	—	—
HACFLO	—	—	—	8 (1)	—	—	3 (1)	20 (4)	—
HAPUNI	—	—	—	—	—	—	1 (3)	—	—
HEDSUL	—	—	—	—	—	—	—	—	4 (1)
HELUNI	—	—	—	—	—	—	—	7 (1)	—
HERLAN	10 (10)	17 (1)	33 (2)	17 (1)	—	17 (20)	21 (4)	73 (6)	8 (10)
HEUCYL	—	—	—	—	—	—	—	7 (1)	—
HYDCAP	—	—	—	—	—	—	—	7 (1)	—
HYPPER	10 (1)	—	—	—	—	—	—	—	—
IRIMIS	—	—	—	—	—	—	5 (2)	—	12 (1)
LACOBL	—	—	—	—	—	—	1 (1)	—	—
LACSER	—	—	5 (1)	—	—	—	—	—	—
LATHYR	—	—	—	17 (1)	—	—	—	—	—
LATOCH	5 (1)	—	14 (1)	—	33 (1)	—	8 (3)	53 (2)	4 (1)
LEOCAR	5 (10)	—	—	—	—	—	—	—	—
LINPER	—	—	—	—	—	—	1 (1)	—	—
LINVUL	—	—	—	8 (3)	—	—	—	—	—
LISCAU	—	—	—	—	—	—	—	7 (1)	—
LITRUD	—	—	—	—	—	—	—	—	4 (1)
LUPARG	—	—	5 (1)	—	—	—	1 (1)	—	4 (1)
LUPSER	—	—	—	—	—	—	—	—	4 (1)
LYSCIL	5 (10)	13 (10)	5 (3)	—	—	17 (3)	7 (7)	—	—
LYSTHY	—	—	—	—	—	—	1 (3)	—	—
MEDHIS	—	—	—	—	—	—	1 (1)	—	—
MEDLUP	19 (1)	4 (1)	5 (30)	—	—	—	5 (1)	—	12 (7)
MEDSAT	5 (10)	4 (3)	5 (1)	8 (1)	—	—	1 (1)	—	—
MELALB	24 (17)	—	—	8 (3)	—	—	1 (3)	—	4 (3)
MELOFF	10 (10)	—	10 (2)	8 (1)	—	—	3 (20)	—	8 (1)
MENARV	5 (1)	22 (3)	5 (1)	8 (1)	—	17 (10)	9 (10)	7 (3)	8 (1)
MERCIL	—	—	—	—	—	—	3 (2)	—	—
MERPER	—	—	5 (1)	—	—	—	—	—	—
MERTEN	—	—	—	—	—	—	1 (1)	—	—
MIMGUT	—	—	—	—	—	—	1 (1)	—	4 (3)
MIMMOS	5 (1)	—	—	—	—	—	—	—	—
MIRALB	—	4 (1)	—	—	—	—	—	—	—
MITELL	—	—	—	—	—	—	1 (10)	—	—
MONFIS	5 (1)	—	—	25 (1)	67 (1)	—	4 (1)	13 (1)	—
MONTIA	—	—	5 (1)	—	—	—	—	—	—
MYOLAX	—	9 (2)	—	—	—	—	—	—	—
MYOSYL	—	—	—	—	—	—	—	13 (1)	—
NEMBRE	—	—	—	—	—	—	—	13 (2)	—
NEPCAT	5 (1)	—	—	—	—	—	—	—	—
OSMCHI	5 (1)	17 (13)	14 (5)	17 (1)	—	33 (1)	31 (3)	33 (9)	19 (1)
OSMDEP	—	—	—	—	—	—	4 (5)	—	—
OSMOCC	—	17 (1)	14 (7)	8 (1)	33 (60)	—	11 (10)	73 (16)	—
OXYSER	—	—	—	—	—	—	1 (3)	—	—
OXYTRO	5 (1)	—	—	—	—	—	1 (3)	—	—
PARFIM	—	—	—	—	—	—	1 (1)	—	—
PARPAL	—	—	—	—	—	—	1 (1)	—	—
PEDBRA	—	—	—	—	33 (1)	17 (1)	7 (1)	33 (1)	—

PEDGRO	—	—	—	—	—	—	1 (10)	—	—
PEDICU	—	—	—	—	—	—	—	—	4 (3)
PENSTE	—	—	—	—	—	—	—	—	4 (1)
PERGAI	—	—	—	—	—	—	1 (1)	—	4 (1)
PETSAG	—	—	—	—	—	17 (30)	3 (10)	—	—
PHAPRO	—	—	—	—	—	—	1 (50)	—	—
PHYPAR	5 (1)	—	—	—	—	—	3 (7)	—	—
PICOPP	5 (1)	—	—	—	—	—	—	—	—
PLALAN	—	—	—	—	—	—	1 (1)	—	—
PLAMAJ	—	—	5 (1)	—	—	17 (1)	1 (1)	—	4 (3)
POLAMP	—	4 (10)	—	—	—	—	—	—	—
POLBIS	—	—	—	—	—	—	—	—	4 (1)
POTANS	—	—	—	—	—	—	—	—	4 (3)
POTARG	—	—	—	—	—	—	—	13 (1)	4 (1)
POTENT	—	—	—	—	—	—	1 (1)	—	—
POTGLA	—	—	—	—	—	—	—	7 (1)	—
POTGRA	—	—	—	—	33 (1)	—	5 (4)	—	19 (2)
POTPAL	5 (3)	—	—	—	—	—	—	—	—
PRUVUL	5 (1)	4 (1)	5 (1)	—	—	—	5 (1)	7 (1)	—
PSOESC	—	4 (1)	—	—	—	—	—	—	—
PYRASA	—	—	5 (10)	8 (1)	—	17 (1)	19 (1)	—	8 (2)
PYRMIN	—	—	—	—	33 (1)	—	1 (1)	7 (1)	—
PYRSEC	—	—	—	—	—	—	7 (1)	—	8 (5)
RANABO	—	—	—	—	—	17 (1)	—	—	—
RANARV	—	—	—	—	—	—	1 (3)	—	—
RANHYP	—	—	—	—	—	—	1 (1)	—	—
RANMAC	—	—	—	—	—	—	1 (1)	—	—
RANUNC	—	4 (1)	—	—	—	—	3 (1)	7 (1)	—
RANUNI	—	—	—	—	—	—	—	13 (1)	8 (1)
RORIPP	—	—	—	—	—	17 (20)	—	—	—
RUBPUB	—	—	5 (1)	—	—	17 (3)	—	—	—
RUDLAC	—	—	—	17 (10)	—	—	1 (10)	—	—
RUMACE	—	—	—	—	—	—	1 (10)	—	—
RUMCRI	—	—	5 (1)	8 (1)	—	—	1 (3)	7 (1)	8 (1)
SANMAR	5 (3)	—	10 (1)	—	33 (1)	17 (1)	13 (2)	13 (1)	4 (1)
SCUGAL	—	4 (1)	—	—	—	17 (10)	1 (1)	—	—
SENFOE	—	4 (1)	—	—	—	—	—	—	—
SENHYD	—	—	—	—	—	17 (1)	—	—	—
SENINT	—	—	—	—	—	—	1 (10)	20 (14)	—
SENPSE	10 (5)	13 (7)	14 (9)	17 (2)	—	50 (1)	23 (10)	60 (2)	12 (1)
SENSER	—	4 (1)	—	8 (1)	—	17 (1)	8 (1)	7 (1)	—
SENTRI	—	—	5 (3)	—	—	17 (3)	7 (3)	7 (3)	—
SILMEN	—	4 (10)	—	—	—	—	—	—	—
SISALT	—	—	—	8 (3)	—	—	—	—	—
SMIHER	—	—	—	—	33 (1)	—	—	—	—
SMIRAC	—	—	—	—	33 (1)	—	11 (1)	7 (1)	4 (1)
SMISTE	24 (10)	61 (5)	67 (4)	33 (1)	67 (1)	50 (1)	64 (4)	53 (1)	54 (1)
SOLCAN	29 (13)	26 (10)	19 (1)	8 (1)	—	33 (1)	16 (10)	—	27 (10)
SOLGIG	—	4 (20)	5 (1)	17 (5)	—	—	7 (1)	—	—
SOLIDA	10 (5)	—	5 (20)	—	—	—	1 (3)	—	—
SOLMIS	—	9 (3)	5 (20)	17 (2)	—	—	5 (17)	—	4 (1)
SONARV	—	—	—	—	—	—	1 (1)	—	—
SONASP	10 (1)	—	—	8 (3)	—	—	—	—	—
SONCHU	—	—	5 (1)	—	—	—	—	—	—
STELON	—	4 (10)	—	—	—	—	—	—	—
STEOCC	—	—	—	—	—	—	1 (1)	—	—
STEUMB	—	—	—	—	—	17 (1)	—	—	—

STRAMP	5 (3)	4 (1)	—	—	—	—	7 (1)	20 (1)	—
SWEPER	—	—	—	—	—	—	1 (1)	—	—
TANVUL	24 (7)	9 (7)	—	42 (9)	—	—	—	—	—
TARCER	—	4 (1)	10 (2)	—	—	—	3 (1)	—	4 (1)
TARLAE	—	—	—	8 (1)	—	—	—	—	—
TAROFF	33 (4)	22 (6)	43 (1)	17 (1)	33 (1)	50 (2)	37 (4)	33 (1)	58 (4)
THADAS	—	—	5 (3)	8 (1)	33 (1)	—	3 (3)	—	—
THAFEN	—	4 (1)	—	—	—	—	1 (1)	—	4 (1)
THALIC	—	4 (1)	—	8 (3)	—	—	3 (1)	7 (1)	—
THAOCC	5 (40)	22 (4)	29 (29)	8 (1)	33 (20)	33 (3)	40 (4)	80 (13)	12 (1)
THAVEN	—	—	—	8 (1)	—	—	1 (1)	—	—
THELYP	5 (1)	—	—	—	—	—	—	—	—
THERHO	—	—	—	—	33 (1)	—	—	—	—
THLARV	—	—	5 (1)	—	—	—	1 (1)	—	4 (1)
TIATRI	—	—	—	—	—	—	1 (10)	—	—
TRADUB	14 (8)	—	5 (1)	—	—	—	1 (1)	—	8 (1)
TRIDUB	—	4 (10)	—	—	—	—	—	—	—
TRIFOL	5 (20)	—	5 (1)	—	—	—	—	—	—
TRIHYB	—	—	5 (1)	—	—	—	1 (1)	7 (1)	—
TRILON	—	—	—	—	—	—	3 (10)	—	—
TRIPRA	—	4 (10)	14 (8)	—	—	—	3 (1)	7 (1)	8 (2)
TRIREP	5 (20)	4 (30)	19 (17)	—	—	17 (3)	11 (3)	—	31 (12)
TYPLAT	—	—	—	—	—	—	—	—	4 (1)
URTDIO	—	22 (3)	5 (3)	25 (1)	—	17 (1)	13 (3)	33 (1)	8 (2)
VALDIO	—	—	—	—	—	—	3 (3)	20 (2)	4 (1)
VALEDU	—	—	—	—	—	—	1 (1)	—	—
VALERI	—	—	—	—	—	—	3 (1)	—	—
VALOCC	5 (1)	—	—	—	—	—	1 (1)	—	—
VALSIT	—	—	—	—	—	—	—	13 (1)	—
VERAME	—	—	—	—	—	—	3 (1)	—	4 (1)
VEROFF	—	—	—	—	—	—	1 (1)	—	—
VERSER	—	—	—	—	—	—	1 (1)	—	—
VERTHA	10 (2)	—	—	8 (1)	—	—	—	—	—
VERVIR	—	—	5 (1)	—	—	17 (1)	3 (20)	40 (4)	—
VICAME	14 (1)	9 (5)	14 (4)	8 (1)	33 (1)	17 (1)	33 (2)	60 (3)	12 (1)
VICIAX	—	4 (1)	—	—	—	—	—	—	—
VIOADU	—	—	—	—	—	—	4 (1)	7 (1)	—
VIOARV	—	—	—	—	—	—	1 (3)	—	—
VIOCAN	5 (1)	4 (1)	10 (1)	8 (1)	33 (3)	17 (1)	21 (7)	27 (25)	4 (1)
VIOGLA	—	—	—	—	—	—	1 (40)	—	—
VIOLAX	5 (1)	9 (12)	10 (12)	25 (1)	—	33 (2)	7 (1)	13 (1)	19 (2)
VIOPAL	—	—	—	—	—	—	1 (1)	—	—
ZIGELE	—	—	—	—	—	—	1 (1)	—	4 (1)
ZIZAPT	—	—	—	8 (1)	—	—	1 (1)	—	—
ZIZAUR	—	—	—	—	—	—	1 (1)	—	—
Ferns and Allies									
ATHFIL	—	—	5 (3)	—	—	—	—	—	—
BOTMUL	—	—	—	—	—	—	1 (1)	—	—
EQUARV	10 (2)	17 (26)	29 (15)	17 (2)	—	67 (15)	40 (20)	13 (12)	15 (23)
EQUFLU	—	—	—	—	—	—	3 (15)	—	—
EQUHYE	24 (5)	4 (10)	—	33 (1)	—	—	9 (4)	20 (1)	4 (1)
EQULAE	10 (1)	13 (1)	5 (1)	—	—	—	4 (1)	—	19 (1)
EQUPAL	—	—	—	—	—	—	1 (50)	—	—
EQUPRA	5 (1)	4 (3)	—	—	—	—	4 (17)	—	—
EQUSYL	—	4 (40)	—	—	—	—	—	—	—
GYMDRY	—	—	—	—	—	—	1 (3)	—	—
PTEAQU	—	4 (20)	—	—	—	—	—	—	—

Appendix 16. Constancy and average cover (in percent) of plants in Montana habitat types, phases, and community types

Habitat Type Or Community Type	POPANG/ RAB C.T.	POPANG/ CORSTO C.T.	POPANG/ SYMOCC C.T.	POPANG/ HERB C.T.	POPDEL/ RAB C.T.	POPDEL/ CORSTO C.T.	POPDEL/ SYMOCC C.T.	POPDEL/ HERB C.T.
No. Of Stands	8	13	5	5	42	11	19	10
Trees								
ACENEG	—	—	20 (3)	—	—	—	16 (2)	—
ELAANG	—	—	—	—	7 (1)	9 (1)	37 (15)	50 (12)
FRAPEN	—	—	20 (3)	—	7 (1)	18 (2)	32 (1)	10 (1)
JUNSCO	13 (1)	15 (1)	20 (3)	—	2 (1)	27 (5)	32 (1)	—
PINCON	13 (1)	—	20 (1)	—	—	—	—	—
PINFLE	13 (1)	8 (3)	—	—	—	—	—	—
POPANG	100 (30)	100 (51)	100 (56)	100 (44)	2 (20)	18 (12)	11 (3)	20 (1)
POPDEL	—	31 (25)	20 (20)	—	100 (39)	100 (57)	100 (53)	100 (58)
POPTRE	—	—	—	20 (1)	—	—	—	—
POPTRI	—	31 (16)	—	—	2 (20)	9 (40)	5 (20)	—
PSEMEN	25 (2)	—	—	—	—	—	—	—
SALAMY	—	15 (3)	20 (10)	—	52 (3)	45 (4)	16 (2)	60 (1)
Shrubs								
ALNINC	—	8 (3)	—	—	—	—	—	—
AMEALN	—	—	20 (3)	20 (1)	5 (1)	18 (2)	—	20 (1)
ARCUVA	13 (1)	—	—	—	—	—	—	—
ARTCAN	—	—	—	—	5 (1)	36 (5)	11 (2)	20 (2)
ARTTRI	25 (1)	8 (1)	—	—	—	—	—	—
BETOCC	13 (3)	15 (20)	—	—	—	—	—	—
CHRVIS	—	—	—	—	—	27 (2)	—	—
CHRVVV	—	—	—	—	—	9 (1)	—	—
CLELIG	13 (60)	23 (3)	20 (3)	—	—	18 (3)	32 (9)	10 (1)
CLEOCC	—	—	20 (1)	—	—	—	—	—
CORCAN	—	—	—	20 (1)	—	—	—	—
CORSTO	—	100 (30)	—	40 (1)	7 (1)	55 (49)	11 (1)	10 (1)
DRYDRU	25 (30)	—	—	—	—	—	—	—
GUTSAR	—	—	—	—	2 (1)	—	—	—
HOLDIS	—	—	—	20 (1)	—	—	—	—
JUNHOR	—	8 (1)	—	—	—	—	—	—
PARQUI	—	—	—	—	12 (1)	9 (3)	32 (2)	20 (2)
POTFRU	13 (1)	—	—	—	—	—	—	—
PRUVIR	—	8 (1)	20 (20)	—	2 (10)	36 (15)	—	—
RHUARO	13 (20)	8 (3)	—	—	2 (1)	36 (1)	16 (15)	—
RIBAME	—	8 (1)	—	—	—	—	—	—
RIBESX	—	46 (1)	40 (1)	—	—	18 (1)	5 (1)	—
RIBODO	—	—	—	—	10 (1)	18 (3)	37 (2)	30 (2)
RIBSET	—	8 (1)	—	—	—	9 (1)	—	—
ROSACI	—	15 (30)	—	—	—	—	—	—
ROSAXX	—	15 (40)	20 (30)	—	—	—	—	—
ROSWOO	13 (20)	62 (26)	40 (20)	60 (14)	21 (1)	100 (26)	89 (26)	40 (1)
RUBIDA	—	15 (2)	20 (10)	—	—	—	—	—
SALBEB	—	—	—	20 (1)	—	—	—	—
SALBOO	—	—	20 (3)	20 (1)	—	—	5 (3)	—
SALERI	—	—	20 (3)	—	—	—	—	—
SALEXI	38 (34)	31 (12)	40 (12)	—	69 (34)	18 (2)	11 (32)	—

SALLAS	—	15 (22)	—	—	2 (10)	—	5 (10)	—
SALLUT	25 (1)	8 (20)	20 (1)	—	14 (27)	18 (35)	16 (15)	—
SARVER	—	—	—	—	—	9 (10)	—	—
SHEARG	—	—	20 (3)	—	2 (1)	18 (20)	32 (22)	10 (1)
SYMALB	—	8 (1)	—	20 (1)	—	—	—	—
SYMOCC	—	77 (23)	80 (12)	20 (1)	14 (4)	73 (36)	84 (30)	40 (5)
TAMCHI	—	—	—	—	2 (1)	—	—	—
TOXRYD	—	—	—	—	10 (1)	9 (40)	42 (16)	30 (1)
VITRIP	—	—	—	—	7 (1)	—	21 (10)	20 (1)
VITVUL	—	—	—	—	—	9 (3)	—	—
Graminoids								
AGRCAN	50 (1)	—	40 (2)	20 (3)	—	—	11 (50)	—
AGRCRI	—	—	—	—	2 (1)	9 (3)	5 (1)	10 (1)
AGROPY	13 (1)	—	—	40 (3)	—	9 (1)	—	—
AGROST	—	15 (10)	—	—	—	—	—	—
AGRREP	—	15 (20)	20 (20)	—	40 (9)	18 (12)	26 (3)	70 (27)
AGRSCA	—	—	20 (20)	—	—	—	—	—
AGRSMI	—	—	—	—	21 (7)	27 (33)	37 (26)	30 (18)
AGRSPI	—	—	—	20 (1)	—	—	—	—
AGRSTO	63 (8)	62 (28)	40 (12)	40 (1)	10 (25)	—	—	30 (33)
ANDHAL	—	—	—	—	2 (1)	—	—	—
BOUGRA	—	—	—	—	—	9 (1)	—	—
BROCIL	13 (1)	—	—	—	—	—	—	—
BROINE	—	15 (30)	60 (28)	20 (3)	24 (16)	45 (33)	47 (14)	30 (10)
BROJAP	—	—	—	—	2 (1)	—	11 (5)	20 (10)
BROTEC	—	—	—	—	—	9 (1)	11 (10)	—
CALAMA	—	8 (1)	—	—	—	—	—	—
CALLON	—	—	—	—	14 (3)	—	—	20 (3)
CALSTR	—	8 (1)	—	—	—	—	—	—
CARBRE	—	—	—	—	10 (6)	—	—	—
CAREXX	13 (1)	8 (1)	—	—	—	—	—	—
CARLAN	—	8 (3)	—	—	5 (10)	—	—	—
CARROS	—	—	—	20 (1)	—	—	—	—
DACGLO	—	8 (1)	—	—	—	—	5 (60)	—
DISSPI	—	—	—	—	5 (1)	—	—	—
ECHCRU	—	—	—	—	24 (3)	—	—	—
ECHINO	—	—	—	—	2 (1)	—	—	—
ELECOM	—	8 (3)	—	—	—	—	—	—
ELEPAL	—	—	—	—	10 (7)	9 (1)	—	—
ELYCAN	—	—	—	—	50 (8)	27 (1)	32 (12)	50 (15)
ELYGLA	—	—	20 (1)	—	—	—	—	—
ELYVIR	—	8 (3)	—	—	—	9 (3)	11 (12)	30 (14)
ERAHYP	—	—	—	—	5 (1)	—	—	—
FESOVI	—	—	—	20 (70)	—	—	—	—
FESSCA	—	—	—	20 (40)	—	—	—	—
HORJUB	—	8 (3)	—	—	19 (5)	9 (1)	11 (10)	20 (7)
JUNBAL	—	—	20 (40)	20 (1)	—	—	—	—
JUNCUS	—	—	—	—	2 (1)	—	—	—
JUNHAL	—	—	—	—	—	—	—	10 (30)
JUNTOR	—	—	—	—	5 (12)	—	—	—
KOECRI	13 (1)	—	—	—	—	—	—	—
MUHRAC	—	—	—	—	31 (9)	—	37 (5)	40 (16)
PANCAP	—	—	—	—	2 (1)	—	—	—
PHAARU	—	15 (12)	—	—	2 (1)	9 (20)	—	—
PHLPRA	63 (2)	23 (9)	20 (3)	40 (22)	—	—	5 (1)	—
POACOM	—	—	—	—	—	—	—	10 (60)
POAJUN	—	—	—	—	—	—	5 (1)	—

POAPAL	13 (1)	31 (12)	20 (3)	20 (3)	2 (3)	—	11 (20)	—
POAPRA	13 (1)	69 (30)	80 (31)	100 (21)	5 (25)	9 (3)	21 (50)	30 (31)
POAXXX	13 (3)	—	—	—	5 (3)	—	21 (11)	10 (3)
POLMON	—	—	—	—	7 (15)	—	—	—
SCIMAR	—	—	—	—	2 (1)	—	—	—
SCIPUN	—	—	—	—	7 (28)	—	—	—
SCIVAL	—	—	—	—	2 (3)	—	—	—
SETVIR	—	—	—	—	5 (1)	—	5 (1)	—
SITHYS	13 (1)	—	—	—	—	—	—	—
SPAGRA	—	—	—	—	2 (1)	—	—	—
SPAPEC	—	—	—	—	5 (2)	9 (3)	—	10 (10)
SPOCRY	—	—	—	—	5 (12)	—	—	—
STICOM	—	—	—	—	—	—	5 (10)	—
STIVIR	—	8 (1)	—	—	—	18 (5)	5 (1)	—
TRIWOL	25 (1)	—	—	20 (1)	—	—	—	—
Forbs								
ACHMIL	25 (1)	15 (1)	—	60 (1)	—	—	5 (1)	—
AGAURT	—	8 (3)	—	—	—	—	—	—
AMBPSI	—	—	—	—	10 (2)	—	5 (3)	20 (3)
ANTANA	13 (1)	—	—	—	—	—	—	—
ANTENN	13 (1)	—	—	—	—	—	—	—
APOAND	—	—	—	—	—	—	5 (20)	—
APOCAN	—	8 (3)	—	—	2 (3)	—	—	—
APOCYN	—	—	—	—	—	9 (3)	—	—
ARABIS	25 (1)	—	—	—	—	—	—	—
ARCLAP	—	8 (3)	—	—	—	—	—	—
ARCMIN	—	—	—	—	—	—	5 (20)	—
ARTBIE	—	—	—	—	2 (3)	—	—	—
ARTDRA	25 (3)	—	—	—	—	—	—	—
ARTLUD	—	8 (1)	—	—	14 (1)	9 (3)	21 (1)	20 (1)
ASCLEP	—	—	20 (1)	—	—	—	—	—
ASCSPE	—	—	—	—	5 (1)	—	5 (20)	—
ASCVER	—	—	—	—	12 (1)	—	16 (1)	10 (1)
ASPOFF	—	—	—	—	—	—	11 (2)	—
ASTBRA	—	—	—	—	5 (32)	—	—	—
ASTCHI	25 (2)	—	—	—	—	—	—	—
ASTERX	13 (1)	—	40 (2)	20 (3)	—	—	—	—
ASTOBL	—	—	—	—	2 (3)	—	—	—
ASTOCC	25 (1)	—	—	—	—	—	—	—
ASTPAN	—	—	—	—	5 (2)	—	—	—
ASTRAG	25 (1)	—	—	20 (1)	—	—	—	—
CENMAC	—	8 (1)	—	—	—	—	—	—
CENREP	—	—	—	—	—	9 (3)	—	—
CHEALB	—	—	—	—	10 (1)	—	—	—
CHELEP	—	—	—	—	2 (1)	—	—	—
CHENOP	—	—	—	—	—	18 (3)	5 (3)	—
CHRLEU	—	—	—	20 (1)	—	—	—	—
CHRVIL	13 (1)	—	—	—	—	—	—	—
CIRARV	—	69 (13)	40 (10)	40 (2)	24 (7)	36 (7)	16 (14)	10 (1)
CIRSCA	—	—	—	20 (1)	—	—	—	—
CIRSIU	—	—	20 (3)	—	—	—	—	—
CIRVUL	—	—	—	20 (1)	—	—	—	—
COMUMB	13 (1)	—	—	—	—	—	—	—
CONCAN	—	—	—	—	7 (2)	—	—	—
CYCATR	—	—	—	—	7 (1)	—	—	—
CYNOFF	—	8 (3)	—	—	—	—	5 (20)	10 (1)

DALEAX	—	—	—	—	—	—	—	10 (1)
DESSOP	—	—	—	—	—	—	5 (10)	—
EPIANG	13 (1)	—	20 (20)	—	—	—	—	—
EPICIL	—	—	—	—	5 (20)	—	—	—
EPILOB	—	8 (1)	—	—	—	—	—	—
EPISUF	13 (20)	—	—	—	—	—	—	—
ERIUMB	13 (3)	—	—	—	—	—	—	—
EUPESU	—	—	—	—	10 (15)	9 (20)	—	10 (1)
EUPGLY	—	—	—	—	7 (2)	—	—	—
FRAVIR	13 (3)	—	—	20 (40)	—	—	—	—
GALBOR	—	—	—	20 (1)	—	—	—	—
GENDET	13 (1)	—	—	—	—	—	—	—
GEUMAC	—	8 (1)	—	—	—	—	—	—
GLYLEP	—	8 (20)	60 (21)	20 (1)	36 (4)	45 (6)	32 (11)	80 (3)
GNAPAL	—	—	—	—	5 (10)	—	—	—
GRISQU	—	—	—	—	12 (4)	9 (1)	5 (3)	20 (1)
HELAUT	—	—	—	—	2 (1)	—	—	—
HELPET	—	—	—	—	7 (2)	—	—	—
HERLAN	—	15 (10)	—	—	—	—	—	—
HUMLUP	—	8 (1)	—	—	—	—	5 (3)	10 (1)
IRIMIS	—	—	20 (1)	—	—	—	—	—
KOCSCO	—	—	—	—	2 (20)	—	5 (20)	—
LACSER	—	8 (3)	—	—	—	—	—	—
LITRUD	—	8 (1)	—	—	—	—	—	—
LUPARG	13 (20)	—	—	20 (3)	—	—	—	—
LUPINU	13 (3)	—	—	—	—	—	—	—
LYSCIL	—	8 (3)	—	—	—	—	—	—
MEDLUP	—	—	—	20 (40)	2 (1)	—	—	—
MEDSAT	—	—	20 (20)	20 (1)	—	18 (10)	—	—
MELALB	13 (1)	15 (2)	—	—	24 (11)	18 (2)	11 (35)	40 (15)
MELOFF	13 (1)	8 (1)	—	40 (2)	26 (7)	9 (1)	11 (12)	30 (14)
MENARV	—	31 (2)	—	—	7 (15)	—	—	—
OENALB	—	—	—	—	2 (1)	—	—	—
OENBIE	—	—	—	—	5 (2)	—	—	—
OSMOCC	—	8 (1)	—	—	—	—	—	—
OXYTRO	13 (3)	—	—	—	—	—	—	—
PLAMAJ	—	8 (3)	—	—	5 (12)	—	—	—
PLAPAT	—	—	—	—	2 (1)	—	—	—
POLAMP	—	—	—	20 (3)	10 (2)	—	—	—
POLAVI	—	—	—	—	10 (5)	—	—	—
POLLAP	—	—	—	—	7 (1)	—	—	—
POLMIN	—	—	—	—	2 (20)	—	—	—
POLYGO	—	—	—	—	2 (3)	—	—	—
POTANS	—	—	—	—	5 (2)	—	—	—
POTPAR	—	—	—	—	17 (2)	—	—	—
RANUNC	—	—	—	—	2 (1)	—	—	—
RATCOL	—	—	—	—	2 (1)	—	5 (1)	—
RORSIN	—	—	—	—	2 (1)	—	—	—
RUBACA	—	8 (20)	—	—	—	—	—	—
RUDLAC	—	8 (20)	—	—	—	—	—	—
RUMCRI	—	8 (3)	—	—	5 (2)	9 (1)	5 (20)	10 (10)
RUMMAR	—	—	—	—	17 (2)	—	—	—
SALIBE	—	—	—	—	5 (1)	—	—	—
SEDLAN	25 (1)	—	—	—	—	—	—	—
SENHYD	—	—	—	20 (1)	—	—	—	—
SISLOE	—	—	—	—	2 (1)	—	—	—
SMISTE	—	62 (7)	20 (1)	40 (3)	—	27 (20)	11 (20)	—

shoots, especially during the winter, may be heavy. The linear nature of many of these communities along waterways serve as important corridors for wildlife movement. Moose and beaver tend to heavily utilize most species of willows.

Fisheries
The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Fire
Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities
Soils and streambanks are subject to trampling damage, particularly if fine textured and wet. Grazing should be deferred until sites are drier to reduce trampling and compaction problems (Marlow 1984). Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Unless water tables are restored, these sites will for all practical purposes remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix drummondiana (Drummond willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix drummondiana* (Drummond willow) produce an abundance of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations
These areas are frequently flooded, requiring additional consideration when planning roads or campsites.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Salix drummondiana* (Drummond willow) community type has not been previously described. However, communities containing high constancies and coverages of *Salix drummondiana* (Drummond willow) have been described. These include the *Salix boothii* (Booth willow) dominated communities described by Padgett and others (1989) for Utah and southeastern Idaho, the *Salix geyeriana* (Geyer willow) dominated communities types described by Hansen and others (1989) for Montana, and the *Salix boothii* (Booth willow) dominated communities described by Youngblood and others (1985) for eastern Idaho and western Wyoming.

Salix exigua Community Type
(Sandbar Willow Community Type)

SALEXI (SAEX)
Number Of Stands Sampled = 118

LOCATION AND ASSOCIATED LANDFORMS

The *Salix exigua* (sandbar willow) community type is a major, widespread type at low to mid elevations throughout Montana. Sites range from 777 to 1,754 m (2,550 to 5,750 ft). Typical sites occupied by this type are sand and cobble deposits subject to periodic flooding each year, ditches, and lakeshores.

FLORISTIC CHARACTERISTICS

Major shrub species of this community type are *Salix exigua* (sandbar willow), with some stands having large amounts of *Cornus stolonifera* (red-osier dogwood) and *Prunus virginiana* (common chokecherry). Other species of *Salix* (willow) may be present, indicating a possible successional trend toward willow communities dominated by *Salix lutea* (yellow willow), *Salix geyeriana* (Geyer willow), and *Salix boothii* (Booth willow). Herbaceous species present include a wide variety of pioneering species.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Acer negundo (box-elder)	3	0-3	5
Populus deltoides (Great Plains cottonwood)	1	0-1	5
Populus trichocarpa (black cottonwood)	1	0-1	5

Salix amygdaloides (peach-leaf willow)	2	0-3	10
Shrubs			
Alnus incana (mountain alder)	1	0-1	5
Clematis occidentalis (Columbia clematis)	3	0-3	5
Cornus stolonifera (red-osier dogwood)	38	0-80	14
Prunus virginiana (common chokecherry)	14	0-30	14
Rosa spp. (rose)	3	0-3	5
Rosa woodsii (woods rose)	2	0-3	24
Salix exigua (sandbar willow)	82	60-98	100
Salix lasiandra (Pacific willow)	1	0-1	5
Salix lutea (yellow willow)	1	0-1	14
Solanum dulcamara (climbing nightshade)	1	0-1	5
Symphoricarpos occidentalis (western snowberry)	2	0-3	10
Toxicodendron rydbergii (poison ivy)	1	0-1	5
Graminoids			
Agropyron repens (quackgrass)	1	0-1	5
Agropyron smithii (western wheatgrass)	20	0-20	5
Agrostis stolonifera (redtop)	28	0-80	19
Bromus inermis (smooth brome)	7	0-10	10
Bromus japonicus (Japanese brome)	3	0-3	5
Carex lanuginosa (woolly sedge)	2	0-3	10
Carex rostrata (beaked sedge)	42	0-80	10
Carex spp. (sedge)	1	0-1	5
Carex stipata (sawbeak sedge)	1	0-1	5
Carex vesicaria (inflated sedge)	10	0-10	5
Deschampsia cespitosa (tufted hairgrass)	10	0-10	5
Echinochloa crusgalli (large barnyard-grass)	20	0-20	5
Eleocharis palustris (common spikesedge)	15	0-30	10
Elymus virginicus (Virginia wildrye)	12	0-20	10
Hordeum brachyantherum (meadow barley)	1	0-1	5
Hordeum jubatum (foxtail barley)	8	0-20	14
Phalaris arundinacea (reed canarygrass)	44	0-80	24
Poa palustris (fowl bluegrass)	10	0-20	29
Poa pratensis (Kentucky bluegrass)	7	0-10	10
Scirpus pungens (sharp bulrush)	3	0-3	5
Spartina gracilis (alkali cordgrass)	80	0-80	5
Spartina pectinata (prairie cordgrass)	80	0-80	5
Forbs			
Apocynum androsaemifolium (spreading dogbane)	3	0-3	5
Apocynum cannabinum (hemp dogbane)	3	0-3	10
Artemisia dracunculus (tarragon)	1	0-1	5
Artemisia lindleyana (riverbank wormwood)	3	0-3	5
Aster chilensis (long-leaved aster)	1	0-1	5
Aster spp. (aster)	3	0-3	5
Calystegia sepium (hedge bindweed)	1	0-1	5
Centaurea maculosa (spotted knapweed)	1	0-1	5
Chenopodium album (lambsquarter)	1	0-1	10
Cicuta maculata (spotted water-hemlock)	1	0-1	5
Cirsium arvense (Canada thistle)	7	0-20	19

Coreopsis tinctoria (common bugseed)	1	0-1	5
Descurainia sophia (flixweed tansymustard)	10	0-10	5
Epilobium angustifolium (fireweed)	1	0-1	5
Epilobium ciliatum (common willow-herb)	2	0-3	10
Galium aparine (goose-grass)	1	0-1	5
Geum macrophyllum (large-leaved avens)	1	0-1	5
Glycyrrhiza lepidota (American licorice)	1	0-1	5
Helianthus annuus (common sunflower)	1	0-1	5
Kochia scoparia (summer cypress)	20	0-20	5
Lactuca spp. (lettuce)	2	0-3	10
Lysimachia ciliata (fringed loosestrife)	7	0-10	10
Medicago lupulina (black medic)	1	0-1	5
Melilotus alba (white sweet-clover)	1	0-1	5
Melilotus officinalis (yellow sweet-clover)	7	0-10	10
Mentha arvensis (field mint)	2	0-3	24
Mimulus guttatus (common monkey-flower)	1	0-1	5
Phacelia procera (tall phacelia)	1	0-1	5
Physostegia parviflora (purple dragonhead)	1	0-1	5
Plantago major (common plantain)	1	0-1	5
Polygonum amphibium (water smartweed)	10	0-20	10
Potentilla anserina (common silverweed)	10	0-20	10
Potentilla argentea (silvery cinquefoil)	3	0-3	5
Rumex crispus (curly dock)	1	0-1	5
Rumex maritimus (golden dock)	12	0-20	10
Salsola iberica (Russian thistle)	20	0-20	5
Smilacina stellata (starry Solomon-plume)	1	0-1	5
Solidago canadensis (Canada goldenrod)	1	0-3	14
Sonchus arvensis (field milk-thistle)	2	0-3	10
Stachys palustris (swamp hedge-nettle)	1	0-1	5
Tanacetum vulgare (common tansy)	1	0-1	10
Typha latifolia (common cattail)	7	0-10	10
Urtica dioica (stinging nettle)	1	0-1	10
Verbascum thapsus (common mullein)	1	0-1	5
Verbena hastata (blue verbena)	20	0-20	5
Xanthium strumarium (common cocklebur)	2	0-3	19
Ferns and Allies			
Equisetum arvense (field horsetail)	2	0-3	10
Equisetum pratense (meadow horsetail)	1	0-1	5

SUCCESSIONAL INFORMATION

The *Salix exigua* (sandbar willow) community type is an early seral (pioneer) primary successional stage on newly deposited sediments that may persist under a regime of repeated fluvial disturbance. It commonly occurs in open stands of *Populus trichocarpa* (black cottonwood), *Populus angustifolia* (narrowleaf cottonwood),or *Populus deltoides* (Great Plains cottonwood), or as a fringe around dense cottonwood stands.

In eastern Montana, many stands are seral to either the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. Seedlings

of both *Salix exigua* (sandbar willow) and *Populus deltoides* (Great Plains cottonwood) are typically established at the same time on alluvial mud flats. Initially, *Salix exigua* (sandbar willow) may grow faster than *Populus deltoides* (Great Plains cottonwood). However, in a few short years, saplings of *Populus deltoides* (Great Plains cottonwood) will overtop *Salix exigua* (sandbar willow) and begin to dominate the overstory canopy. As the dense overstory canopy of *Populus deltoides* (Great Plains cottonwood) matures, *Salix exigua* (sandbar willow) is shaded out. At the same time that *Salix exigua* (sandbar willow) is being shaded out, the understory is beginning to be dominated by seedlings, saplings, and pole size *Fraxinus pennsylvanica* (green ash).

In the mountains and lower foothills of eastern and central Montana, the *Salix exigua* (sandbar willow) community type may represent a successional stage of the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation. Heavy grazing pressures may cause some sites to go to the *Salix geyeriana* (Geyer willow) community type or the *Salix lutea* (yellow willow) community type.

Disturbance Stages

Salix exigua (sandbar willow) is highly adapted to most forms of disturbance. It is a prolific sprouter and will reestablish itself on sites dominated by *Glycyrrhiza lepidota* (American licorice) and *Agropyron smithii* (western wheatgrass) following release from heavy grazing pressure, provided it has not been totally removed from the site. In addition, heavy grazing may open up stands resulting in invasion by introduced species or nonpalatable native species.

SOILS

Soils are Entisols or rarely Mollisols, and consist of thin sandy loams overlying deep sand, gravel, or cobbles (Brichta 1987). Surface soils are usually moist in the spring and early summer; subsoils remain saturated throughout the growing season. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Wetter communities are usually absent. Adjacent drier communities include the *Populus trichocarpa* (black cottonwood), *Populus angustifolia* (narrowleaf cottonwood), *Populus deltoides* (Great Plains cottonwood), *Salix geyeriana* (Geyer willow), and *Poa pratensis* (Kentucky bluegrass) types. Upland communities are dominated by conifers and shrubs and grasses such as *Artemisia tridentata* (big sagebrush), *Artemisia cana* (silver sagebrush), *Sarcobatus vermiculatus* (black greasewood), *Agropyron smithii* (western wheatgrass), and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to occasionally moderate because of the high densities of *Salix exigua* (sandbar willow) stems. Dense stands limit livestock access.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site. However, release from heavy grazing pressure will allow it to reestablish itself, provided it has not been totally removed from the site.

Wildlife

Stands of this community type provide excellent thermal and hiding cover for many species of wildlife. *Salix exigua*

(sandbar willow) is normally not as heavily browsed as other more palatable willow species. Beaver tends to heavily utilize *Salix exigua* (sandbar willow).

Fisheries

The *Salix exigua* (sandbar willow) community type typically provides only limited amount of overhanging shade due to the up right growth form of this species. The importance of willows in streambank protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

The use of fire in this type as an improvement technique has been little studied. However, limited information indicates this type tends to sprout vigorously following fire. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Soil Management and Rehabilitation Opportunities

Soil compaction is usually not a problem on coarse textured soils and substrates. Fine textured soils are subject to compaction when moist. Unlike most other willows, *Salix exigua* (sandbar willow) can send up individual stems from a complex underground root system, making it an excellent woody species for stabilizing streambanks. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix exigua (sandbar willow) is a pioneering species commonly located along irrigation ditches, cutbanks, and wet areas adjacent to roads. It has an excellent capability to rapidly colonize and spread on disturbed areas, making it useful in streambank stabilization and revegetation projects at low to mid elevations. Once *Salix exigua* (sandbar willow) has stabilized soils, other shrub and herbaceous species become established. Because of this characteristic, it would be wise for farmers, ranchers, and other land managers to maintain these stands. Once degradation occurs, rapid erosion of the streambank can occur with devastating results.

Salix exigua (sandbar willow) is highly adapted to most forms of disturbance. It is a prolific sprouter and will reestablish itself following release from heavy grazing pressure; provided it has not been totally removed from the site.

Revegetating degraded sites or exposed sand/gravel bars is feasible using *Salix exigua* (sandbar willow). Cuttings should be rooted and grown in a nursery to insure survival. *Salix exigua* (sandbar willow) produces an abundance of roots along the entire stem. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10 days after planting.

Recreational Uses and Considerations

Recreational opportunities are limited because of dense thickets and large mosquito populations.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar *Salix exigua* (sandbar willow) community types have been described by Norton and others (1981; Greys River, Wyoming), Mutz and Queiroz (1983; southeastern Idaho), Tuhy and Jensen (1982; central Idaho), Youngblood and others (1985b; eastern Idaho and western Wyoming), Padgett and others (1989; Utah and southeastern Idaho), Chadde and others (1988; northern Yellowstone National Park), and Szaro (1989; Arizona and New Mexico). Undergrowth composition varied widely but was often composed of introduced grasses such as *Agrostis stolonifera* (redtop), *Poa palustris* (fowl bluegrass), and *Poa pratensis* (Kentucky bluegrass).

Salix geyeriana/Calamagrostis canadensis Habitat Type
(Geyer Willow/Bluejoint Reedgrass Habitat Type)

SALGEY/CALCAN (SAGE2/CACA4)
Number Of Stands Sampled = 32

Note: The *Salix geyeriana* (Geyer willow) habitat type includes all combinations of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type is a major type at mid to moderately high elevations throughout the mountains and foothills of Montana. However, *Salix geyeriana* (Geyer willow) is essentially absent from northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type occupies streamside sites along major drainages and tributaries. Sites are also located near springs and seeps. Wetter sites may be dominated by the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type. The *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated types occupy intermediate elevations in comparison to the *Salix lutea* (yellow willow) dominated types which occupy lower foothills, and the *Salix drummondiana* (Drummond willow) dominated types which occupy the higher elevation sites. Sites for the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type range in elevation from 1,469 to 2,234 m (4,820 to 7,330 ft).

FLORISTIC CHARACTERISTICS

The overstory is dominated by *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow). *Calamagrostis canadensis* (bluejoint reedgrass) and/or *Calamagrostis stricta* (narrow-spiked reedgrass) are the dominant undergrowth species. A variety of forbs are present, including *Geum macrophyllum* (large leaved avens), *Pyrola asarifolia* (pink

wintergreen), *Galium trifidum* (small bedstraw), and *Epilobium ciliatum* (common willow-herb).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Shrubs			
Lonicera utahensis (Utah honeysuckle)	20	0-20	33
Potentilla fruticosa (shrubby cinquefoil)	10	0-10	33
Ribes spp. (currant)	5	0-10	67
Salix boothii (Booth willow)	2	0-3	67
Salix drummondiana (Drummond willow)	3	0-3	33
Salix geyeriana (Geyer willow)	70	60-80	100
Salix wolfii (Wolf's willow)	3	0-3	33
Graminoids			
Agrostis scabra (tickle-grass)	1	0-1	33
Agrostis stolonifera (redtop)	3	0-3	33
Calamagrostis canadensis (bluejoint reedgrass)	40	0-60	67
Calamagrostis stricta (narrow-spiked reedgrass)	20	0-20	33
Carex rostrata (beaked sedge)	3	0-3	33
Carex vesicaria (inflated sedge)	1	0-1	33
Deschampsia cespitosa (tufted hairgrass)	3	0-20	28
Forbs			
Arnica chamissonis (meadow arnica)	3	0-3	33
Aster foliaceus (leafy aster)	1	0-1	33
Aster occidentalis (western aster)	1	0-1	33
Cirsium arvense (Canada thistle)	10	0-10	33
Epilobium angustifolium (fireweed)	3	0-3	33
Epilobium ciliatum (common willow-herb)	2	0-3	67
Galium trifidum (small bedstraw)	2	0-3	67
Geum macrophyllum (large-leaved avens)	1	1-3	100
Ligusticum tenuifolium (slender-leafed licorice-root)	1	0-1	33
Pyrola asarifolia (pink wintergreen)	2	0-3	67
Ranunculus repens (creeping buttercup)	1	0-1	33
Senecio integerrimus (western groundsel)	1	0-1	33
Smilacina stellata (starry Solomon-plume)	1	0-1	33
Viola spp. (violet)	10	0-10	33

SUCCESSIONAL INFORMATION

Grazing pressure by livestock will cause a decrease in the more desirable grasses such as *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) with a corresponding increase in either introduced or less desirable species such as *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), or *Juncus balticus* (Baltic rush). If grazing pressures are severe enough, the site takes on the appearance of the grazing disclimax *Salix geyeriana* (Geyer willow) community type.

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed

species over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type.

SOILS

These soils classify as Mollisols (Aquolls) and Entisols (Mollic Fluvents). Parent material is commonly stratified alluvium, usually deep silt or sand overlying more sand, gravel, or cobbles. Coarse fragments are abundant throughout these soils. Water tables are commonly within 1 m (39 in) of the soil surface in the spring, yet commonly remain above 1 m throughout the summer. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type. In other situations, wetter sites may support the *Carex rostrata* (beaked sedge) habitat type or open water. Drier sites may support a variety of types including the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types, the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type or upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is high, and where extensive, this type may be an important source of summer forage. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Due to the high forage production and highly palatable grasses, many of these sites have heavy summer and fall use, especially after uplands have been grazed. Sustained grazing decreases the vigor, reproductive success, and competitive ability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) (Volland 1985). Under season long grazing, they may be replaced by *Poa pratensis* (Kentucky bluegrass). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry. Proper levels of grazing should range from light to moderate.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species by livestock over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Wildlife

Abundant food, cover, and proximity to water provide habitat for numerous wildlife species such as mammals and songbirds. Summer and winter use by elk may be moderate (Gaffney 1941). The linear nature of many of these communities along

waterways serve as important corridors for wildlife movement. Moose and beaver tend to heavily utilize most species of willows.

Research by McMillan (1953), Gaffney (1941), and Chadde and Kay (1988), and personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferred browse species by ungulates over *Salix boothii* (Booth willow). This may account for the reduced canopy cover and occurrence of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Fisheries

Where adjacent to streams, this type effectively stabilizes soils and forms overhanging banks, enhancing fisheries quality. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands (Kovalchik 1986 and 1987). Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning favors rhizomatous species such as *Poa pratensis* (Kentucky bluegrass).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Wet, fine textured soils are highly susceptible to trampling damage by cattle. Grazing should be deferred until soils are drier to protect streambanks and minimize damage (Marlow 1984). Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix geyeriana (Geyer willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cuttings, however, may be more difficult to root than *Salix boothii* (Booth willow). Cut stems of *Salix geyeriana* (Geyer willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations

Fishing opportunities are good in streams associated with this type. Moist soils and streambanks are subject to trampling damage. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Based upon an increased understanding, the *Salix geyeriana/Deschampsia cespitosa* (Geyer willow/tufted hairgrass) habitat type described in earlier regional draft documents has been combined with the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type. Similar communities have been described for Idaho and western Wyoming (Tuhy and Jensen 1982), eastern Idaho and western Wyoming (Youngblood and others 1985b), and for Utah and southeastern Idaho (Padgett and others 1989).

Salix geyeriana/Carex rostrata Habitat Type
(Geyer Willow/Beaked Sedge Habitat Type)

SALGEY/CARROS (SAGE2/CARO6)
Number Of Stands Sampled = 71

Note: The *Salix geyeriana* (Geyer willow) habitat type includes all combinations of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type is a major type at mid to moderately high elevations throughout the mountains and valleys of Montana. However, *Salix geyeriana* (Geyer willow) is essentially absent from northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type occupies wet streambanks, terraces, seeps and springs, and on ponded areas near abandoned beaver ponds. On larger streams with well developed floodplains, this type may occur as part of a diverse mosaic of sites due to varying degrees of wetness and the influence of flooding, scouring, and channel changes. The *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated types occupy intermediate elevations in comparison to the *Salix lutea* (yellow willow) dominated types which occupy lower foothills, and the *Salix drummondiana* (Drummond willow) dominated types which occupy the higher elevation sites. Sites for the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type range in elevation from 1,463 to 2,143 m (4,800 to 7,030 ft).

FLORISTIC CHARACTERISTICS

Salix geyeriana (Geyer willow) and *Salix boothii* (Booth willow) are the most common shrubs. The undergrowth is dominated by *Carex rostrata* (beaked sedge) with lesser amounts of *Carex aquatilis* (water sedge) also present. *Geum macrophyllum* (large leaved avens) is the most common forb associated with this type.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus tremuloides (quaking aspen)	1	0-1	6
Populus trichocarpa (black cottonwood)	3	0-3	6
Shrubs			
Betula glandulosa (bog birch)	5	0-10	12
Cornus stolonifera (red-osier dogwood)	1	0-1	6
Lonicera involucrata (twin-berry)	1	0-1	6
Lonicera utahensis (Utah honeysuckle)	4	0-10	29
Potentilla fruticosa (shrubby cinquefoil)	8	0-20	24
Rhamnus alnifolia (alder buckthorn)	30	0-30	6
Ribes lacustre (swamp current)	3	0-3	6
Ribes setosum (Missouri gooseberry)	1	0-1	6
Ribes spp. (currant)	8	0-20	18
Salix boothii (Booth willow)	39	0-80	53
Salix brachycarpa (short-fruited willow)	1	0-1	6
Salix drummondiana (Drummond willow)	11	0-30	29
Salexi exigua (sandbar willow)	3	0-3	6
Salix geyeriana (Geyer willow)	51	0-80	88
Salix planifolia (planeleaf willow)	17	0-30	12
Salix wolfii (Wolf's willow)	12	0-20	12
Graminoids			
Agrostis scabra (tickle-grass)	11	0-20	24
Alopecurus aequalis (short-awn foxtail)	3	0-3	6
Alopecurus alpinus (alpine foxtail)	3	0-3	6
Bromus ciliatus (fringed brome)	1	0-1	12
Calamagrostis canadensis (bluejoint reedgrass)	11	0-20	35
Carex aquatilis (water sedge)	21	0-60	53
Carex atherodes (awned sedge)	40	0-40	6
Carex canescens (gray sedge)	10	0-10	6
Carex concinnoides (northwestern sedge)	3	0-3	6
Carex disperma (soft-leaved sedge)	15	0-20	12
Carex interior (inland sedge)	1	0-1	12
Carex lanuginosa (woolly sedge)	2	0-3	12
Carex pachystachya (thick-headed sedge)	1	0-1	6
Carex rostrata (beaked sedge)	47	0-80	94
Carex spp. (sedge)	1	0-1	6
Carex vesicaria (inflated sedge)	10	0-10	6

Deschampsia cespitosa (tufted hairgrass)	20	0-20	6
Glyceria grandis (American mannagrass)	3	0-3	6
Glyceria striata (fowl mannagrass)	8	0-20	18
Grass spp. (grasses)	3	0-3	6
Poa palustris (fowl bluegrass)	4	0-10	24
Poa pratensis (Kentucky bluegrass)	1	0-1	6
Scirpus microcarpus (small-flowered bulrush)	10	0-10	6
Trisetum wolfii (Wolf's trisetum)	10	0-10	6
Forbs			
Arnica chamissonis (meadow arnica)	1	0-1	6
Aster foliaceus (leafy aster)	1	0-1	12
Aster occidentalis (western aster)	8	0-10	18
Cirsium scariosum (elk thistle)	10	0-10	6
Epilobium angustifolium (fireweed)	1	0-1	6
Epilobium ciliatum (common willow-herb)	6	0-20	29
Epilobium palustre (swamp willow-herb)	3	0-3	6
Fragaria virginiana (Virginia strawberry)	1	0-1	6
Galium trifidum (small bedstraw)	10	0-10	18
Galium triflorum (sweetscented bedstraw)	3	0-3	12
Geum macrophyllum (large-leaved avens)	8	0-20	41
Lemna minor (water lentil)	20	0-20	6
Ligusticum tenuifolium (slender-leafed licorice-root)	15	0-20	12
Lysimachia ciliata (fringed loosestrife)	3	0-3	6
Mentha arvensis (field mint)	2	0-3	24
Pedicularis groenlandica (elephant's head)	1	0-1	6
Perideridia gairdneri (Gairdner's yampah)	1	0-1	6
Plantago major (common plantain)	1	0-1	6
Polemonium occidentale (western polemonium)	2	0-3	12
Potentilla palustris (purple cinquefoil)	30	0-30	6
Pyrola asarifolia (pink wintergreen)	10	0-10	6
Rorippa palustris (marsh yellowcress)	1	0-1	6
Rumex crispus (curly dock)	1	0-1	12
Scutellaria galericulata (marsh skullcap)	1	0-1	6
Senecio hydrophilus (alkali-marsh butterweed)	3	0-3	6
Senecio integerrimus (western groundsel)	10	0-20	12
Senecio pseudaureus (streambank groundsel)	2	0-3	12
Smilacina stellata (starry Solomon-plume)	5	0-10	12
Solidago canadensis (Canada goldenrod)	5	0-10	12
Stellaria longipes (longstalk starwort)	1	0-1	6
Thalictrum spp. (meadowrue)	1	0-1	6
Typha latifolia (common cattail)	1	0-1	6
Veronica americana (American speedwell)	3	0-3	6
Vicia americana (American vetch)	3	0-3	6
Viola spp. (violet)	1	0-3	18
Ferns and Allies			
Equisetum arvense (field horsetail)	25	0-30	12
Equisetum hyemale (common scouring-rush)	10	0-10	6

SUCCESSIONAL INFORMATION

With prolonged disturbance, introduced grasses, such as *Poa palustris* (fowl bluegrass), *Agrostis stolonifera* (redtop), and *Poa pratensis* (Kentucky bluegrass), tend to increase. If browsing is heavy, willow coverages will decrease, resulting in more open communities. The site may then become occupied by the *Salix geyeriana* (Geyer willow) community type which represents a grazing disclimax.

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type.

Heavy cutting of the willows by beaver may lead to dominance by the graminoids. If beaver leave the area because of the lack of food, or are removed by trapping, major storm events or seasonal runoff can cause the dams to be washed out. With the elimination of beaver, the dams will not be repaired, resulting in downcutting and eventually, a lowering of the water table. The lowering of the water table can result in the changing of the site's potential. If the water table equilibrates at a new but lower (drier) state, the site's potential changes to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type. The *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type occupies a slightly drier position on the landscape than that of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type.

SOILS

Soils are typically fine textured Mollisols (Aquolls, Borolls), or rarely Inceptisols and Entisols (Brichta 1987). These soils have commonly developed from the fine textured materials which accumulate on sites of periodic inundation. Water tables remain near the surface throughout the summer, and redox depletions (segregated gleyed soil) or reduced matrices (gleyed throughout) are common at depths between 20 and 35 cm (8 and 14 in). Available water is estimated between moderate to high. Soil reaction ranges from neutral to mildly alkaline (pH 7.0 to 7.5).

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter support the *Carex rostrata* (beaked sedge) habitat type, the *Typha latifolia* (common cattail) habitat type, or open water. The *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix geyeriana* (Geyer willow) community type may occupy adjacent drier sites. Other communities on drier disturbed sites include the *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), and *Juncus balticus* (Baltic rush) community types and the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type. Uplands are dominated by conifers such as *Pseudotsuga menziesii* (Douglas fir), *Pinus contorta* (lodgepole pine), and *Pinus ponderosa* (ponderosa pine), or by shrubs and grasses such as *Artemisia tridentata* (big sagebrush) and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled with duration of treatments limited to less than 30 days and frequency of this treatment to about one year in three or four (Myers 1989).

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species by livestock over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Wildlife

A diversity of wildlife species, ranging from large mammals to rodents and songbirds, use this type for food, cover, and nesting. Moose and beaver tend to heavily utilize most species of willows.

Research by McMillan (1953), Gaffney (1941), and Chadde and Kay (1988), and personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferred browse species by ungulates over *Salix boothii* (Booth willow). This may account for the reduced canopy cover and occurrence of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Fisheries

The dense network of roots from the various willows and the rhizomatous *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish. In addition, the various species of willows provide valuable overhanging stream cover and shade. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

The wet nature of these soils makes them highly susceptible to damage by livestock and heavy machinery. These disturbances often lead to soil compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody

species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank

Salix geyeriana (Geyer willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cuttings, however, may be more difficult to root than *Salix boothii* (Booth willow). Cut stems of *Salix geyeriana* (Geyer willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Carex rostrata (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge) all form a dense, thick sod that is highly resistant to erosion. Along the stream, the sod may be undercut and sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to damage, and streambank sloughing can occur.

Recreational Uses and Considerations

This habitat type is commonly adjacent to fisheries and streamside trails may develop. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities, codominated by *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow), have been described by a number of researchers: Norton and others (1981; Greys River, Wyoming), Mutz and Queiroz (1983; southeastern Idaho), Youngblood and others (1985; eastern Idaho and western Wyoming), Chadde and others (1988; Yellowstone National Park), and Padgett and others (1989; Utah).

Salix geyeriana Community Type
(Geyer Willow Community Type)

SALGEY (SAGE2)
Number Of Stands Sampled = 71

Note: The *Salix geyeriana* (Geyer willow) community type includes all combinations of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix geyeriana* (Geyer willow) community type is a major community type located at mid to moderately high elevations throughout the mountains, foothills and valleys of Montana. However, this type is essentially absent from northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix geyeriana* (Geyer willow) community type occupies alluvial terraces adjacent to major rivers and streams. Sites are also located near springs and seeps. The *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated types occupy intermediate elevations in comparison to the *Salix lutea* (yellow willow) dominated types which occupy lower foothills, and the *Salix drummondiana* (Drummond willow) dominated types which occupy the higher elevation sites. Sites for the *Salix geyeriana* (Geyer willow) community type range in elevation from 1,344 to 2,234 m (4,410 to 7,330 ft).

FLORISTIC CHARACTERISTICS

The *Salix geyeriana* (Geyer willow) community type represents a grazing disclimax. *Salix boothii* (Booth willow) and *Salix geyeriana* (Geyer willow) are the major shrubs of this grazing disclimax. Major herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Geum macrophyllum* (large-leaved avens), *Poa palustris* (fowl bluegrass), *Phleum pratense* (common timothy), and *Agrostis stolonifera* (redtop).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Salix boothii (Booth willow)	32	0-80	92
Salix geyeriana (Geyer willow)	26	0-80	41
Graminoids			
Agrostis stolonifera (redtop)	18	0-80	41
Calamagrostis canadensis (bluejoint reedgrass)	4	0-20	11
Calamagrostis stricta (narrow-spiked reedgrass)	2	0-3	14
Deschampsia cespitosa (tufted hairgrass)	5	0-40	23
Phleum pratense (common timothy)	7	0-40	48
Poa palustris (fowl bluegrass)	10	0-80	51
Poa pratensis (Kentucky bluegrass)	15	0-80	59
Forbs			
Geum macrophyllum (large-leaved avens)	3	0-20	58
Smilacina stellata(starry Solomon-plume)	5	0-30	45
Taraxacum officinale (common dandelion)	3	0-20	42

SUCCESSIONAL INFORMATION

The *Salix geyeriana* (Geyer willow) represents an early/mid seral grazing disclimax of the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked

sedge) habitat type.

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) community type.

SOILS

These soils classify as Mollisols (Aquolls) and Entisols (Mollic Fluvents). Parent material is commonly stratified alluvium, usually deep silt or sand overlying more sand, gravel or cobbles. Coarse fragments are abundant throughout these soils. Water tables are commonly within 1 m (39 in) of the soil surface in the spring. Available water is texture dependent and varies widely with estimates ranging from low to high. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support either the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type or the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type. In other situations, wetter sites may include the *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge) habitat types or open water. The *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type may be adjacent on slightly drier sites. Other communities on drier sites include the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types and the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of this type are often open, allowing for easy livestock access. Forage productivity is also high, resulting in potentially heavy utilization, especially as upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species by livestock over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Wildlife

The species and structural diversity of this type make it a valuable cover and food source for a wide range of wildlife species, including deer, moose, waterfowl, upland game, songbirds, and small mammals (Dittberner and Olson 1983). Moose and beaver tend to heavily utilize most species of willows.

Research by McMillan (1953), Gaffney (1941), and Chadde and Kay (1988), and personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferred browse species by ungulates over *Salix boothii* (Booth willow). This may account for the reduced canopy cover and occurrence of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Fisheries

The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Fire

Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands (Kovalchik 1986 and 1987). Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Soils and streambanks are subject to trampling damage, particularly if fine textured and wet. Grazing should be deferred until sites are drier to reduce trampling and compaction problems (Marlow 1984). Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Unless water tables are restored, these sites will for all practical purposes remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix geyeriana (Geyer willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cuttings, however, may be more difficult to root than *Salix boothii* (Booth willow). Cut stems of *Salix geyeriana* (Geyer willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations

These areas are frequently flooded, requiring additional consideration when planning roads or campsites.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

In eastern Idaho and western Wyoming, Youngblood and others (1985b) identified several similar community types (*Salix geyeriana/Poa palustris* (Geyer willow/fowl bluegrass), *Salix boothii/Poa palustris* (Booth willow/fowl bluegrass) community types) indicating disturbed conditions.

Salix lasiandra Community Type
(Pacific Willow Community Type)

SALLAS (SALA5)
Number Of Stands Sampled = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lasiandra* (Pacific willow) community type is an incidental type at low to mid elevations in western Montana and the southern portion of central Montana. Sites range from 927 to 2,013 m (3,040 to 6,600 ft). This community type typically occurs immediately adjacent to small streams and rivers on alluvial deposits of sands and gravels with a frequent to common flooding frequency. Some stands can be found on islands of larger rivers. Generally, this community type is associated with the various cottonwood types.

FLORISTIC CHARACTERISTICS

At lower elevations, *Salix lasiandra* (Pacific willow) grows into medium sized tree overtopping all other willows. However, at higher elevations, it tends to have a more shrubby growth form. The herbaceous understory consists of *Mentha arvense* (field mint), *Phalaris arundinacea* (reed canarygrass), and *Poa palustris* (fowl bluegrass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

	% Canopy Cover

Species	Average	Range	Constancy
Shrubs			
Artemisia cana (silver sagebrush)	1	0-1	33
Salix lasiandra (Pacific willow)	59	20-98	100
Graminoids			
Agropyron cristatum (crested wheatgrass)	1	0-1	33
Calamagrostis canadensis (bluejoint reedgrass)	3	0-3	33
Carex aquatilis (water sedge)	3	0-3	33
Carex rostrata (beaked sedge)	3	0-3	33
Carex spp. (sedge)	1	0-1	33
Carex vesicaria (inflated sedge)	3	0-3	33
Deschampsia cespitosa (tufted hairgrass)	3	0-3	33
Eleocharis palustris (common spikesedge)	3	0-3	33
Phalaris arundinacea (reed canarygrass)	60	0-60	33
Poa palustris (fowl bluegrass)	20	0-20	33
Forbs			
Geum macrophyllum (large-leaved avens)	1	0-1	33
Melilotus alba (white sweet-clover)	1	0-1	33
Mentha arvensis (field mint)	22	0-40	67
Sium suave (hemlock water-parsnip)	3	0-3	33
Thermopsis montana (mountain thermopsis)	3	0-3	33
Trifolium pratense (red clover)	1	0-1	33
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	33

SUCCESSIONAL INFORMATION

Salix lasiandra (Pacific willow) is a pioneer or early seral primary successional species on newly deposited alluvial materials. Habitat requirements generally correspond with those associated with the *Salix exigua* (sandbar willow) community type and various cottonwood community types. At lower elevations where *Salix lasiandra* (Pacific willow) forms a medium sized tree-like shrub, it is common in open *Populus trichocarpa* (black cottonwood) stands or as a fringe around dense cottonwood stands.

Many stands seem to represent an early seral stage of the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type. The presence and health (condition) of remnant woody or herbaceous species will indicate possible successional trends.

Disturbance Stages

With increasing overuse by livestock, willows show declining vigor as indicated by uneven stem age distribution, highlining or umbrella shaped willow clumps, or dead clumps. With severe disturbance, *Salix lasiandra* (Pacific willow) and associated willows disappear with the stands becoming dominated by *Rosa woodsii* (woods rose) and species of *Poa* (bluegrass). If disturbance is severe enough, *Rosa woodsii* (woods rose) will be replaced by a stand of *Poa pratensis* (Kentucky bluegrass).

SOILS

Soils are typically Entisols (Fluvents and Aquents); less frequently Mollisols (Borolls). Soils are typically coarse textured but remain moist with water tables above 1 m (39 in) throughout the growing season. Coarse textured soils, moderate stream

gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Typically, the adjacent wetter community is the stream or river. Adjacent drier communities include the *Populus trichocarpa* (black cottonwood) dominated community types, *Populus angustifolia* (narrowleaf cottonwood) dominated community types, and *Salix* (willow) dominated types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of the *Salix lasiandra* (Pacific willow) community type typically form narrow, often discontinuous bands of limited extent. Forage productivity is often low due to disturbance by frequent flooding. Overall, this community type has limited value for livestock.

Stands of the *Salix lasiandra* (Pacific willow) community type are typically heavily impacted by livestock. Because of their location, most stands at lower elevations receive season long grazing and are commonly used as a winter feed ground by ranchers. Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Wildlife

The *Salix lasiandra* (Pacific willow) community type provides browse and cover for deer, birds, and small mammals. Beaver tend to heavily utilize most species of willows. It is also provides diversity for other mammals and songbirds.

Fisheries

The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Fire

The response of *Salix lasiandra* (Pacific willow) to fire and its sprouting capabilities are poorly documented.

Soil Management and Rehabilitation Opportunities

Coarse textured soils generally do not have compaction problems. However, many stands are currently heavily impacted by livestock resulting in large amounts of bare ground. These degraded stands are vulnerable to erosion problems during high water periods. Management should emphasize the importance of willows in protecting the streambank. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient streambank protection.

Use of *Salix lasiandra* (Pacific willow) for stabilizing streambanks is recommended on appropriate sites. It is easily rooted and forms abundant roots on planted cuttings approximately 10 days after planting (Platts and others 1987).

Recreational Uses and Considerations

The *Salix lasiandra* (Pacific willow) community type is commonly used as fishing access points. Stands of this community type should not be used for campgrounds or picnic areas due to the high water table and periodic flooding.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below

along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have not been described elsewhere.

Salix lutea/Calamagrostis canadensis Habitat Type (Yellow Willow/Bluejoint Reedgrass Habitat Type)

SALLUT/CALCAN (SALU2/CACA4)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type is a minor type at mid to low elevations throughout the mountains and foothills of central and eastern Montana, and valleys of western Montana. However, *Salix lutea* (yellow willow) is limited in distribution in northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix lutea* (yellow willow) dominated sites occur at lower elevations than the *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated sites, with the *Salix drummondiana* (Drummond willow) dominated types occupying the higher elevation sites. Sites for the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type range in elevation from 1,116 to 1,341 m (3,660 to 4,400 ft). This type occupies stream and river edges, seeps, and moist alluvial terraces. Wetter sites may be dominated by the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type.

FLORISTIC CHARACTERISTICS

The major shrub species of this habitat type are the relatively tall *Salix lutea* (yellow willow), with varying amounts of *Salix bebbiana* (Bebb willow) also present. Major herbaceous species include *Calamagrostis canadensis* (bluejoint reedgrass) and/or *Calamagrostis stricta* (narrow-spiked reedgrass). Lesser amounts of *Deschampsia cespitosa* (tufted hairgrass) are also present.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy

Shrubs			
Betula occidentalis (water birch)	1	0-1	40
Cornus stolonifera (red-osier dogwood)	20	0-40	40
Rosa woodsii (woods rose)	2	0-3	60
Salix bebbiana (Bebb willow)	54	0-80	60
Salix lutea (yellow willow)	11	1-20	100
Graminoids			
Agrostis stolonifera (redtop)	7	0-10	40
Calamagrostis canadensis (bluejoint reedgrass)	30	0-40	40
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	20
Deschampsia cespitosa (tufted hairgrass)	5	0-10	60
Festuca rubra (red fescue)	2	0-3	40
Juncus balticus (Baltic rush)	40	0-60	40
Phleum pratense (common timothy)	3	0-3	40
Poa pratensis (Kentucky bluegrass)	40	0-60	40
Forbs			
Allium schoenoprasum (chives)	2	0-3	40
Aster chilensis (long-leaved aster)	3	0-3	40
Geranium spp. (geranium)	3	0-3	40
Geum macrophyllum (large-leaved avens)	1	0-1	40
Mentha arvensis (field mint)	5	0-10	40
Viola spp. (violet)	5	0-10	40

SUCCESSIONAL INFORMATION

If browsing pressure is heavy, willow coverages will decrease, resulting in more open communities. Grazing pressure by livestock will cause a decrease in the more desirable grasses such as *Calamagrostis canadensis* (bluejoint reedgrass), *Calamagrostis stricta* (narrow-spiked reedgrass), and *Deschampsia cespitosa* (tufted hairgrass) with a corresponding increase in either introduced or less desirable species such as *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), or *Juncus balticus* (Baltic rush). If grazing pressures are severe enough, the site takes on the appearance of the grazing disclimax *Salix lutea* (yellow willow) community type.

SOILS

These soils are either Entisols (Fluvents) or Mollisols. Soils of stands on alluvial terraces are usually a deep silt or sand. Sites adjacent to stream channels consist of a thin sandy loam overlying gravel or cobbles (Brichta 1987). These soils are saturated early in spring and often remain moist throughout the growing season. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type. In other situations, wetter sites may support the *Carex rostrata* (beaked sedge) habitat type or open water. Drier sites may support a variety of types including the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types, the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type or upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is high, and where extensive, this type may be an important source of summer forage. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Due to the high forage production and highly palatable grasses, many of these sites have heavy summer and fall use, especially after uplands have been grazed. Sustained grazing decreases the vigor, reproductive success, and competitive ability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) (Volland 1985). Under season long grazing, they may be replaced by *Poa pratensis* (Kentucky bluegrass). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry. Proper levels of grazing should range from light to moderate.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Wildlife

Big game utilize this type for both summer and winter forage and browse. Winter elk use may be heavy (Gaffney 1941). Dense stands provide excellent thermal and hiding cover for many wildlife species.

Fisheries

Where adjacent to streams, this type effectively stabilizes soils and forms overhanging banks, enhancing fisheries quality. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning favors rhizomatous species such as *Poa pratensis* (Kentucky bluegrass).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Soils are easily damaged from trampling by livestock if grazed when moist. This disturbance often leads to soil compaction,

streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix lutea (yellow willow) is useful in streambank stabilization and revegetation projects (Platts and others 1987). Cuttings should be first rooted then grown in a nursery to insure survival. *Salix lutea* (yellow willow) produces an abundance of roots, mostly along the lower one-third of the cut stem. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10 days after planting.

Recreational Uses and Considerations

Recreational opportunities are limited because of the small size and high density of *Salix lutea* (yellow willow). These areas are frequently flooded, requiring additional consideration when planning roads or campsites. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) identified a comparable *Salix lutea* (yellow willow) community type.

Salix lutea/Carex rostrata Habitat Type
(Yellow Willow/Beaked Sedge Habitat Type)

SALLUT/CARROS (SALU2/CARO6)

Number Of Stands Sampled = 14

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type is a major type at mid to low elevations throughout the mountains and foothills of central and eastern Montana and the valleys in western Montana. However, *Salix lutea* (yellow willow) is limited in distribution in northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix lutea* (yellow willow) dominated sites occur at lower elevations than the *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated sites, with the *Salix drummondiana* (Drummond willow) dominated sites occupying the higher elevation sites. Sites for the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type range in elevation from 1,116 to 1,341 m (3,660 to 4,400 ft). The type occurs on wet streambanks, terraces, seeps and springs, and on ponded areas near abandoned beaver ponds. On larger streams with well developed floodplains, this type may occur as part of a diverse mosaic of sites due to varying degrees of wetness and the influence of flooding, scouring, and channel changes.

FLORISTIC CHARACTERISTICS

The major shrub species of this habitat type are the relatively tall *Salix lutea* (yellow willow). The major herbaceous species is *Carex rostrata* (beaked sedge) and/or *Carex vesicaria* (inflated sedge). Limited amounts of *Carex aquatilis* (water sedge) may also be present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula glandulosa (bog birch)	1	0-1	33
Lonicera involucrata (twin-berry)	1	0-1	33
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	67
Salix bebbiana (Bebb willow)	3	0-3	33
Salexi exigua (sandbar willow)	1	0-1	33
Salix lutea (yellow willow)	40	20-80	100
Graminoids			
Bromus ciliatus (fringed brome)	1	0-1	33
Calamagrostis stricta (narrow-spiked reedgrass)	2	0-3	67
Carex aquatilis (water sedge)	60	0-60	33
Carex atherodes (awned sedge)	3	0-3	7
Carex rostrata (beaked sedge)	67	40-80	100
Carex vesicaria (inflated sedge)	70	0-70	7
Glyceria grandis (American mannagrass)	1	0-1	33
Poa palustris (fowl bluegrass)	1	0-1	67
Forbs			
Epilobium ciliatum (common willow-herb)	3	0-3	33
Mentha arvensis (field mint)	3	0-3	33
Polygonum amphibium (water smartweed)	3	0-3	33
Senecio hydrophilus (alkali-marsh butterweed)	1	0-1	33
Viola spp. (violet)	3	0-3	33
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	33

SUCCESSIONAL INFORMATION

With prolonged disturbance, introduced grasses, such as *Poa palustris* (fowl bluegrass), *Agrostis stolonifera* (redtop), and *Poa pratensis* (Kentucky bluegrass), tend to increase. If browsing is heavy, willow coverages will decrease, resulting in more open communities. The site may then become occupied by the *Salix lutea* (yellow willow) community type which represents a grazing disclimax.

Heavy cutting of the willows by beaver may lead to dominance by the graminoids. If beaver leave the area because of the lack of food, or are removed by trapping, major storm events or seasonal runoff can cause the dams to be washed out. With the elimination of beaver, the dams will not be repaired, resulting in downcutting and eventually, a lowering of the water table. The lowering of the water table can result in the changing of the site's potential. If the water table equilibrates at a new but lower (drier) state, the site's potential changes to the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type. The *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type occupies a slightly drier position on the landscape than that of the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type.

SOILS

The *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type is most commonly located on fine textured materials accumulated on sites of periodic inundation. Soils are typically fine textured Mollisols (Aquolls or Borolls) and only rarely Inceptisols or Entisols. Water tables remain at or near the soil surface throughout the summer. Redox depletions (segregated gleyed soil) or a reduced matrix (gleyed throughout) is common between 20 and 35 cm (8 in and 14 in) in depth. Available water is estimated between moderate and high

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter support the *Carex rostrata* (beaked sedge) habitat type, the *Typha latifolia* (common cattail) habitat type, or open water. The *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type or the *Salix lutea* (yellow willow) community type may occupy adjacent drier sites. Other communities on drier sites include the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types and the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled with duration of treatments limited to less than 30 days and frequency of this treatment to about one year in three or four

(Myers 1989).

Wildlife

Big game utilize this type for both summer and winter forage and browse. Winter elk use may be heavy (Gaffney 1941). Dense stands provide excellent thermal and hiding cover for many wildlife species.

Fisheries

The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

Soils are easily damaged from trampling by livestock if grazed when moist. This disturbance often leads to soil compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix lutea (yellow willow) is useful in streambank stabilization and revegetation projects (Platts and others 1987). Cuttings should be first rooted then grown in a nursery to insure survival. *Salix lutea* (yellow willow) produces an abundance of roots, mostly along the lower one-third of the cut stem. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30 to 50 cm (12 to 20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10 days after planting.

Recreational Uses and Considerations

Recreational opportunities are limited because of the small size and high density of *Salix lutea* (yellow willow). These areas are frequently flooded, requiring additional consideration when planning roads or campsites. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded

to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) identified a comparable *Salix lutea* (yellow willow) community type.

Salix lutea Community Type
(Yellow Willow Community Type)

SALLUT (SALU2)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Salix lutea* (yellow willow) community type is a major type at low to mid elevations throughout the mountains and foothills of central and eastern Montana and valleys of western Montana. However, this type is limited in distribution in northwestern Montana where *Salix drummondiana* (Drummond willow) is the dominate willow. The *Salix lutea* (yellow willow) dominated sites occur at lower elevations than the *Salix geyeriana* - *Salix boothii* (Geyer willow - Booth willow) dominated sites, with the *Salix drummondiana* (Drummond willow) dominated sites occupying the higher elevation sites. Sites for the *Salix lutea* (yellow willow) community type range in elevation from 1,116 to 1,341 m (3,660 to 4,400 ft). This type occupies stream and river edges, seeps, and moist alluvial terraces.

FLORISTIC CHARACTERISTICS

The *Salix lutea* (yellow willow) community type represents a grazing disclimax. The major shrub species of this grazing disclimax are the relatively tall *Salix lutea* (yellow willow), with varying amounts of *Salix exigua* (sandbar willow) also present. Major herbaceous species include *Agrostis stolonifera* (redtop), *Plantago major* (common plantain), *Poa palustris* (fowl bluegrass), and *Mentha arvense* (field mint).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy

Shrubs			
Salix exigua (sandbar willow)	4	0-10	60
Salix lutea (yellow willow)	17	1-80	100
Graminoids			
Agrostis stolonifera (redtop)	37	0-90	60
Beckmannia syzigachne (American sloughgrass)	2	0-3	40
Deschampsia cespitosa (tufted hairgrass)	3	0-3	20
Hordeum jubatum (foxtail barley)	2	0-3	40
Juncus balticus (Baltic rush)	12	0-20	40
Phleum pratense (common timothy)	2	0-3	40
Poa palustris (fowl bluegrass)	7	0-20	60
Poa pratensis (Kentucky bluegrass)	1	0-1	40
Forbs			
Cirsium arvense (Canada thistle)	7	0-10	40
Epilobium ciliatum (common willow-herb)	1	0-1	40
Mentha arvensis (field mint)	5	0-10	60
Plantago major (common plantain)	10	0-20	60
Solidago canadensis (Canada goldenrod)	5	0-10	40

SUCCESSIONAL INFORMATION

The *Salix lutea* (yellow willow) community type represents an early/mid seral grazing disclimax of the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type or the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type.

SOILS

These soils are either Entisols (Fluvents) or Mollisols. Soils of stands on alluvial terraces are usually a deep silt or sand. Sites adjacent to stream channels consist of a thin sandy loam overlying gravel or cobbles (Brichta 1987). Water tables are variable, yet seasonally high. Available water is also highly variable, individual site estimates range from low to high. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support either the *Salix lutea/Carex rostrata* (yellow willow/beaked sedge) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type. In other situations, wetter sites may include the *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge) habitat types or open water. The *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type may be adjacent on slightly drier sites. Other communities on drier sites include the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types and the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of this type are often open, allowing for easy livestock access. Forage productivity is also high, resulting in potentially heavy utilization, especially as upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader,

especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Wildlife

Big game utilize this type for both summer and winter forage and browse. Winter elk use may be heavy (Gaffney 1941). Dense stands provide excellent thermal and hiding cover for many wildlife species.

Fisheries

The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Fire

Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Soils are easily damaged from trampling by livestock if grazed when moist. This disturbance often leads to soil compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix lutea (yellow willow) is useful in streambank stabilization and revegetation projects (Platts and others 1987). Cuttings should be first rooted then grown in a nursery to insure survival. *Salix lutea* (yellow willow) produces an abundance of roots, mostly along the lower one-third of the cut stem. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10 days after planting.

Recreational Uses and Considerations

Recreational opportunities are limited because of the small size and high density of *Salix lutea* (yellow willow). These areas are frequently flooded, requiring additional consideration when planning roads or campsites.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) identified a comparable *Salix lutea* (yellow willow) community type.

Salix planifolia/Carex aquatilis Habitat Type
(Planeleaf Willow/Water Sedge Habitat Type)

SALPLA/CARAQU (SAPL2/CAAQ)

Number Of Stands Sampled = 57

Note: The *Salix planifolia* (planeleaf willow) habitat type includes all combinations of *Salix planifolia* (planeleaf willow) and *Salix commutata* (undergreen willow) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) habitat type is a minor type at mid to high elevations in the mountains of central and southwestern Montana. Sites range in elevation from 1,750 to 2,693 m (5,740 to 8,830 ft). The type is associated with meadows adjacent to lakes, streams, and springs. It is also located along broad valley bottoms and wet slopes. The sites often represent the wettest terrestrial sites available for species of willow.

FLORISTIC CHARACTERISTICS

Two varieties of *Salix planifolia* (planeleaf willow) are found in Montana. Variety *monica* is located at higher elevations (middle and upper subalpine zone dominated by *Abies lasiocarpa* [subalpine fir], *Picea engelmannii* [Engelmann spruce],

and *Pinus contorta* [lodgepole pine]), is approximately 1 m (39 in) in height, and has broader leaves. Variety *planifolia* usually occurs at lower elevations (sagebrush/grass zone), is taller (2-4 m; 6.5-13 ft), and has longer, narrower leaves that are often red-tinged and sparsely hairy. The variety in this habitat type is considered to be variety *monica.*

The diagnostic shrubs of this type include *Salix planifolia* (planeleaf willow) and *Salix commutata* (undergreen willow). Associated herbaceous species include *Carex aquatilis* (water sedge), *Carex rostrata* (beaked sedge), *Deschampsia cespitosa* (tufted hairgrass), and *Pedicularis groenlandica* (elephant's head).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	4
Picea spp. (spruce)	1	0-1	15
Pinus contorta (lodgepole pine)	3	0-3	4
Shrubs			
Betula glandulosa (bog birch)	7	0-20	22
Kalmia microphylla (small-leaved laurel)	10	0-10	4
Lonicera involucrata (twin-berry)	20	0-20	4
Lonicera utahensis (Utah honeysuckle)	4	0-10	15
Potentilla fruticosa (shrubby cinquefoil)	17	0-30	7
Rhamnus alnifolia (alder buckthorn)	1	0-1	4
Ribes lacustre (swamp current)	1	0-1	4
Ribes setosum (Missouri gooseberry)	10	0-10	4
Salix boothii (Booth willow)	1	0-1	4
Salix candida (hoary willow)	9	0-20	11
Salix commutata (undergreen willow)	18	0-40	11
Salix drummondiana (Drummond willow)	3	0-3	4
Salix geyeriana (Geyer willow)	3	0-3	4
Salix planifolia (planeleaf willow)	36	0-98	93
Salix wolfii (Wolf's willow)	10	0-20	30
Spiraea douglasii (Douglas's spiraea)	30	0-30	4
Vaccinium occidentale (western huckleberry)	1	0-1	4
Graminoids			
Agrostis exarata (spike bentgrass)	1	0-1	4
Agrostis humilis (alpine bentgrass)	1	0-3	11
Agrostis scabra (tickle-grass)	2	0-10	22
Alopecurus alpinus (alpine foxtail)	2	0-3	7
Bromus ciliatus (fringed brome)	1	0-1	4
Calamagrostis canadensis (bluejoint reedgrass)	48	0-80	15
Calamagrostis stricta (narrow-spiked reedgrass)	20	0-20	7
Carex aquatilis (water sedge)	29	0-70	74
Carex canescens (gray sedge)	11	0-40	19
Carex diandra (lesser-panicled sedge)	20	0-20	7
Carex disperma (soft-leaved sedge)	10	0-10	4
Carex douglasii (Douglas's sedge)	20	0-20	4

Carex illota (sheep sedge)	3	0-3	4
Carex interior (inland sedge)	10	0-10	4
Carex lanuginosa (woolly sedge)	1	0-1	4
Carex lasiocarpa (slender sedge)	3	0-3	4
Carex limosa (mud sedge)	1	0-1	4
Carex luzulina (woodrush sedge)	10	0-10	4
Carex microptera (small-winged sedge)	1	0-1	4
Carex rostrata (beaked sedge)	25	0-60	59
Carex scopulorum (Holm's Rocky Mountain sedge)	30	0-40	22
Carex simulata (short-beaked sedge)	1	0-1	4
Carex spp. (sedge)	1	0-1	4
Carex vesicaria (inflated sedge)	30	0-30	4
Deschampsia cespitosa (tufted hairgrass)	4	0-20	48
Eleocharis pauciflora (few-flowered spike-rush)	21	0-60	30
Eriophorum chamissonis (Chamisso cotton-grass)	5	0-10	7
Eriophorum viridicarinatum (green-keeled cotton-grass)	1	0-1	4
Glyceria striata (fowl mannagrass)	1	0-1	4
Juncus drummondii (Drummond's rush)	1	0-1	4
Juncus ensifolius (dagger-leaf rush)	10	0-20	7
Juncus mertensianus (Merten's rush)	5	0-10	7
Luzula campestris (field woodrush)	1	0-1	4
Luzula parviflora (small-flowered woodrush)	1	0-1	4
Phleum alpinum (alpine timothy)	2	0-3	19
Poa grayana (Gray's bluegrass)	1	0-1	4
Poa leptocoma (bog bluegrass)	1	0-1	4
Poa spp. (bluegrass)	1	0-1	4
Trisetum wolfii (Wolf's trisetum)	4	0-10	11
Forbs			
Angelica arguta (sharptooth angelica)	1	0-1	7
Antennaria corymbosa (meadow pussy-toes)	1	0-1	4
Antennaria umbrinella (umber pussy-toes)	5	0-10	7
Arnica latifolia (broadleaf arnica)	1	0-1	4
Aster foliaceus (leafy aster)	5	0-10	7
Aster modestus (few-flowered aster)	10	0-10	4
Aster occidentalis (western aster)	8	0-20	37
Caltha leptosepala (elkslip marshmarigold)	9	0-30	15
Castilleja miniata (scarlet paintbrush)	1	0-1	4
Cirsium scariosum (elk thistle)	1	0-1	4
Dodecatheon jeffreyi (tall mountain shooting star)	10	0-30	15
Epilobium angustifolium (fireweed)	1	0-1	4
Epilobium ciliatum (common willow-herb)	1	0-1	4
Epilobium glaberrimum (smooth willow-herb)	4	0-10	11
Epilobium palustre (swamp willow-herb)	1	0-1	4
Galium aparine (goose-grass)	3	0-3	4
Galium trifidum (small bedstraw)	1	0-1	11
Galium triflorum (sweetscented bedstraw)	1	0-1	4
Gentiana calycosa (explorer's gentian)	10	0-10	4
Geum macrophyllum (large-leaved avens)	1	0-1	7

Geum rivale (water avens)	1	0-1	4
Habernaria dilatata (white orchis)	1	0-1	4
Ligusticum tenuifolium (slender-leafed licorice-root)	6	0-10	19
Menyanthes trifoliata (buckbean)	1	0-1	4
Mertensia ciliata (mountain bluebell)	1	0-1	4
Mitella breweri (Brewer's mitrewort)	10	0-10	4
Parnassia fimbriata (fringed grass-of-parnassus)	3	0-3	7
Pedicularis groenlandica (elephant's head)	4	0-20	48
Perideridia gairdneri (Gairdner's yampah)	20	0-20	4
Polemonium occidentale (western polemonium)	2	0-3	11
Potamogeton gramineus (grass-leaved pondweed)	1	0-1	4
Potentilla diversifolia (diverse-leaved cinquefoil)	10	0-10	4
Potentilla palustris (purple cinquefoil)	3	0-3	4
Pyrola asarifolia (pink wintergreen)	3	0-3	4
Saxifraga oregana (Oregon saxifrage)	2	0-3	7
Senecio cymbalarioides (few-leaved groundsel)	2	0-10	30
Senecio integerrimus (western groundsel)	10	0-20	11
Senecio pseudaureus (streambank groundsel)	3	0-3	4
Senecio spp. (groundsel)	1	0-1	4
Senecio triangularis (arrowleaf groundsel)	3	0-3	4
Spiranthes romanzoffiana (hodded ladies-tresses)	1	0-1	4
Stellaria longipes (longstalk starwort)	1	0-1	7
Swertia perennis (swertia)	1	0-3	22
Thalictrum occidentale (western meadowrue)	1	0-1	4
Tofieldia glutinosa (sticky tofieldia)	1	0-1	4
Trollius laxus (American globeflower)	10	0-10	4
Urtica dioica (stinging nettle)	3	0-3	4
Valeriana dioica (northern valerian)	3	0-3	4
Veronica spp. (speedwell)	1	0-1	4
Veronica wormskjoldii (Wormskjold speedwell)	2	0-3	7
Viola canadensis (Canada violet)	1	0-1	4
Viola spp. (violet)	1	0-3	33
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	7

SUCCESSIONAL INFORMATION

Moderate disturbance will result in a decrease of *Salix planifolia* (planeleaf willow), *Salix commutata* (undergreen willow), and *Carex aquatilis* (water sedge), and an increase in cover of *Juncus balticus* (Baltic rush), *Poa pratensis* (Kentucky bluegrass), and forbs. With increasing overuse by livestock, other graminoids and forbs begin to dominate the sites. On heavily disturbed sites adjacent to streams, streambed downcutting may lower the water table with the site being dominated by *Poa pratensis* (Kentucky bluegrass). This condition is somewhat uncommon because of the ability of *Carex aquatilis* (water sedge) to reoccupy disturbed sites and because livestock tend to avoid the site when the soils are wet. Water tables can be restored with stream rehabilitation efforts such as loose rock checkdams (Kovalchik 1987).

SOILS

Soils are typically Histosols (Typic or Terric Borofibrists), Entisols (Aquents), and in some instances Mollisols (Histic or Typic Cryaquolls) (Youngblood and others 1985, USDA Soil Conservation Service 1985, Montagne and others 1982). Soils generally consist of accumulations of partially decomposed organic material overlying mineral horizons of alluvial sands,

silts, and clays and occasionally gravels. The soils are gleyed at or near the upper boundary. Soils are very poorly drained with a high available water holding capacity. The sites are permanently saturated and may experience shallow flooding in the spring and early summer. The rooting zones are generally saturated throughout the short growing season slowing decomposition and favoring the accumulation of additional organic matter. Soil pH is very strongly acid to slightly acid (pH 4.4 to 6.3).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), or the *Eleocharis pauciflora* (few-flowered spike-rush) habitat types, or the open water. Adjacent drier communities may include the *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type or the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass), *Abies lasiocarpa/Vaccinium occidentale* (subalpine fir/western huckleberry) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Estimated herbage production is moderate. Short growing seasons and continually wet soils limit livestock use until August and September. *Carex aquatilis* (water sedge) is palatable for cattle and horses (Lewis 1958; Hermann 1970). Season long grazing, especially when soils are saturated, will damage plants and soils.

Forage value of *Carex aquatilis* (water sedge) and *Carex rostrata* (beaked sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor.

Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled.

Wildlife

Wildlife use of *Salix planifolia* (planeleaf willow) may be moderate to heavy. In some sites, heavy winter moose use has all but eliminated those stems near or above the snow surface. However, due to the low stature of *Salix planifolia* var. *monica* (planeleaf willow), most winter use by ungulates is limited when the plants are covered by snow.

Ungulate use of *Carex aquatilis* (water sedge) may be moderate (Wing 1969). Waterfowl consume the seeds of *Carex aquatilis* (water sedge) and use the wetter sites for nesting and cover.

Fisheries

The dense network of roots from the various willows and the rhizomatous *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish. In addition, the various species of willows provide valuable overhanging stream cover and shade. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Bank damage is lessen by late season grazing by livestock. However, late season grazing may remove valuable cover and shade needed by trout and reduce sediment filtering capacity during spring runoff.

Fire

The response of *Salix planifolia* (planeleaf willow) to burning has not been documented, and the degree of sprouting by *Salix planifolia* (planeleaf willow) is unknown. However, use of this species for revegetation may be practical.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) habitat type

Soil Management and Rehabilitation Opportunities

The *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) habitat type is only slightly resistant to trampling by livestock, big game, packstock, and campers. Rutting can be severe when packstock or hiker use occurs on wet soils. This can result in the development of multiple, parallel trails. Off road vehicles cause serious long term damage. Care should be taken to maintain existing roads to help discourage off road travel. If new trails or roads are to be built, they should be located on the adjacent uplands.

On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix planifolia (planeleaf willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix planifolia* (planeleaf willow) produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations

The high subalpine to alpine meadows provide excellent opportunities for viewing moose, and to a lesser degree, elk, deer, and waterfowl. Sites also provide access points for fishing. Heavy human use in the spring and summer can result in damaged soils, bank sloughing, and exposed soils along stream edges.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) described a *Salix planifolia* (planeleaf willow) community type occurring at low elevations that appears to be similar to communities dominated by *Salix planifolia* var. *planifolia* (planeleaf willow). In addition, Padgett and others (1989) described a similar type for Utah and southeastern Idaho.

Salix wolfii/Carex aquatilis Habitat Type
(Wolf's Willow/Water Sedge Habitat Type)

SALWOL/CARAQU (SAWO/CAAQ)
Number Of Stands Sampled = 19

LOCATION AND ASSOCIATED LANDFORMS

The *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type is a minor type in the mountains of central and southwestern Montana. Sites range in elevation from 2,028 to 2,586 m (6,650 to 8,480 ft). It occupies wet basins and valley floors adjacent to low gradient streams at mid to high elevations.

FLORISTIC CHARACTERISTICS

The *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type is characterized by an open shrub layer 60-100 cm (24-39 in) tall over a dense stand of rhizomatous *Carex aquatilis* (water sedge), *Carex vesicaria* (inflated sedge), or *Carex rostrata* (beaked sedge). *Salix wolfii* (Wolf's willow) is dominant but small amounts of other shrubs may be present, including *Betula glandulosa* (bog birch) and *Lonicera utahensis* (Utah honeysuckle). Incidental conifers such as *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) may be present, but show no signs of replacing *Salix wolfii* (Wolf's willow).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula glandulosa (bog birch)	20	0-20	25
Lonicera utahensis (Utah honeysuckle)	20	0-20	25
Salix geyeriana (Geyer willow)	1	0-1	25
Salix planifolia (planeleaf willow)	3	0-3	25
Salix wolfii (Wolf's willow)	53	40-80	100
Graminoids			
Agrostis scabra (tickle-grass)	1	0-1	25
Carex aquatilis (water sedge)	37	0-60	75
Carex microptera (small-winged sedge)	30	0-30	25
Carex rostrata (beaked sedge)	3	0-3	25
Carex vesicaria (inflated sedge)	20	0-20	25
Deschampsia cespitosa (tufted hairgrass)	10	0-20	50
Trisetum wolfii (Wolf's trisetum)	3	0-3	25
Forbs			
Antennaria corymbosa (meadow pussy-toes)	30	0-30	25

Aster occidentalis (western aster)	1	0-1	50
Camassia quamash (common camas)	1	0-1	25
Delphinium depauperatum (slim larkspur)	1	0-1	25
Galium trifidum (small bedstraw)	1	0-1	25
Geum macrophyllum (large-leaved avens)	1	0-1	25
Ligusticum tenuifolium (slender-leafed licorice-root)	7	0-10	50
Polygonum bistortoides (American bistort)	10	0-10	25
Potentilla diversifolia (diverse-leaved cinquefoil)	10	0-10	25
Pyrola asarifolia (pink wintergreen)	1	0-1	25
Senecio integerrimus (western groundsel)	30	0-30	25
Stellaria longipes (longstalk starwort)	1	0-1	25
Trifolium longipes (long-stalked clover)	10	0-10	25

SUCCESSIONAL INFORMATION

Browsing may weaken or eventually eliminate plants of *Salix wolfii* (Wolf's willow) leading to dominance by *Carex aquatilis* (water sedge) and *Carex rostrata* (beaked sedge). If adjacent to streams, downcutting or lateral movement of the channel may result in drier sites and replacement of sedges by graminoids such as *Juncus balticus* (Baltic rush) and *Poa pratensis* (Kentucky bluegrass). Careful observation should show remnant shoots of *Salix wolfii* (Wolf's willow) still present on all but the most severely degraded sites.

SOILS

Soils of this habitat type are predominantly Histosols in high elevation basins and broad valley environments. Entisols (Fluvents) are occasionally present at streamside locations. Organic horizons vary from 70 cm to over 100 cm (27 to 39 in) in depth (Brichta 1987). Redoximorphic features (mottling or gleyed soil) are common throughout the mineral soil. Water tables remain within 1 m (39 in) of the soil surface throughout the growing season. Soil reaction is slightly acid to neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Sedge communities such as the *Carex rostrata* (beaked sedge), *Carex simulata* (short-beaked sedge), and *Carex aquatilis* (water sedge) habitat types are present on adjacent wetter sites. The *Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) habitat type often occupies nearby drier sites. Other communities of drier sites include the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) and *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) types, and the *Poa pratensis* (Kentucky bluegrass) community type. Adjacent uplands are often dominated by conifers or *Artemisia tridentata* (big sagebrush) and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Grazing should be carefully monitored due to the highly organic substrates. Excessive grazing can result in severe churning of the soil. Estimated herbage production is moderate. Short growing seasons and continually wet soils limit livestock use until August and September. Season long grazing, especially when soils are saturated, will damage plants and soils. Forage value of *Carex aquatilis* (water sedge) and *Carex rostrata* (beaked sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor. Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are

protected by a root reserve. Late summer and fall grazing should be carefully controlled.

Wildlife

Cover value for ungulates is low due to the short potential stature of *Salix wolfii* (Wolf's willow) (maximum height of 1-2 m [3-6.5 ft]). The palatability of *Salix wolfii* (Wolf's willow) appears to be low. However, McMillan (1953) reported that *Salix wolfii* (Wolf's willow) is often heavily browsed by moose. Winter use is frequently minimal, however, since the low growing *Salix wolfii* (Wolf's willow) (up to 1 m (39 in) tall) is often snow covered. In addition, *Salix wolfii* (Wolf's willow) is not often used by beaver (Collins 1976).

Fire

The response of *Salix wolfii* (Wolf's willow) to fire has not been reported. However, prescribed burning may be an effective method of rejuvenating decadent clumps. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type

Soil Management and Rehabilitation Opportunities

Organic soils are extremely intolerant to disturbance and should preclude all uses from this habitat type. Roads and trails should be located on adjacent uplands.

On sites adjacent to first or second order streams, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table, allowing the willows and sedges to reclaim a degraded site.

Salix wolfii (Wolf's willow) is valuable in revegetating disturbed streambanks and pond margins, but rooting of cuttings is erratic. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix wolfii* (Wolf's willow) typically produce low to moderate numbers of roots located along the length of the stem. Best results are obtained from cuttings taken in the spring from dormant 2 to 4 year old wood. Cuttings 30 to 50 cm (12 to 20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow

range site.

OTHER STUDIES

Similar communities were identified for eastern Idaho and western Wyoming (Youngblood and others 1985), Utah and southeastern Idaho (Padgett and others (1989), and for northern Yellowstone National Park (Chadde and others 1988). Mutz and Queiroz (1983) described a drier *Salix wolfii/Poa pratensis* (Wolf's willow/Kentucky bluegrass) community type in southeastern Idaho.

Salix wolfii/Deschampsia cespitosa Habitat Type (Wolf's Willow/Tufted Hairgrass Habitat Type)

SALWOL/DESCES (SAWO/DECA5)
Number Of Stands Sampled = 20

LOCATION AND ASSOCIATED LANDFORMS

The *Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) habitat type is a minor type in the mountains of central and southwestern Montana. Sites range in elevation from 1,998 to 2,617 m (6,550 to 8,580 ft). It occurs in meadows and on alluvial terraces associated with broad mountain valley bottoms.

FLORISTIC CHARACTERISTICS

The *Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) habitat type is characterized by an open, small statured shrub layer over a stand of herbaceous species. *Salix wolfii* (Wolf's willow) is the dominant shrub but other shrubs present may include *Potentilla fruticosa* (shrubby cinquefoil). Incidental conifers such as *Abies lasiocarpa* (subalpine fir) and *Picea engelmannii* (Engelmann spruce) may be present, but show no signs of replacing *Salix wolfii* (Wolf's willow). Graminoids include *Deschampsia cespitosa* (tufted hairgrass), *Juncus balticus* (Baltic rush), and *Poa pratensis* (Kentucky bluegrass). Common forbs are *Fragaria virginiana* (Virginia strawberry), *Taraxacum officinale* (common dandelion), *Angelica arguta* (sharptooth angelica), and *Valeriana edulis* (edible valerian).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Potentilla fruticosa (shrubby cinquefoil)	12	0-60	70
Salix wolfii (Wolf's willow)	38	1-80	100
Graminoids			
Agropyron caninum (bearded wheatgrass)	2	0-3	40
Bromus ciliatus (fringed brome)	1	0-3	45
Carex aquatilis (water sedge)	2	0-3	20
Carex atherodes (awned sedge)	1	0-1	5
Carex rostrata (beaked sedge)	1	0-3	15
Deschampsia cespitosa (tufted hairgrass)	10	0-60	80
Juncus balticus (Baltic rush)	25	0-60	65

Phleum pratense (common timothy)	9	0-40	40
Poa pratensis (Kentucky bluegrass)	14	0-60	55
Forbs			
Angelica arguta (sharptooth angelica)	3	0-20	50
Fragaria virginiana (Virginia strawberry)	7	0-20	55
Geum macrophyllum (larged-leaved avens)	1	0-3	40
Potentilla gracilis (slender cinquefoil)	1	0-3	55
Senecio integerrimus (western groundsel)	11	0-60	40
Taraxacum officinale (common dandelion)	3	0-20	55
Valeriana edulis (edible valerian)	3	0-20	50

SUCCESSIONAL INFORMATION

Browsing may weaken or eventually eliminate plants of *Salix wolfii* (Wolf's willow). With increasing levels of grazing, *Deschampsia cespitosa* (tufted hairgrass) will be replaced by *Juncus balticus* (Baltic rush), *Poa pratensis* (Kentucky bluegrass), and forbs such as *Fragaria virginiana* (Virginia strawberry) and *Taraxacum officinale* (common dandelion). Careful observation should show remnant shoots of *Salix wolfii* (Wolf's willow) still present on all but the most severely degraded sites.

SOILS

Soils are typically Fluvents or Aquolls, consisting of 20 to 40 cm (8 to 16 in) of sandy loam overlying gravel or cobbles. Soils remain saturated at least to some depth above 1 m (39 in) depth throughout the growing season, as evidenced by redox depletions or a reduced matrix (gleyed soil). Estimates of available water range from moderate to high.

ADJACENT COMMUNITIES

Adjacent wetter sites include the *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type and sedge types such as the *Carex rostrata* (beaked sedge), *Carex simulata* (short-beaked sedge), and *Carex aquatilis* (water sedge) habitat types. Drier sites support the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) and the *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) habitat types and the *Poa pratensis* (Kentucky bluegrass) community type. Nearby uplands are dominated by conifers and *Artemisia tridentata* (big sagebrush), *Festuca idahoensis* (Idaho fescue), and conifers.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) habitat type provides a fair amount of forage. The dense, low will overstory may impede livestock use, but because the sites are relatively somewhat better drained, they can be subject to heavy grazing pressures. Heavy grazing use is typical, causing a marked decrease in the highly palatable *Deschampsia cespitosa* (tufted hairgrass) and an increase in the less palatable *Juncus balticus* (Baltic rush). *Juncus balticus* (Baltic rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975). Where this type is extensive, the use of riparian or wetland pastures (i.e., basing stocking rates on the forage available from this community rather than from the adjacent uplands) is recommended to minimize adverse impacts.

Wildlife

Cover value and browse potential are low to moderate due to the short potential stature of *Salix wolfii* (Wolf's willow) (maximum height of 1-2 m [3-6.5 ft]). *Salix wolfii* (Wolf's willow) is also not as palatable as other willows. Elk may make moderate summer use of both *Deschampsia cespitosa* (tufted hairgrass) and *Juncus balticus* (Baltic rush) (Kufeld 1987).

Songbirds and other wildlife are common inhabitants because of the diverse mix of species present and the location of this type between uplands and wetter communities.

Fire

The response of *Salix wolfii* (Wolf's willow) to fire has not been reported. However, prescribed burning may be an effective method of rejuvenating decadent clumps. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning favors rhizomatous species such as *Poa pratensis* (Kentucky bluegrass).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Wet, fine textured soils are highly susceptible to trampling damage by cattle. Grazing should be deferred until soils are drier to protect streambanks and minimize damage. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix wolfii (Wolf's willow) is valuable in revegetating disturbed streambanks and pond margins, but rooting of cuttings is erratic. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix wolfii* (Wolf's willow) typically produce low to moderate numbers of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky

Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities were described by Youngblood and others (1985) and Chadde and others (1988) for eastern Idaho and western Wyoming. Padgett and others (1989) also described a similar community for Utah and southeastern Idaho. Mutz and Queiroz (1983) identified a grazing influenced *Salix wolfii/Poa pratensis* (Wolf's willow/Kentucky bluegrass) community type for southeastern Idaho.

NON-WILLOW SHRUB TYPES

Alnus incana Community Type
(Mountain Alder Community Type)

ALNINC (ALIN2)
Number Of Stands Sampled = 51

LOCATION AND ASSOCIATED LANDFORMS

The *Alnus incana* (mountain alder) community type is a major type at low to mid elevations throughout the mountains, valleys, and foothills of Montana. Sites range from 1,147 to 2,044 m (3,760 to 6,700 ft). It occupies alluvial terraces, streambanks, and floodplains along fast moving (moderate to high gradient) mountain and foothill streams. In some instances, it is also located near springs and seeps.

FLORISTIC CHARACTERISTICS

The *Alnus incana* (mountain alder) community type is characterized by a dense overstory of *Alnus incana* (mountain alder) with a diverse understory shrub layer that may includes *Cornus stolonifera* (red-osier dogwood), *Ribes hudsonianum* (stinking currant), and *Oplopanax horridum* (devil's club). Major herbaceous undergrowth species include *Senecio triangularis* (arrowleaf groundsel), *Galium triflorum* (sweetscented bedstraw), *Epilobium ciliatum* (common willow-herb), *Heracleum lanatum* (cow-parsnip), *Cinna latifolia* (drooping woodreed), *Urtica dioica* (stinging nettle), *Athyrium filix-femina* (ladyfern), and *Streptopus amplexifolius* (clasping-leaved twisted stalk).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	50
Picea spp. (spruce)	1	0-1	33
Shrubs			
Alnus incana (mountain alder)	58	20-90	100
Betula occidentalis (water birch)	1	0-1	17
Cornus stolonifera (red-osier dogwood)	20	0-30	50
Lonicera involucrata (twin-berry)	2	0-3	33
Oplopanax horridum (devil's club)	70	0-70	17
Ribes hudsonianum (stinking currant)	80	0-80	17
Ribes lacustre (swamp currant)	2	0-3	33
Ribes odoratum (buffalo currant)	1	0-1	17
Ribes spp. (currant)	5	0-10	33
Rubus idaeus (red raspberry)	5	0-10	33
Rubus parviflorus (thimbleberry)	1	0-1	17
Salix drummondiana (Drummond willow)	2	0-3	33
Symphoricarpos spp. (snowberry)	1	0-1	17
Taxus brevifolia (Pacific yew)	1	0-1	17
Graminoids			

Agrostis idahoensis (Idaho bentgrass)	10	0-10	17
Agrostis stolonifera (redtop)	60	0-60	17
Calamagrostis canadensis (bluejoint reedgrass)	10	0-10	17
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	17
Cinna latifolia (drooping woodreed)	11	0-20	50
Elymus glaucus (blue wildrye)	1	0-1	17
Glyceria elata (tall mannagrass)	1	0-1	33
Glyceria grandis (American mannagrass)	1	0-1	33
Luzula parviflora (small-flowered woodrush)	1	0-1	17
Poa palustris (fowl bluegrass)	1	0-1	17
Forbs			
Actaea rubra (baneberry)	1	0-1	17
Angelica dawsonii (Dawson's angelica)	1	0-1	17
Arnica longifolia (longleaf arnica)	1	0-1	17
Aster eatonii (Eaton's aster)	1	0-1	17
Aster hesperius (marsh aster)	3	0-3	17
Aster modestus (few-flowered aster)	10	0-10	17
Aster occidentalis (western aster)	10	0-10	17
Epilobium angustifolium (fireweed)	1	0-1	17
Epilobium ciliatum (common willow-herb)	1	0-1	83
Galium triflorum (sweetscented bedstraw)	2	0-10	83
Geranium carolinianum (Carolina geranium)	1	0-1	17
Geum macrophyllum (large-leaved avens)	1	0-1	50
Habenaria dilatata (white orchid)	1	0-1	17
Heracleum lanatum (cow-parsnip)	2	0-3	67
Mertensia ciliata (mountain bluebell)	1	0-1	17
Mimulus moschatus (musk-flower)	1	0-1	17
Mitella spp. (mitrewort)	10	0-10	17
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	33
Prunella vulgaris (self-heal)	1	0-1	17
Pyrola secunda (one-sided wintergreen)	1	0-1	17
Saxifraga arguta (brook saxifrage)	1	0-1	17
Senecio triangularis (arrowleaf groundsel)	3	0-10	83
Smilacina stellata (starry Solomon-plume)	1	0-1	17
Solidago canadensis (Canada goldenrod)	1	0-1	17
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	50
Thalictrum occidentale (western meadowrue)	10	0-20	33
Tiarella trifoliata (trefoil foamflower)	3	0-3	17
Urtica dioica (stinging nettle)	7	0-10	50
Veratrum viride (green false hellebore)	3	0-3	17
Veronica americana (American speedwell)	1	0-1	17
Viola spp. (violet)	2	0-3	33
Ferns and Allies			
Athyrium filix-femina (ladyfern)	14	0-30	50
Equisetum arvense (field horsetail)	1	0-1	17
Equisetum hyemale (common scouring-rush)	1	0-1	17
Equisetum pratense (meadow horsetail)	3	0-3	33
Fern spp. (ferns)	1	0-1	17

Gymnocarpium dryopteris (oak-fern)	22	0-40	33

SUCCESSIONAL INFORMATION

The *Alnus incana* (mountain alder) community type seems to be an early/mid seral disturbance community type. *Alnus incana* (mountain alder) tends to be established after severe disturbance and may persist for a long time before finally being replaced by willows or conifers. Stands are located along mined streams (placer mining), streams with yearly ice jam problems, or streams that were used historically in transporting logs to mills (streams with a high occurrence of splash dams). In some instances, this type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation. Heavy grazing pressures may cause some sites to go to the *Salix geyeriana* (Geyer willow) community type or the *Salix lutea* (yellow willow) community type. Other areas may see a gradual conversion to conifers, such as the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type. The presence and health (condition) of remnant woody or herbaceous species will indicate possible successional trends.

Disturbance Stages

Alnus incana (mountain alder) is highly adapted to most forms of disturbance. However, heavy grazing may eliminate the more palatable native graminoids, thereby replacing them with introduced species or nonpalatable native species.

SOILS

Soils are typically Entisols (Fluvents) and Inceptisols (Aquepts). Soils are poorly developed alluvial sand deposits overlying river cobbles or, in seep areas, sands overlying bedrock. Sand depths vary from 10 to 75 cm (4 to 30 in). Profiles remain moist throughout the growing season. The coarse textured soils, moderate stream gradients, and large amounts of coarse rock fragments in the soil profile provide for an environment in which the rapid movement of highly aerated water can occur. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent drier communities range from cottonwood and grass dominated communities at lower elevations (*Populus trichocarpa* (black cottonwood), *Populus angustifolia* (narrowleaf cottonwood), *Poa pratensis* (Kentucky bluegrass) types) to forests dominated by *Picea engelmannii* (Engelmann spruce) and *Pseudotsuga menziesii* (Douglas fir).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

This type is of limited value for livestock because of the typically dense shrub layer. More open stands provide moderate amounts of forage, and are used as a source of summer shade. *Alnus incana* (mountain alder) is infrequently browsed by livestock but is susceptible to trampling damage as animals search for palatable plants (Kovalchik 1986; Kovalchik 1987). Dense stands of *Alnus incana* (mountain alder) hinder access by cattle, but heavy grazing can result in the loss of this type by creating a dish shaped stream channel and a water regime unsuitable for *Alnus incana* (mountain alder).

Herbaceous species such as *Agrostis stolonifera* (redtop) and *Poa pratensis* (Kentucky bluegrass) provide spring forage. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Agrostis stolonifera (redtop) is rated as fairly good to good forage for livestock (USDA Forest Service 1937). It is tolerant of close use due to its somewhat prostrate growth form, rhizomatous growth habit, and lower palatability than associated species.

Wildlife

Browsing of older *Alnus incana* (mountain alder) stems is typically low but use of young twigs, sprouts, and associated shrubs and grasses may be heavy. The high structural diversity of this community type provides thermal and hiding cover for ungulates such as whitetail and mule deer (Healy and Gill 1974). Elk may make light to moderate use of *Alnus incana* (mountain alder) community type during the summer and fall (Kufeld 1973). Associated shrub and herbaceous species also provide browse and forage. Numerous bird species use this type for both food and nesting.

Fisheries

Fisheries are enhanced by dense stands of *Alnus incana* (mountain alder) community type. This community type helps to stabilizes streambanks, creates overhanging banks, and lessens erosion caused by spring floods. Streams lined with this community type may develop deep and narrow channels, providing cover, spawning sites, food, and the cool temperatures favored by trout and other salmonoids.

Fire

In the *Alnus incana* (mountain alder) community type, all but light ground fires should be avoided. Intense burns will kill the shrub, leaving only a sparse herbaceous understory to protect the site from erosion and bank de-stabilization (Kovalchik 1986; Kovalchik 1987). However, *Alnus incana* (mountain alder) sprouts readily and retains its vigor when cut at four or five year intervals. Cutting in spring and winter results in rapid growth of sprouts, while cutting in mid summer produces fewer, slower growing sprouts.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment contents minimize most soil compaction problems associated with development. Management should greatly consider maintaining this type because of its excellent streambank stabilization values (see discussions in Fisheries and Fire sections).

Recreational Uses and Considerations

Recreational values of this community type are primarily connected with the associated high quality fishery. Dense stands limit canoe or raft access, and camping sites are often unsuitable due to moist or wet conditions.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site.

OTHER STUDIES

Similar communities have been described for Idaho and western Wyoming by Tuhy and Jensen (1982), Mutz and Queiroz (1983), Youngblood and others (1985), and Chadde and others (1988). *Alnus incana* (mountain alder) dominated communities were also described for Utah and southeastern Idaho by Padgett and others (1989). Finally, a somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Alnus sinuata Community Type
(Sitka Alder Community Type)

ALNSIN (ALSI3)
Number Of Stands Sampled = 7

CAUTION — Not all sites currently dominated by *Alnus sinuata* (sitka alder) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Alnus sinuata* (sitka alder) community type is a minor type at mid to high elevations in the mountains of northwestern Montana. Elevations of sampled sites range from 1,463 to 1,804 m (4,800 to 5,920 ft). It typically forms long narrow riparian or wetland stringers along mountain streams but is also located on wet stream benches, overflow channels, and hillside seeps.

FLORISTIC CHARACTERISTICS

The *Alnus sinuata* (sitka alder) community type is characterized by a dense overstory of *Alnus sinuata* (sitka alder), with a diverse undergrowth of herbaceous species. *Ribes lacustre* (swamp currant) and *Lonicera involucrata* (twin-berry) may be present as scattered shrubs. *Abies lasiocarpa* (subalpine fir) seedlings or saplings are often present. Major herbaceous species include *Heracleum lanatum* (cow-parsnip), *Streptopus amplexifolius* (clasping-leaved twisted stalk), *Galium triflorum* (sweetscented bedstraw), *Athyrium filix-femina* (ladyfern), and *Senecio triangularis* (arrowleaf groundsel).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-3	80
Picea spp. (spruce)	1	0-3	60
Shrubs			

Acer glabrum (Rocky Mountain maple)	1	0-1	20
Alnus sinuata (Sitka alder)	80	60-90	100
Cornus stolonifera (red-osier dogwood)	1	0-1	20
Lonicera involucrata (twin-berry)	3	0-3	40
Menziesia ferruginea (fool's huckleberry)	1	0-1	20
Oplopanax horridum (devil's club)	10	0-10	20
Ribes lacustre (swamp currant)	2	0-3	60
Rubus parviflorus (thimbleberry)	10	0-10	20
Salix drummondiana (Drummond willow)	3	0-3	20
Salix scouleriana (Scouler willow)	10	0-10	20
Sambucus racemosa (red elderberry)	20	0-20	20
Sorbus spp. (mountain -ash)	1	0-1	20
Vaccinium globulare (globe huckleberry)	1	0-1	20
Graminoids			
Agrostis diegoensis (thin bentgrass)	3	0-3	20
Agrostis scabra (tickle-grass)	1	0-1	20
Agrostis thurberiana (Thurber bentgrass)	1	0-1	20
Bromus spp. (fescue)	3	0-3	20
Calamagrostis canadensis (bluejoint reedgrass)	3	0-3	20
Cinna latifolia (drooping woodreed)	3	0-3	20
Deschampsia elongata (slender hairgrass)	1	0-1	20
Elymus glaucus (blue wildrye)	2	0-3	40
Festuca occidentalis (western fescue)	1	0-1	20
Trisetum canescens (tall trisetum)	3	0-3	20
Trisetum spicatum (spike trisetum)	1	0-1	20
Forbs			
Actaea rubra (baneberry)	10	0-10	20
Anaphalis margaritacea (common pearly-everlasting)	2	0-3	40
Angelica arguta (sharptooth angelica)	2	0-3	40
Angelica dawsonii (Dawson's angelica)	3	0-3	20
Arnica chamissonis (meadow arnica)	1	0-1	20
Arnica cordifolia (heart-leafed arnica)	20	0-20	20
Arnica spp. (arnica)	10	0-10	20
Aster foliaceus (leafy aster)	1	0-1	20
Circaea alpina (enchanter's nightshade)	3	0-3	20
Disporum hookeri (hooker fairy-bell)	20	0-20	20
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	20
Epilobium angustifolium (fireweed)	30	0-30	20
Epilobium ciliatum (common willow-herb)	3	0-3	20
Galium triflorum (sweetscented bedstraw)	1	0-3	80
Habernaria saccata (slender bog-orchid)	1	0-1	40
Habernaria spp. (bog-orchid)	1	0-1	20
Heracleum lanatum (cow-parsnip)	9	0-30	80
Mimulus spp. (monkey-flower)	3	0-3	20
Mitella breweri (Brewer's mitrewort)	1	0-1	20
Mitella spp. (mitrewort)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	3	0-3	40
Parnassia fimbriata (fringed grass-of-parnassus)	30	0-30	20

Pyrola minor (snowline pyrola)	3	0-3	20
Pyrola spp.(pyrola)	1	0-1	20
Pyrola uniflora (woodnymph)	3	0-3	20
Senecio cymbalarioides (few-leaved groundsel)	1	0-1	20
Senecio triangularis (arrowleaf groundsel)	4	0-10	60
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-3	80
Thalictrum occidentale (western meadowrue)	1	0-1	20
Thalictrum venulosum (veiny meadowrue)	3	0-3	20
Tiarella trifoliata (trefoil foamflower)	10	0-10	20
Vaccaria pyramidata (cowherb)	3	0-3	20
Veratrum viride (green false hellebore)	3	0-3	20
Viola spp. (violet)	1	0-1	20
Ferns and Allies			
Athyrium filix-femina (ladyfern)	25	0-70	60
Equisetum arvense (field horsetail)	1	0-1	20
Equisetum fluviatile (water horsetail)	1	0-1	20
Gymnocarpium dryopteris (oak-fern)	5	0-10	40

SUCCESSIONAL INFORMATION

Alnus sinuata (sitka alder) is highly competitive and tends to establish at mid to high elevations along streambanks that are continually scoured and flooded, on sites with high water tables, or on sites following severe disturbance. Without further alluvial deposition this community type is often stable, though eventual replacement by willows, such as *Salix drummondiana* (Drummond willow), appears to occur on some sites. *Abies lasiocarpa* (subalpine fir) and *Picea* (spruce) occur as scattered individuals in most stands but, due to flooding and scouring, rarely mature past the sapling stage. *Alnus sinuata* (sitka alder), conifers and many herbaceous species in this type grow on down and decomposing tree trunks from the adjoining upland conifer habitat types. Cooper and others (1991) considered wetland dominated by *Alnus sinuata* (sitka alder) to be long lived mid-seral communities.

Disturbance Stages

Alnus sinuata (sitka alder) is well known as a colonizer of disturbed soils. It is highly resistant to flooding damage (Haeussler and Coates 1986).

SOILS

Soils are typically Entisols (Fluvents) or Inceptisols (Aquepts). Parent material is commonly alluvial sand over river cobbles. Soil texture is variable but predominantly sand. Water tables appear to remain within 1 m (39 in) of the soil surface throughout the growing season. Redox concentrations (mottles) were recorded in two of the six sites sampled.

ADJACENT COMMUNITIES

Wetter adjacent communities were typically the open water of the stream. Adjacent drier wetland types include types from the *Picea* (spruce) and *Abies lasiocarpa* (subalpine fir) series. Adjacent upland types are also habitat types from the *Picea* (spruce) and *Abies lasiocarpa* (subalpine fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

This type is of limited value for livestock because of the typically dense shrub layer and partially prostrate springy stems.

Wildlife

Alnus sinuata (sitka alder) has a relatively low browse value, although it is browsed somewhat by deer (Marchant and Sherlock 1984). Cones, buds, and seeds are eaten by birds (Healy and Gill 1974).

Fisheries

Fisheries are enhanced by dense stands of the *Alnus sinuata* (sitka alder) community type. This type helps to stabilizes streambanks and lessens erosion caused by spring floods. This community type may provide cover, spawning sites, food, and cool temperatures favored by trout and other salmonoids.

Fire

Mueggler (1965) found that broadcast burning favored *Alnus sinuata* (sitka alder) in the cedar-hemlock zone of northern Idaho. Frequency and cover were especially increased on sites that had been repeatedly burned over a 30 year period. Although *Alnus sinuata* (sitka alder) invasion and persistence may be favored by fire, established plants are relatively slow to recover from burning. In cool, wet areas, *Alnus sinuata* (sitka alder) reportedly takes 5-7 years to recover from broadcast burns of moderate to severe intensity (Haeussler and Coates 1986).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment contents minimize most soil compaction problems associated with development. Management should give great consideration to maintaining this type because of its excellent streambank stabilization values.

Alnus sinuata (sitka alder) is known to sprout following cutting, but there are no studies of its sprouting behavior (Marchant and Sherlock 1984).

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site.

OTHER STUDIES

Cooper and others (1991) mention a wetland *Alnus sinuata* (sitka alder) habitat type in their discussion of *Alnus sinuata* (sitka alder) communities but do not define or describe the type. No other classifications define this type.

Artemisia cana/Agropyron smithii Habitat Type

ARTCAN/AGRSMI (ARCA13/AGSM)
Number Of Stands Sampled = 43

CAUTION — Not all sites currently dominated by *Artemisia cana* (silver sagebrush) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type occupies nearly level, older alluvial terraces on both broad and narrow floodplains and coalescing alluvial fans in valleys. It is a major type throughout central and eastern Montana, and a minor type in southwestern Montana. The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type represents one of the driest extremes of the riparian or wetland zone. Sites are either located in deep, loamy, alluvial soils, or where either overland flow or soil conditions (fine textured soils), or a combination of both, allow for a greater than normal moisture regime. In many situations, the fine textured soils have resulted in a perched water table. The *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type has been found to function as a disturbance-caused (disclimax) habitat type where site potential has changed due to prolonged heavy grazing. Sites range in elevation from 567 to 960 m (1,860 to 3,150 ft).

FLORISTIC CHARACTERISTICS

Artemisia cana (silver sagebrush) dominates the shrub layer and *Agropyron smithii* (western wheatgrass) dominates the herbaceous layer. *Stipa viridula* (green needlegrass) is important in undisturbed sites. Some sites may have dense patches of *Symphoricarpos occidentalis* (western snowberry) as an understory species in this habitat type.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Shrubs			
Artemisia cana (silver sagebrush)	38	30-40	100
Artemisia frigida (fringed sage)	1	0-1	20
Ceratoides lanata (winterfat)	1	0-1	20
Gutierrezia sarothrae (broom snakeweed)	1	0-1	20
Graminoids			
Agropyron caninum (bearded wheatgrass)	3	0-3	20
Agropyron smithii (western wheatgrass)	85	50-98	100
Bouteloua gracilis (blue grama)	1	0-1	20
Bromus japonicus (Japanese brome)	10	0-10	20
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	40
Distichlis spicata (inland saltgrass)	1	0-1	20
Koeleria cristata (prairie junegrass)	1	0-1	20
Stipa comata (needle-and-thread)	1	0-1	20
Stipa viridula (green needlegrass)	9	0-30	80
Forbs			
Achillea millefolium (common yarrow)	1	0-1	20

Conyza canadensis (horseweed)	1	0-1	20
Erigeron strigosus (branching daisy)	1	0-1	20
Grindelia squarrosa (curlycup gumweed)	1	0-1	20
Lactuca oblongifolia (blue lettuce)	1	0-1	20
Melilotus officinalis (yellow sweet-clover)	1	0-3	60
Parietaria pensylvanica (Pennsylvania pellitory)	1	0-1	20
Ratibida columnifera (prairie coneflower)	1	0-1	20
Sisymbrium altissimum (tumblemustard)	1	0-1	20
Sphaeralcea coccinea (red globe-mallow)	1	0-1	20
Taraxacum officinale (common dandelion)	1	0-1	20
Tragopogon dubius (goat's beard)	1	0-1	20
Vicia americana (American vetch)	1	0-1	20

SUCCESSIONAL INFORMATION

Following disturbance, *Poa pratensis* (Kentucky bluegrass), *Bromus japonicus* (Japanese brome), *Bouteloua gracilis* (blue grama), *Achillea millefolium* (common yarrow), and *Taraxacum officinale* (common dandelion) increase dramatically. Cover of *Agropyron smithii* (western wheatgrass) and *Stipa viridula* (green needlegrass) decreases noticeably. Palatable species still present in severely overgrazed stands are restricted to areas beneath the canopies of *Artemisia cana* (silver sagebrush).

Some sites may currently be dominated by widely spaced, decadent cottonwood communities with an understory of *Artemisia cana* (silver sagebrush) and *Agropyron smithii* (western wheatgrass). In some situations, *Symphoricarpos occidentalis* (western snowberry) may also be present. These widely spaced, decadent cottonwood communities with an understory of *Artemisia cana* (silver sagebrush) and *Agropyron smithii* (western wheatgrass) represent a mid/late seral primary successional stage of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type.

SOILS

Soil texture varies little between clay loam to loam. *Artemisia cana* (silver sagebrush) is very tolerant of imperfect drainage, high water tables and periodic flooding. Overland flows caused by spring runoff and storm events help to recharge the water table. Redox concentrations (mottles) are common, indicating a fluctuating water table. Available water is estimated at moderate. Soil reaction ranges between slightly acid to moderately alkaline (pH 6.0 to 8.0). Some sites sampled occurred on weakly saline soils.

ADJACENT COMMUNITIES

Adjacent wetter sites may be the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. In other situations, wetter sites may be dominated by cottonwoods or willows. Adjacent drier sites are dominated by a variety of upland shrub and/or grassland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is moderate to high. Palatability of *Artemisia cana* (silver sagebrush) is rated as low for cattle and fair for sheep. However, *Agropyron smithii* (western wheatgrass) is highly desired by livestock. *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982). Vigorous rhizomes make *Agropyron smithii* (western wheatgrass) one of the more tolerant of the desirable and abundant grasses to grazing pressure and drought. However, overgrazing in May and June will decrease its

abundance. When growing conditions improve, as is the case following drought or overgrazing, it may rapidly colonize areas previously occupied.

Use in winter by all types of grazing animals may be especially heavy when snow covers low growing vegetation. Many sites are used as winter grounds for livestock due to the availability of water sources (e.g. springs, streams, etc.).

Herbicides have been effective in eliminating *Artemisia cana* (silver sagebrush) and releasing the various grass species if applied when *Artemisia cana* (silver sagebrush) is phenologically active. If grazing has eliminated the more desirable grasses, broadleaf forbs may become dominant.

Wildlife

Palatability of *Artemisia cana* (silver sagebrush) is rated as good for deer, elk, and antelope, especially is the winter and when snow covers low growing vegetation. However, *Agropyron smithii* (western wheatgrass) is highly desired by wildlife such as deer and antelope. *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982).

The moderate structural diversity of the *Artemisia cana* (silver sagebrush) provides thermal and hiding cover for big game and upland bird species. In addition the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type provides food and nesting cover for sage grouse, and is an important winter habitat for antelope. Therefore, heavy grazing pressure by livestock in this habitat type may have serious consequences for antelope.

Fire

Artemisia cana (silver sagebrush) usually sprouts vigorously from root suckers following spring burns, with associated increases in the cover of the palatable grasses (White and Currie 1982). Fall burns typically have higher shrub mortality rates and reduce the vigor of *Artemisia cana* (silver sagebrush) sprouts.

Agropyron smithii (western wheatgrass) has a good tolerance to fire in the dormant state. In addition, it usually survives fires during the growing season but recovery may be delayed (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Artemisia cana (silver sagebrush) may be useful in revegetating some degraded wetland sites. It is well adapted to newly exposed soils and tolerates short periods of flooding. *Artemisia cana* (silver sagebrush) is used in seed mixtures for big game range restoration, highway stabilization and beautification, and in mine reclamation work (Wasser 1982). Establishment is through direct seeding or the use of seedlings. Seedling success rates are typically high and growth rates are rapid. It is important to reduce competition in preparing a seedbed and to reduce animal stocking and weed competition during seedling establishment period. Established plants provide a fair measure of soil stability.

Agropyron smithii (western wheatgrass) is potentially valuable for revegetating disturbed or degraded appropriate wetland sites. Using transplants will speed the recovery process as seedlings are typically slow growing. However, once established, plants will quickly spread by rhizomes.

Recreational Uses and Considerations

Recreational opportunities are excellent for both big game and upland bird hunting. Sites may offer excellent opportunities for campsites or nature trails, as long as soils do not have much clay.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = badlands range site, overflow range site, silty range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = clay pan range site, overflow range site, saline lowland range site, silty range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = clayey range site, dense clay range site, overflow range site, saline lowland range site, subirrigated range site.

OTHER STUDIES

This discussion is an expanded description of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type as defined by Hansen and others (1984) and Hansen and Hoffman (1988). Similar types have been described for the northern Great Plains by Hanson and Whitman (1938), Mackie (1970), and Jorgensen (1979).

Artemisia cana/Festuca idahoensis Habitat Type
(Silver Sagebrush/Idaho Fescue Habitat Type)

ARTCAN/FESIDA (ARCA13/FEID)
Number Of Stands Sampled = 6

CAUTION — Not all sites currently dominated by *Artemisia cana* (silver sagebrush) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) habitat type is an incidental type at mid to high elevations in the mountains and foothills of central and southwestern Montana. It typically occurs on alluvial outwash fans and on alluvial terraces. Site elevations range from 2,196 to 2,376 m (7,200 to 7,790 ft).

FLORISTIC CHARACTERISTICS

Artemisia cana (silver sagebrush) dominates the shrub layer. *Poa pratensis* (Kentucky bluegrass) and *Festuca idahoensis* (Idaho fescue) are dominant undergrowth species, with lesser amounts of *Taraxacum officinale* (common dandelion), *Potentilla gracilis* (slender cinquefoil), and *Achillea millefolium* (common yarrow) also present.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Shrubs			
Artemisia cana (silver sagebrush)	23	1-40	100

Graminoids			
Agropyron caninum (bearded wheatgrass)	8	0-20	50
Danthonia intermedia (timber oatgrass)	1	0-1	50
Festuca idahoensis (Idaho fescue)	14	0-40	50
Poa pratensis (Kentucky bluegrass)	16	0-40	67
Forbs			
Achillea millefolium (common yarrow)	1	0-3	67
Geum triflorum (old man's whiskers)	8	0-20	50
Potentilla gracilis (slender cinquefoil)	2	0-3	67
Taraxacum officinale (common dandelion)	12	0-20	67

SUCCESSIONAL INFORMATION

With disturbance, *Festuca idahoensis* (Idaho fescue) may be replaced by *Poa pratensis* (Kentucky bluegrass) and forbs such as *Taraxacum officinale* (common dandelion) and *Fragaria virginiana* (Virginia strawberry).

SOILS

Soils are Borolls formed in alluvium. Soil texture varies little between silt loam to sandy loam. Coarse fragments are common. *Artemisia cana* (silver sagebrush) is tolerant of imperfect drainage, high water tables, and periodic flooding. Redox concentrations (mottles) are common, indicating a fluctuating water table. Available water is estimated at moderate. Soil reaction ranges from slightly acid to moderately alkaline (pH 6.0 to 8.0).

ADJACENT COMMUNITIES

This habitat type represents the driest extreme of the riparian or wetland zone in central and southwestern Montana. It often intergrades with wetter sites supporting the *Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) and *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat types. Drier sites are typically uplands dominated by *Artemisia tridentata* (big sagebrush) and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) habitat type produces moderate to high amounts of forage. *Artemisia cana* (silver sagebrush) is of low palatability to cattle and of fair palatability to sheep. *Festuca idahoensis* (Idaho fescue) is moderately tolerant of grazing but can be injured by too intense early spring grazing. Mature plants are strongly competitive while seedlings are weakly competitive.

The accessibility of stands of this type may result in excessive use by livestock. Use in winter by all types of grazing animals may be especially heavy when snow covers low growing vegetation. Management based on the forage produced in this and adjacent riparian or wetland areas may be necessary to maintain or improve conditions.

Wildlife

This type, because of its productivity and proximity to wetter communities, is an important source of forage and cover for mammals, songbirds, and game birds. Palatability of *Artemisia cana* (silver sagebrush) is rated as good for deer, elk, and antelope, especially is the winter and when snow covers low growing vegetation. In addition, *Artemisia cana* (silver sagebrush) is an important food source for sage grouse and provides nesting cover. *Artemisia cana* (silver sagebrush) and *Poa pratensis* (Kentucky bluegrass) are highly palatable to mule deer (Dittberner and Olson 1983).

Fire

Artemisia cana (silver sagebrush) is a vigorous root sprouter following fires and this is not an effective method of decreasing shrub densities. However, fall burns typically have higher shrub mortality rates and reduces the vigor of *Artemisia cana* (silver sagebrush) sprouts (Hansen and others 1988).

Festuca idahoensis (Idaho fescue) is fairly tolerant of fall burning but recovery periods may be long.

Soil Management and Rehabilitation Opportunities

Any mechanical or ungulate use when soils are moist can cause soil compaction and increased bare ground. *Artemisia cana* (silver sagebrush) may be useful in revegetating degraded riparian or wetland sites. It is well adapted to newly exposed soils and tolerates short periods of flooding. *Artemisia cana* (silver sagebrush) is used in seed mixtures for big game range restoration, highway stabilization and beautification, and in mine reclamation work (Wasser 1982). Establishment is through direct seeding or the use of seedlings. Seedling success rates are typically high and growth rates are rapid. It is important to reduce competition in preparing a seedbed and to reduce animal stocking and weed competition during seedling establishment. Established plants provide a fair measure of soil stability.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site.

OTHER STUDIES

Mueggler and Stewart (1980) suggested but did not sample a similar habitat type for western Montana. Youngblood and others (1985) defined an *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) community type for eastern Idaho and western Wyoming and an *Artemisia cana/Poa pratensis* (silver sagebrush/Kentucky bluegrass) community type representing a grazing disclimax on similar sites.

Betula glandulosa/Carex rostrata Habitat Type
(Bog Birch/Beaked Sedge Habitat Type)

BETGLA/CARROS (BEGL/CARO6)

Number Of Stands Sampled = 33

LOCATION AND ASSOCIATED LANDFORMS

The *Betula glandulosa/Carex rostrata* (bog birch) habitat type is a minor type at mid elevations in western Montana. Elevations of sampled sites range from 915 to 1,701 m (3,000 to 5,580 ft). It occurs adjacent to beaver ponds, lakes, or marshes, and on seeps, swales and wet alluvial terraces adjacent to low gradient meandering streams. Sites are generally quite wet.

FLORISTIC CHARACTERISTICS

Associated shrubs in the *Betula glandulosa/Carex rostrata* (bog birch) habitat type include *Rhamnus alnifolia* (buckthorn) and various willows. The canopy cover of the shrub layer is sparse to moderate while the herbaceous layer cover is high. Understory species composition varies and is dependent primarily on water levels. Wetter sites may support *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge), while slightly drier sites may have an understory dominated by grasses.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Alnus incana (mountain alder)	7	0-10	40
Betula glandulosa (bog birch)	15	1-50	100
Cornus stolonifera (red-osier dogwood)	2	0-3	40
Potentilla fruticosa (shrubby cinquefoil)	2	0-3	40
Rhamnus alnifolia (alder buckthorn)	20	0-20	20
Ribes hudsonianum (stinking currant)	1	0-1	20
Salix geyeriana (Geyer willow)	3	0-3	40
Salix planifolia (planeleaf willow)	3	0-3	20
Salix wolfii (Wolf's willow)	1	0-1	20
Graminoids			
Calamagrostis stricta (narrow-spiked reedgrass)	10	0-10	20
Carex aquatilis (water sedge)	12	0-20	40
Carex atherodes (awned sedge)	2	0-3	40
Carex interior (inland sedge)	3	0-3	20
Carex lasiocarpa (slender sedge)	2	0-3	40
Carex leptalea (bristle-stalked sedge)	1	0-1	20
Carex limosa (mud sedge)	10	0-10	20
Carex livida (pale sedge)	40	0-40	20
Carex multicostata (many-ribbed sedge)	1	0-1	20
Carex oederi (green sedge)	1	0-1	20
Carex rostrata (beaked sedge)	11	0-30	60
Carex simulata (short-beaked sedge)	3	0-3	20
Eleocharis pauciflora (few-flowered spike-rush)	10	0-10	20
Glyceria striata (fowl mannagrass)	1	0-1	40
Juncus nodosus (tuberous rush)	3	0-3	20
Phalaris arundinacea (reed canarygrass)	1	0-1	20
Scirpus acutus (hardstem bulrush)	1	0-1	20
Scirpus americanus (American bulrush)	10	0-10	20
Forbs			
Aster junciformis (rush aster)	1	0-1	20
Aster occidentalis (western aster)	1	0-1	20
Cicuta maculata (spotted water-hemlock)	1	0-1	40
Circaea alpina (enchanter's nightshade)	10	0-10	20
Epilobium ciliatum (common willow-herb)	1	0-1	20
Galium aparine (goose-grass)	1	0-1	40

Galium boreale (northern bedstraw)	1	0-1	20
Geum macrophyllum (large-leaved avens)	1	0-1	20
Mentha arvensis (field mint)	3	0-3	40
Menyanthes trifoliata (buckbean)	7	0-10	40
Parnassia palustris (northern grass-of-parnassus)	1	0-1	20
Potentilla palustris (purple cinquefoil)	1	0-1	40
Ranunculus sceleratus (blister buttercup)	40	0-40	20
Scutellaria galericulata (marsh skullcap)	3	0-3	20
Senecio integerrimus (western groundsel)	3	0-3	20
Sparganium minimum (small bur-reed)	20	0-20	20
Triglochin maritimum (seaside arrow-grass)	1	0-1	20
Typha latifolia (common cattail)	3	0-3	20
Veronica americana (American speedwell)	1	0-1	20
Viola spp. (violet)	1	0-1	20
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	20
Equisetum laevigatum (smooth scouring-rush)	80	0-80	20

SUCCESSIONAL INFORMATION

Grazing by livestock was light for most stands sampled. Stands that are grazed suggest that heavy grazing pressures can lead to an increase in species well adapted to grazing such as *Agrostis stolonifera* (redtop), *Poa palustris* (fowl bluegrass), and *Poa pratensis* (Kentucky bluegrass).

SOILS

Soils are Histosols, are commonly flooded until mid summer, and are saturated year round on wetter sites (Hansen and others 1988). Redox concentrations (mottles) are present in most mineral soils of sites sampled; redox depletions (gleyed soil) were found on only one site. Organic matter accumulations may form floating, quaking mats as this habitat type encroaches onto open water. Drier extremes can have shallow organic horizons overlying deeper mineral soils. Water levels remain within the rooting zone throughout the summer.

ADJACENT COMMUNITIES

Wetter communities may be dominated by *Salix drummondiana* (Drummond willow), *Salix geyeriana* (Geyer willow), *Carex rostrata* (beaked sedge), or *Carex buxbaumii* (Buxbaum's sedge). Drier wetland communities support *Poa pratensis* (Kentucky bluegrass), *Populus trichocarpa* (black cottonwood), and *Potentilla fruticosa* (shrubby cinquefoil). At higher elevations, adjacent wetland forests are often dominated by *Picea engelmannii* (Engelmann spruce) or *Abies lasiocarpa* (subalpine fir). Adjacent uplands support habitat types from the *Abies lasiocarpa* (subalpine fir), *Pseudotsuga menziesii* (Douglas fir), and *Pinus ponderosa* (ponderosa pine) series, depending on elevation and aspect.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production from this type is often moderate to high. Forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor.

Overuse by livestock will result in a reduced vigor of the shrubs present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, shrubs show a sharp decline in vigor and may be eventually eliminated from the site.

Wildlife

Betula glandulosa (bog birch) is a valuable browse species for elk; use levels during the year are often moderate (Kufeld 1973).

Fisheries

The dense network of roots from *Betula glandulosa* (bog birch) and the rhizomatous *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish. In addition, *Betula glandulosa* (bog birch) may provide valuable overhanging stream cover and shade. The importance of shrubs in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool. However, it is important to remember that livestock grazing can cause degradation of streambanks. Therefore, it important to have clear, concise, and obtainable management objectives laid out ***BEFORE*** management changes are implemented.

Fire

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

The wet nature of these soils makes them highly susceptible to damage by livestock and heavy machinery. These disturbances often lead to soil compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of shrubs in protecting the streambank.

Carex rostrata (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge) all tend to for a dense, thick sod that is highly resistant to erosion. Along the stream, the sod may be undercut and sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to damage, and streambank sloughing can occur.

Recreational Uses and Considerations

This type is unsuitable for camping or hiking trails due to moist or wet conditions and organic substrates.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Betula glandulosa/Carex rostrata* (bog birch) habitat type has not been previously described. However, stands dominated by *Betula glandulosa* (bog birch) are common throughout the Rocky Mountain region (Windell and others 1986).

Betula occidentalis Community Type
(Water Birch Community Type)

BETOCC (BEOC2)
Number Of Stands Sampled = 23

LOCATION AND ASSOCIATED LANDFORMS

The *Betula occidentalis* (water birch) community type is a minor type at low to mid elevations throughout the mountains, valleys, and foothills of Montana. Stands are common along the upper Clark Fork River and the lower Blackfoot River. Sites range from 914 to 1,830 m (3,000 to 6,000 ft). It occupies alluvial terraces, streambanks, and floodplains along fast-moving (moderate to high gradient) mountain and foothill streams. In some instances, it is also located near springs and seeps.

FLORISTIC CHARACTERISTICS

Betula occidentalis (water birch) dominates the overstory of this community type. Other shrubs present may include *Cornus stolonifera*(red-osier dogwood) and *Rosa woodsii* (woods rose). A diverse mixture of disturbance-caused herbaceous species tend to dominate the community type. Common graminoids include *Poa pratensis* (Kentucky bluegrass), and *Agrostis stolonifera* (redtop).

Due to the limited number of relatively undisturbed stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula occidentalis (water birch)	52	10-98	100
Cornus stolonifera (red-osier dogwood)	11	0-40	48
Rosa woodsii (woods rose)	7	0-20	48
Graminoids			
Agrostis stolonifera (redtop)	22	0-60	52
Poa pratensis (Kentucky bluegrass)	25	0-60	48

SUCCESSIONAL INFORMATION

The *Betula occidentalis* (water birch) community type represent an early/mid seral primary successional stage. Potential for sites dominated by stands of *Betula occidentalis* (water birch) varies. Undergrowths of these stands may have formerly been dominated by native grasses such as *Calamagrostis canadensis* (bluejoint reedgrass). In some instances, this type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation. Heavy grazing pressures may cause some sites to go to the *Salix geyeriana* (Geyer willow) community type or the *Salix lutea* (yellow willow) community type. Other areas may see a gradual conversion to conifers, such as the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type. The presence and health (condition) of remnant woody or herbaceous species will indicate possible successional trends.

Disturbance Stages

Betula occidentalis (water birch) is highly adapted to most forms of disturbance. However, heavy grazing may eliminate the more palatable native graminoids, thereby replacing them with introduced species or nonpalatable native species.

SOILS

Soils are most often Entisols (Fluvents). Soil texture varies from loam to sand with abundant gravel throughout the profile. Soils are typically thin overlying river cobbles. Water tables remain near the soil surface through out the summer. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent communities include various willow and graminoid types (*Salix exigua* (sandbar willow) community type, *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) and *Carex rostrata* (beaked sedge) habitat types) and the *Juniperus scopulorum* (Rocky Mountain juniper) habitat type. Uplands are dominated by conifers such as *Picea engelmannii* (Engelmann spruce) and *Pseudotsuga menziesii* (Douglas fir), or by *Artemisia tridentata* (big sagebrush), *Festuca idahoensis* (Idaho fescue), and *Poa pratensis* (Kentucky bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage productivity varies with the density of the stand. Dense stands limit livestock use. Herbaceous species such as *Agrostis stolonifera* (redtop) and *Poa pratensis* (Kentucky bluegrass) provide spring forage. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Agrostis stolonifera (redtop) is rated as fairly good to good forage for livestock (USDA Forest Service 1937). It is tolerant of close use due to its somewhat prostrate growth form, rhizomatous growth habit, and lower palatability than associated species.

Wildlife

Linear communities of *Betula occidentalis* (water birch) provide shade and hiding cover and travel corridors for numerous wildlife species. *Betula occidentalis* (water birch) is normally only lightly browsed, but if other woody species are scarce,

use will occur. Its structural diversity also has high wildlife habitat values, especially for avian species (Youngblood and others 1985a).

Fire

Shoots of the thin barked *Betula occidentalis* (water birch) are readily killed by fire but plants resprout from uninjured basal buds. *Poa pratensis* (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment contents minimize most soil compaction problems associated with development. Management should greatly consider maintaining this type because of its excellent streambank stabilization values.

Recreational Uses and Considerations

Recreational use is associated with fisheries of adjacent streams. Access is often difficult if stands are very dense. Heavy use may increase sloughing rates.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Chadde and others (1988) described a *Betula occidentalis* (water birch) community type having a variety of undergrowth species. Padgett and others (1989) identified several *Betula occidentalis* (water birch) community types for Utah. They are *Betula occidentalis/Cornus stolonifera* (water birch/red-osier dogwood), *Betula occidentalis*/Mesic Forb (water birch/Mesic Forb), and *Betula occidentalis/Poa pratensis* (water birch/Kentucky bluegrass) community types.

Cornus stolonifera Community Type
(Red-Osier Dogwood Community Type)

CORSTO (COST4)
Number Of Stands Sampled = 16

LOCATION AND ASSOCIATED LANDFORMS

The *Cornus stolonifera* (red-osier dogwood) community type is an incidental type at low to mid elevations along steams and rivers throughout the mountainous regions of Montana. Stands are located on flat alluvial benches adjacent to moderate to high gradient streams. The community type occurs as small dense thickets, narrow bands, or irregular patches. Sites range in elevation from 716 to 1,295 m (2,350 to 4,250 ft).

FLORISTIC CHARACTERISTICS

Undisturbed stands dominated by *Cornus stolonifera* (red-osier dogwood) community type form dense, communities dominated by shrubs. When disturbance occurs, stands tend to open.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Picea spp. (spruce)	1	0-1	33
Shrubs			
Cornus stolonifera (red-osier dogwood)	67	50-90	100
Lonicera involucrata (twin-berry)	50	0-50	33
Ribes lacustre (swamp currant)	1	0-1	33
Ribes setosum (Missouri gooseberry)	1	0-1	33
Salexi exigua (sandbar willow)	1	0-1	33
Solanum dulcamara (climbing nightshade)	10	0-10	33
Symphoricarpos occidentalis (western snowberry)	1	0-1	33
Graminoids			
Agropyron repens (quackgrass)	1	0-1	33
Carex atherodes (awned sedge)	1	0-1	33
Carex rostrata (beaked sedge)	1	0-1	33
Phalaris arundinacea (reed canarygrass)	10	0-10	33
Poa palustris (fowl bluegrass)	10	0-10	33
Forbs			
Epilobium paniculatum (autumn willow-herb)	1	0-1	33
Galium triflorum (sweetscented bedstraw)	1	0-1	67
Heracleum lanatum (cow-parsnip)	1	0-1	33
Lysimachia ciliata (fringed loosestrife)	1	0-1	33
Mentha arvensis (field mint)	10	0-10	33
Potentilla flabellifolia (fan-leaf cinquefoil)	1	0-1	33
Rorippa palustris (marsh yellowcress)	3	0-3	33
Rumex crispus (curly dock)	1	0-1	33
Smilacina stellata (starry Solomon-plume)	1	0-1	33
Solidago canadensis (Canada goldenrod)	10	0-10	33
Urtica dioica (stinging nettle)	1	0-1	67

Ferns and Allies			
Equisetum hyemale (common scouring-rush)	1	0-1	33

SUCCESSIONAL INFORMATION

The *Cornus stolonifera* (red-osier dogwood) community type represents a early primary successional stage that colonizes stream bars and adjacent floodplains throughout the mountainous regions of Montana. It seems to be successional to many of the coniferous types such as the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type, and the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type.

SOILS

Soils are commonly young with little or no development overlying cobbles, and classify to either Entisols or Inceptisols. Soil texture varies little from loam to sandy loam with abundant coarse fragments throughout the soil profile. Estimates of available water are low to moderate. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or open water. Adjacent drier communities are typically dominated by a variety of upland communities dominated by the *Picea* (spruce) and *Pseudotsuga menziesii* (Douglas fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is moderate to high. However, dense stands may limit access by livestock. In some areas, livestock browsing of *Cornus stolonifera* (red-osier dogwood) may be quite high.

Wildlife

Cornus stolonifera (red-osier dogwood) is often eaten by moose (Costain 1989) and is heavily utilized by deer. In addition, beaver may use it for food and building materials (Allen 1983). The dense shrub stratum provides hiding and thermal cover for small mammals and avian species.

Fisheries

Cornus stolonifera (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured soils and high coarse fragment contents minimize most soil compaction problems associated with development. This community type is subject to recurring scouring by floods and alluvial deposition. Stands are relatively stable because of strong roots and stems. Management should emphasize the importance of *Cornus stolonifera* (red-osier dogwood) for streambank stabilization. This is particularly important on higher gradient stream channels with scouring

seasonal floods.

For revegetation of degraded sites, *Cornus stolonifera* (red-osier dogwood) is valuable as it is readily established along stream edges by direct seeding or by transplanting rooted cuttings or nursery grown seedlings. Its rapid growth quickly stabilizes deteriorated streambanks.

Recreational Uses and Considerations
Due to the possibility of seasonal flooding, campsites and building sites should be located elsewhere. However, the *Cornus stolonifera* (red-osier dogwood) community type offers good opportunities for viewing wildlife.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985b) described two similar community types for eastern Idaho and western Wyoming. In addition, Padgett and others (1989) also described a *Cornus stolonifera* (red-osier dogwood) community type for Utah and southeastern Idaho.

Crataegus succulenta Community Type
(Succulent Hawthorn Community Type)

CRASUC (CRSU5)
Number Of Stands Sampled = 22

CAUTION — Not all sites currently dominated by *Crataegus succulenta* (succulent hawthorn) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

Note: The *Crataegus succulenta* (succulent hawthorn) community type includes all combinations of *Crataegus succulenta* (succulent hawthorn) and *Crataegus douglasii* (Douglas hawthorn) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Crataegus succulenta* (succulent hawthorn) community type is a minor type at low to mid elevations throughout Montana. It occurs on alluvial terraces along streams and rivers throughout the region. In addition, stands are located in V-shaped ravines and swale like depressions where overland flows provide additional moisture. However, in some instances stands may be located on the side slopes of hillsides immediately below a spring or seep. Sites range in elevation from 670 to 1,372 m (2,200 to 4,500 ft).

FLORISTIC CHARACTERISTICS

The *Crataegus succulenta* (succulent hawthorn) community type represents a grazing disclimax. It tends to develop small, dense, impenetrable, narrow or irregular thickets. Communities dominated by *Crataegus succulenta* (succulent hawthorn) have understories of *Rosa woodsii* (woods rose), *Prunus virginiana* (common chokecherry), or *Symphoricarpos occidentalis* (western snowberry). When disturbance occurs, stands open, allowing *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), and *Poa pratensis* (Kentucky bluegrass) to increase.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Crataegus douglasii (black hawthorn)	36	0-80	75
Crataegus succulenta (succulent hawthorn)	73	0-98	27
Rosa woodsii (woods rose)	16	0-60	50
Graminoids			
Phleum pratense (common timothy)	6	0-10	41
Poa pratensis (Kentucky bluegrass)	23	0-80	50

SUCCESSIONAL INFORMATION

The *Crataegus succulenta* (succulent hawthorn) community type represents a mid seral grazing disclimax. It may be a seral stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. In other locations, it may represent a seral stage of a *Populus tremuloides* (quaking aspen) habitat type or the *Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry) habitat type. Careful observation of site characteristics and remnant plant species will assist in the determination of the site potential.

Increased disturbance leads to stands with large amounts of *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), and *Poa pratensis* (Kentucky bluegrass) present. Excessive disturbance may result in large areas of exposed soil surface.

SOILS

Soils are variable, ranging from Entisols (Torrifluvents) to Mollisols (Haploborolls and Argiborolls). Soil texture ranges from clay loam to sandy loam. Water tables are generally within 1 m (39 in) of the soil surface during spring runoff or after storm events but can fall below 1 m during dry periods. Flooding durations are usually brief, but the *Crataegus succulenta* (succulent hawthorn) community type is tolerant of poorly drained soils and prolonged flooding.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-

leaf willow) community types, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production from dense thickets is low. Stands may be so dense as to preclude most livestock use. However, cattle will eat *Crataegus succulenta* (succulent hawthorn) foliage that is within reach, as well as the associated herbaceous layer. Heavy grazing and browsing pressures will cause an increase in *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), and *Poa pratensis* (Kentucky bluegrass). Excessive disturbance may result in large amounts of exposed soil.

Wildlife

Stands of *Crataegus succulenta* (succulent hawthorn) community type have a high structural diversity, providing both thermal and hiding cover for deer. Numerous trails can be observed in most stands. This community type also supports a rich bird population even during the winter. Berries of *Crataegus succulenta* (succulent hawthorn) dry on the twigs and supply food for birds and small mammals. The characteristic branching of *Crataegus succulenta* (succulent hawthorn) is especially attractive for cover and as nesting sites for birds such as magpies and thrushes. Upland game birds such as grouse and pheasants frequently use this community type.

Fire

Crataegus succulenta (succulent hawthorn) is fire tolerant. The species has a shallow and much branched rhizomatous root system that will sprout and sucker following removal of the above ground stems.

Soil Management and Rehabilitation Opportunities

The sprouting capability of *Crataegus succulenta* (succulent hawthorn), along with the strongly rhizomatous nature of many of the associated species makes the *Crataegus succulenta* (succulent hawthorn) community type an excellent soil stabilizer.

Recreational Uses and Considerations

In terms of recreation, nature trails should be routed around dense stands of this community type. However, *Crataegus succulenta* (succulent hawthorn) may be valuable for planting in recreation areas as a biological barrier to protect physical structures, fragile natural areas, and to direct foot traffic.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, thin clayey

range site, thin sandy range site, thin silty range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have not been described elsewhere.

Kalmia microphylla/Carex scopulorum Habitat Type
(Small-leaved Laurel/Holm's Rocky Mountain Sedge Habitat Type)

KALMIC/CARSCO (KAMI/CASC12)
Number Of Stands Sampled = 12

LOCATION AND ASSOCIATED LANDFORMS

The *Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) habitat type is an incidental type at mid to high elevations in the mountains of Montana. Site elevations range from 1,951 to 2,425 m (6,400 to 7,950 ft) with slopes ranging from 0 to 4 percent. This habitat type occurs in cold, moist, low gradient mountain meadows, and along first to second order streams or lake margins in subalpine to alpine areas. The *Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) habitat type typically forms clumps or small patches, often on sites slightly higher than surrounding wetter communities, typically dominated by the *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type.

FLORISTIC CHARACTERISTICS

Kalmia microphylla (small-leaved laurel) dominates the shrub layer. The graminoid layer includes *Carex scopulorum* (Holm's Rocky Mountain sedge), *Carex nigricans* (black alpine sedge), and *Danthonia intermedia* (timber oatgrass). Forbs tend to be quite abundant in this type and include *Gentiana calycosa* (explorer's gentian), *Aster foliaceus* (leafy aster), *Dodecatheon jeffreyi* (tall mountain shooting star), and *Ligusticum tenuifolium* (slender-leafed licorice-root).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	50
Larix occidentalis (western larch)	1	0-1	25
Picea spp. (spruce)	1	0-1	25
Pinus albicaulis (white-bark pine)	1	0-1	38
Pinus contorta (lodgepole pine)	1	0-1	13
Shrubs			
Kalmia microphylla (small-leaved laurel)	24	10-60	100
Ledum glandulosum (Labrador-tea)	20	0-20	13
Phyllodoce empetriformis (red mountain-heath)	4	0-10	38
Salix eastwoodiae (Eastwood's willow)	1	0-1	13

Vaccinium scoparium (whortleberry)	5	0-10	25
Graminoids			
Agrostis humilis (alpine bentgrass)	15	0-30	25
Agrostis stolonifera (redtop)	20	0-20	13
Agrostis tenuis (colonial bentgrass)	10	0-10	13
Agrostis thurberiana (Thurber bentgrass)	27	0-30	38
Agrostis variabilis (variant bentgrass)	20	0-20	13
Calamagrostis canadensis (bluejoint reedgrass)	30	0-30	25
Carex aquatilis (water sedge)	60	0-60	13
Carex canescens (gray sedge)	1	0-1	13
Carex dioica (yellow-bog sedge)	20	0-20	13
Carex lanuginosa (woolly sedge)	3	0-3	13
Carex lenticularis (lentil-fruited sedge)	5	0-10	25
Carex leptalea (bristle-stalked sedge)	5	0-10	25
Carex luzulina (woodrush sedge)	15	0-20	25
Carex nigricans (black alpine sedge)	36	0-60	63
Carex phaeocephala (Dunhead sedge)	20	0-20	25
Carex scopulorum (Holm's Rocky Mountain sedge)	30	0-40	63
Carex spp. (sedge)	1	0-1	13
Danthonia intermedia (timber oatgrass)	13	0-20	50
Deschampsia cespitosa (tufted hairgrass)	16	0-30	63
Glyceria elata (tall mannagrass)	1	0-1	13
Juncus drummondii (Drummond's rush)	1	0-1	13
Juncus hallii (Hall's rush)	1	0-1	13
Muhlenbergia filiformis (slender muhly)	30	0-30	13
Phleum alpinum (alpine timothy)	3	0-3	13
Forbs			
Aster foliaceus (leafy aster)	28	0-50	63
Aster occidentalis (western aster)	20	0-20	13
Caltha leptosepala (elkslip marshmarigold)	25	0-30	25
Dodecatheon jeffreyi (tall mountain shooting star)	17	0-50	63
Epilobium ciliatum (common willow-herb)	1	0-1	13
Erythronium grandiflorum (glacier-lily)	1	0-1	25
Gentiana calycosa (explorer's gentian)	27	0-60	75
Hypericum formosum (western St. John's-wort)	1	0-1	13
Ligusticum spp. (lovage)	1	0-1	25
Ligusticum tenuifolium (slender-leafed licorice-root)	35	0-40	50
Lupinus argenteus (silvery lupine)	1	0-1	13
Pedicularis bracteosa (bracted lousewort)	3	0-3	13
Pedicularis groenlandica (elephant's head)	1	0-1	25
Potentilla norvegica (Norwegian cinquefoil)	17	0-30	38
Senecio triangularis (arrowleaf groundsel)	10	0-10	13
Tofieldia glutinosa (sticky tofieldia)	10	0-20	38
Veronica wormskjoldii (Wormsskjold speedwell)	1	0-1	13
Viola spp. (violet)	1	0-1	25
Xerophyllum tenax (beargrass)	1	0-1	13
Ferns and Allies			
Equisetum palustre (marsh horsetail)	3	0-3	13

SUCCESSIONAL INFORMATION

Moderate grazing and trampling by livestock or big game may increase the cover of perennial forbs (Kovalchik 1987). Continued heavy grazing may decrease the herbaceous cover with sites becoming dominated by bare ground.

Moderately disturbed sites will improve rapidly with protection due to the abundance of moisture and the dense, tough sod produced by the rhizomes of *Carex scopulorum* (Holm's Rocky Mountain sedge).

SOILS

Soils are typically Histosols, more specifically Typic or Terric Borofibrists (USDA Soil Conservation Service 1985; Montagne and others 1982). Parent materials are either bedrock or alluvium. Water tables are usually within 5 cm (2 in) of the soil surface and soils are saturated throughout the growing season. These conditions slow decomposition and favor the accumulation of organic material. Soil reaction is strongly acid (pH 5.0).

ADJACENT COMMUNITIES

Adjacent wetter communities are typically dominated by either the *Carex scopulorum* (Holm's Rocky Mountain sedge) or the *Eleocharis pauciflora* (few-flowered spike-rush) habitat type. Adjacent drier communities may include subalpine forests dominated by the *Pinus albicaulis* (white-bark pine)-*Abies lasiocarpa* (subalpine fir) habitat types, *Abies lasiocarpa/Vaccinium cespitosum* (subalpine fir/dwarf huckleberry) habitat type, or the *Abies lasiocarpa/Vaccinium scoparium* (subalpine fir/whortleberry) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Estimated herbage production is low to moderate. Short grazing seasons and continually wet soils limit livestock use. *Kalmia microphylla* (small-leaved laurel) is poisonous to cattle, sheep, and goats and is worthless as a forage (USDA Forest Service 1937).

Associated graminoids include *Carex scopulorum* (Holm's Rocky Mountain sedge) and *Carex nigricans* (black alpine sedge). Both *Carex scopulorum* (Holm's Rocky Mountain sedge) and *Carex nigricans* (black alpine sedge) produce low to moderate amounts of herbage, and are considered fair to medium palatability for livestock (Hermann 1970).

Wildlife

Landforms supporting the *Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) habitat type provide important summer habitat for deer and elk.

Fire

Wildfire is rare in this habitat type throughout the growing season. *Carex scopulorum* (Holm's Rocky Mountain sedge) will resprout from underground rhizomes following fire.

Soil Management and Rehabilitation Opportunities

The *Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) habitat type is only slightly resistant to trampling by livestock, big game, packstock, and campers. Rutting can be severe when moderate packstock or hiker use occurs on wet soils. This can result in the development of multiple, parallel trails. Off road vehicles cause serious long term damage. Care should be taken to maintain existing roads to help discourage off road travel. New trails or roads should be located on adjacent uplands.

Carex nigricans (black alpine sedge), a common sedge of this habitat type, may be valuable for revegetating high elevation meadows. Its creeping rootstock spreads and provides an excellent cover.

Recreational Uses and Considerations
The high subalpine to alpine meadows provide excellent opportunities for viewing wildlife during the summer.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved evergreen, Water Regime (nontidal) = saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = wet meadow range site.

OTHER STUDIES

Similar communities have not been described elsewhere.

Potentilla fruticosa/Deschampsia cespitosa Habitat Type
(Shrubby Cinquefoil/Tufted Hairgrass Habitat Type)

POTFRU/DESCES (POFR4/DECA5)
Number Of Stands Sampled = 76

CAUTION — Not all sites currently dominated by *Potentilla fruticosa* (shrubby cinquefoil) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type is a major type at low to high elevations in the mountains, foothills and mountain valleys of Montana. Site elevations range from 860 to 2,257 m (2,820 to 7,400 ft). This type occupies sites adjacent to glacial depressions, terraces along meandering streams, and slopes near springs and seeps. In addition, it occupies broad mountain meadows.

FLORISTIC CHARACTERISTICS

Potentilla fruticosa (shrubby cinquefoil) dominates the habitat type. *Artemisia cana* (silver sagebrush) may also be present but is usually subordinate to *Potentilla fruticosa* (shrubby cinquefoil). Herbaceous species include *Deschampsia cespitosa* (tufted hairgrass), *Potentilla gracilis* (slender cinquefoil), and *Stipa occidentalis* (western needlegrass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover Average	Range	Constancy
Trees			
Pinus contorta (lodgepole pine)	1	0-1	13
Populus tremuloides (quaking aspen)	2	0-3	25
Shrubs			
Artemisia cana (silver sagebrush)	80	0-80	13
Potentilla fruticosa (shrubby cinquefoil)	29	10-60	100
Rosa woodsii (woods rose)	1	0-1	13
Graminoids			
Agropyron caninum (bearded wheatgrass)	2	0-3	38
Alopecurus alpinus (alpine foxtail)	12	0-20	25
Calamagrostis canadensis (bluejoint reedgrass)	1	0-1	13
Calamagrostis stricta (narrow-spiked reedgrass)	20	0-20	13
Carex aquatilis (water sedge)	1	0-1	13
Carex buxbaumii (Buxbaum's sedge)	40	0-40	13
Carex microptera (small-winged sedge)	30	0-30	13
Carex pachystachya (thick-headed sedge)	40	0-40	13
Carex praegracilis (clustered field sedge)	3	0-3	13
Carex praticola (meadow sedge)	20	0-20	13
Carex rostrata (beaked sedge)	2	0-3	25
Carex simulata (short-beaked sedge)	1	0-1	13
Carex spp. (sedge)	1	0-1	13
Danthonia intermedia (timber oatgrass)	3	0-3	13
Deschampsia cespitosa (tufted hairgrass)	40	20-80	100
Hordeum brachyantherum (meadow barley)	3	0-3	13
Juncus balticus (Baltic rush)	7	0-20	50
Melica subulata (Alaska oniongrass)	1	0-1	13
Muhlenbergia filiformis (slender muhly)	20	0-20	13
Poa pratensis (Kentucky bluegrass)	9	0-20	38
Stipa occidentalis (western needlegrass)	17	0-40	50
Forbs			
Achillea millefolium (common yarrow)	1	0-1	38
Antennaria corymbosa (meadow pussy-toes)	10	0-10	13
Antennaria microphylla (rosy pussy-toes)	8	0-20	38
Aster chilensis (long-leaved aster)	2	0-3	38
Aster foliaceus (leafy aster)	3	0-3	13
Aster occidentalis (western aster)	1	0-1	13
Aster spp. (aster)	3	0-3	13
Barbarea orthoceras (American wintercress)	3	0-3	13
Cirsium scariosum (elk thistle)	2	0-3	50
Erysimum cheiranthoides (wormseed wallflower)	1	0-1	13
Fragaria virginiana (Virginia strawberry)	1	0-3	38
Galium boreale (northern bedstraw)	1	0-1	50
Gentiana spp. (gentian)	3	0-3	13
Geum macrophyllum (large-leaved avens)	1	0-3	38

Geum triflorum (old man's whiskers)	1	0-1	13
Hieracium gracile (alpine hawkweed)	1	0-1	13
Linum perenne (blue flax)	2	0-3	50
Penstemon rydbergii (Rydberg's penstemon)	10	0-10	13
Polygonum bistortoides (American bistort)	3	0-3	13
Polygonum douglasii (Douglas' knotweed)	1	0-1	13
Potentilla gracilis (slender cinquefoil)	6	0-30	75
Smilacina stellata (starry Solomon-plume)	1	0-1	13
Solidago canadensis (Canada goldenrod)	1	0-1	13
Taraxacum officinale (common dandelion)	1	0-1	13
Thalictrum spp. (meadowrue)	1	0-1	13
Valeriana edulis (edible valerian)	2	0-3	38
Ferns and Allies			
Equisetum laevigatum (smooth scouring-rush)	1	0-1	25

SUCCESSIONAL INFORMATION

With increasing disturbance, *Deschampsia cespitosa* (tufted hairgrass) will decrease and species such as *Juncus balticus* (Baltic rush), *Poa pratensis* (Kentucky bluegrass) and disturbance related forbs will increase (*Taraxacum officinale* [common dandelion] and *Fragaria virginiana* [Virginia strawberry]). Moderate levels of grazing will also cause an increase in the cover of *Potentilla fruticosa* (shrubby cinquefoil). However, heavy levels of grazing will eventually cause a decrease in the canopy cover of *Potentilla fruticosa* (shrubby cinquefoil).

SOILS

Soils are commonly Mollisols (Typic or Argic Cryoborolls) (Brichta 1987). Mollisols by definition require considerable soil development; formative elements Cryo and Bor describe a cold soil temperature regime. Together these suggest a long term stability for these sites. Soil texture varies little between clay loam and sandy loam. Water tables fluctuate widely, yet water levels usually drop below 1 m (39 in) of the soil surface by late summer. Redoximorphic features (mottling or gleyed soil) are common near 1 m (39 in) depth. Soil reaction is slightly acid to neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Adjacent wetter sites are dominated by the *Carex rostrata* (beaked sedge) habitat type and various *Salix* (willow) types. The *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) habitat type may be common on slightly drier sites. *Pinus contorta* (lodgepole pine), *Artemisia tridentata* (big sagebrush), and *Festuca idahoensis* (Idaho fescue) communities dominate nearby uplands.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Potentilla fruticosa (shrubby cinquefoil) has a low palatability for livestock. However, the vegetation associated with the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type is highly productive. Easy access may result in excessive grazing use. Heavy grazing use is typical, causing a marked decrease in the highly palatable *Deschampsia cespitosa* (tufted hairgrass) and an increase in the less palatable *Juncus balticus* (Baltic rush). *Juncus balticus* (Baltic rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

Potentilla fruticosa (shrubby cinquefoil) is tolerant of moderate defoliation by grazing, browsing, or shearing. However, it is injured by intense, repeated defoliation, especially when coupled with drought conditions.

Wildlife

Potentilla fruticosa (shrubby cinquefoil) has a low palatability for big game. However, this type, because of its widespread distribution, is an important source of forage for ungulates and as nesting and hiding cover for numerous songbird species. Value of *Potentilla fruticosa* (shrubby cinquefoil) is generally low (USDA Forest Service 1937). Winter use of *Potentilla fruticosa* (shrubby cinquefoil) by deer and elk is typically light (Gaffney 1941; Knight 1970).

Fire

Potentilla fruticosa (shrubby cinquefoil) and *Artemisia cana* (silver sagebrush) readily resprout following fire, and burning to reduce shrub densities is normally not effective.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning tends to favor rhizomatous species such as *Poa pratensis* (Kentucky bluegrass) and *Agropyron caninum* (bearded wheatgrass). Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa* (tufted hairgrass).

Soil Management and Rehabilitation Opportunities

Heavy livestock use is common in this habitat type and results in compacted soils and reduced forage production. *Potentilla fruticosa* (shrubby cinquefoil) is well adapted for revegetating disturbed streambanks and moist meadow sites. Readily established from nursery grown stock, it grows fairly quickly and provides excellent soil stability.

Deschampsia cespitosa (tufted hairgrass) has a weak, fibrous root system that is of little value for stabilizing streambanks (Youngblood and others 1985b). However, *Juncus balticus* (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes, and once established, rapidly spreads. These soil holding characteristics may make it valuable for stabilizing streambanks.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

Similar communities have been described by Mutz and Queiroz (1983), Youngblood and others (1985), Padgett and others (1989), and Chadde and others (1988). A drier, upland, *Potentilla fruticosa/Festuca idahoensis* (shrubby cinquefoil/Idaho fescue) habitat type was identified for western Montana by Mueggler and Stewart (1980).

Prunus virginiana Community Type
(Common Chokecherry Community Type)

PRUVIR (PRVI)
Number Of Stands Sampled = 25

LOCATION AND ASSOCIATED LANDFORMS

The *Prunus virginiana* (common chokecherry) community type is an incidental type at low to mid elevations along steams, rivers, lakes, and ponds throughout Montana. In some instances, stands may be located on side slopes of hillsides immediately below a spring or seep. The community type occurs as small dense thickets, narrow bands, or irregular patches. Sites range in elevation from 716 to 1,295 m (2,350 to 4,250 ft).

FLORISTIC CHARACTERISTICS

Stands dominated by *Prunus virginiana* (common chokecherry) community type form dense, monotypic stands. When disturbance occurs, stands tend to open. Associated species in open stands may include *Symphoricarpos occidentalis* (western snowberry), *Poa pratensis* (Kentucky bluegrass), *Smilacina stellata* (starry Solomon-plume), and *Taraxacum officinale* (common dandelion).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Prunus virginiana (common chokecherry)	47	1-98	100
Symphoricarpos occidentalis (western snowberry)	16	0-50	72
Graminoids			
Poa pratensis (Kentucky bluegrass)	23	0-60	40
Forbs			
Smilacina stellata (starry Solomon-plume)	9	0-20	44
Taraxacum officinale (common dandelion)	2	0-10	40

SUCCESSIONAL INFORMATION

In central and eastern Montana, the *Prunus virginiana* (common chokecherry) community type represents a mid seral grazing disclimax successional stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. Careful observation of site characteristics and remnant plant species will assist in the determination of the site potential.

Increased disturbance leads to stands with large amounts of *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), and *Poa pratensis* (Kentucky bluegrass) present. Excessive disturbance may result in large areas of exposed soil.

SOILS

Soils are variable, ranging from Entisols (Torrifluvents) to Mollisols (Haploborolls and Argiborolls). Soil texture ranges from silt to sandy loam. The *Prunus virginiana* (common chokecherry) community type is most common on well drained, older, more developed soils that afford good rooting depth and higher fertility. This type can tolerate weakly saline soils, but is intolerant of poor drainage and prolonged flooding.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

In dense, monotypic stands, forage production from the *Prunus virginiana* (common chokecherry) community type is low. The palatability of *Prunus virginiana* (common chokecherry) ranges from poor to fair for both cattle and sheep, although livestock losses due to poisoning sometimes occur. Livestock normally do not eat fatal quantities except when other forage is scarce (Wasser 1982; Johnson and Nichols 1982).

Over the years there has been some debate whether *Prunus virginiana* (common chokecherry) leaves are poisonous to livestock. The leaves and seeds do have sugars that contain cyanide. These cyanide sugars are not poisonous themselves, but when plant material is crushed, eaten or decomposed, enzymes cause hydrogen cyanide to be released (Ode 1987). In high concentrations hydrogen cyanide is a metabolic poison to most animals, including humans. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide if they consume small amounts of it over an extended period of time. Therefore, *Prunus virginiana* (common chokecherry) will poison livestock only if it is consumed in large amounts without prior exposure.

Wildlife

The moderate structural diversity of the *Prunus virginiana* (common chokecherry) community type provides thermal and hiding cover for livestock, big game, and upland bird species. *Prunus virginiana* (common chokecherry) rates fair to good as palatable browse for big game. In some instances, dwarfed and thinned communities can occur as the result of concentrations of game in winter. As stands open and herbaceous species establish due to increasing disturbance, the forage value for both livestock and wildlife increases accordingly. *Prunus virginiana* (common chokecherry) is moderately tolerant of browsing.

Prunus virginiana (common chokecherry) is among one of our most important wildlife food plants. The fruits are relished by both birds and mammals. The leaves and twigs of *Prunus virginiana* (common chokecherry) are also nutritious for browsing animals, and this shrub is rated as one of the best sources of winter browse for deer and elk (Ode 1987). This is due to the increase of protein content in the stems during the fall and winter. The leaves and stems are also higher in carbohydrates, calcium, and phosphorus than other native shrubs.

Fisheries

Prunus virginiana (common chokecherry) is an excellent shrub for providing thermal cover for fish and for controlling erosion along streams.

Fire

Prunus virginiana (common chokecherry) will survive all but a hot, intense fire. *Prunus virginiana* (common chokecherry)

has an aggressive root system and vigorously sprouts from surviving root crowns after fire (or occasionally from rhizomes).

Soil Management and Rehabilitation Opportunities
Disturbed areas can be revegetated with *Prunus virginiana* (common chokecherry) with nursery grown stock or rooted cuttings. Adapted to a wide variety of sites, transplant success rates are typically high.

Recreational Uses and Considerations
The fruit of *Prunus virginiana* (common chokecherry) is highly regarded for making wine and tasty jelly, but one must harvest ahead of the birds (Johnson and Nichols 1982). Indians ate the fruit fresh or preserved it by drying. In addition they combined it with venison and buffalo meat to make mincemeat. They also used the berries for medicinal purposes.

Because of the density of branches, twigs, and heavy foliage, communities dominated by *Prunus virginiana* (common chokecherry) provide excellent screens in recreation areas. Because of their fruits, they also provide excellent opportunities for viewing a variety of wildlife.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, silty range site, subirrigated range site, thin sandy range site, thin silty range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, thin clayey range site, thin sandy range site, thin silty range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site.

OTHER STUDIES

Similar communities have not been described elsewhere.

Rosa woodsii Community Type
(Woods Rose Community Type)

ROSWOO (ROWO)
Number Of Stands Sampled = 59

CAUTION — Not all sites currently dominated by *Rosa woodsii* (woods rose) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

Note: The *Rosa woodsii* (woods rose) community type includes all combinations of *Rosa woodsii* (woods rose) and

***Rosa acicularis* (prickly rose) due to similarities in management concerns and environmental conditions.**

LOCATION AND ASSOCIATED LANDFORMS

The *Rosa woodsii* (woods rose) community type is a major type at low to mid elevations in Montana. It occurs on alluvial floodplain terraces along streams and rivers. In addition, stands are located in V-shaped ravines and swale like depressions where overland flows provide additional moisture. However, in some instances stands may be located on the side slopes of hillsides immediately below a spring or seep. Sites range in elevation from 655 to 1,707 m (2,150 to 5,600 ft).

FLORISTIC CHARACTERISTICS

The *Rosa woodsii* (woods rose) community type represents a grazing disclimax. It usually forms dense, impenetrable stands. In some instances, the stands contain only *Rosa* species (rose), while in most cases, stands take on a two layer appearance. The upper layer is comprised of *Rosa* species (rose). The second layer, which is only slightly shorter than the *Rosa* species (rose) layer, is comprised of dense clones of *Symphoricarpos occidentalis* (western snowberry). The lowest layer is generally dominated by *Poa pratensis* (Kentucky bluegrass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Rosa acicularis (prickly rose)	19	0-50	8
Rosa woodsii (woods rose)	28	0-98	88
Symphoricarpos occidentalis (western snowberry)	25	0-80	44
Graminoids			
Poa pratensis (Kentucky bluegrass)	29	0-70	49
Forbs			
Cirsium arvense (Canada thistle)	8	0-40	42

SUCCESSIONAL INFORMATION

In central and eastern Montana, the *Rosa woodsii* (woods rose) community type represents a mid seral grazing disclimax successional stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. Once again, careful observation of site characteristics and remnant plant species will assist in the determination of the site potential.

The thorny nature of *Rosa woodsii* (woods rose) generally precludes most forms of disturbance. However, if the dense overstory is opened up, disturbance species such as *Poa pratensis* (Kentucky bluegrass) and *Achillea millefolium* (common yarrow) will invade.

SOILS

Soils vary from dry, young Entisols (Torrifluvents) to more well developed Mollisols (Argiborolls). Soil texture varies little from silt loam to sandy loam. Soils are commonly well drained and nonsaline. *Rosa woodsii* (woods rose) is intolerant of poor drainage, high water tables, and prolonged flooding (Wasser 1982).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production from dense thickets of the *Rosa woodsii* (woods rose) community type is low. Stands may be so dense that they exclude most livestock use. However, the leaves of *Rosa woodsii* (woods rose) are considered fair to fairly good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Wildlife

Stands of the *Rosa woodsii* (woods rose) community type provide good structural diversity for both thermal and hiding cover. Deer and elk may browse heavily on *Rosa woodsii* (woods rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (woods rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Fire

Rosa woodsii (woods rose) is strongly fire tolerant, except for smoldering fires with heavy volumes of surface fuel. The species has a shallow and much branched rhizomatous root system that will readily sprout and sucker. This sprouting capability of *Rosa woodsii* (woods rose) make it a good soil stabilizer. This is especially important given the severe disturbance common to areas colonized by this community type

Soil Management and Rehabilitation Opportunities

Rosa woodsii (woods rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanted materials.

Recreational Uses and Considerations

Native Americans made extensive use of *Rosa woodsii* (woods rose) roots, stems, leaves, flowers, and rose hips for food and therapeutic materials (US Forest Service 1975). The persistent rose hips are edible, and are one of the best natural sources of vitamin C. They can be dried for use in flavoring teas, jellies, fruitcakes, and puddings.

Nature trails should be routed around dense stands of *Rosa woodsii* (woods rose) community type. However, *Rosa woodsii* (woods rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, silty range site, subirrigated range site, thin sandy range site, thin silty range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, thin clayey range site, thin sandy range site, thin silty range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valley Parks, West of the Continental Divide; 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

Similar communities have not been described elsewhere.

Sarcobatus vermiculatus/Agropyron smithii Habitat Type
(Black Greasewood/Western Wheatgrass Habitat Type)

SARVER/AGRSMI (SAVE4/AGSM)
Number Of Stands Sampled = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type occupies nearly level, older alluvial terraces on both broad and narrow floodplains and coalescing alluvial fans in valleys. In addition, it may occur on rather broad expanses along flat lakeshores and playas. It is a major type throughout central and eastern Montana, and a minor type in southwestern Montana. The *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type represents one of the driest extremes of the riparian or wetland zone. Sites are where either overland flow or soil conditions (fine textured, poorly drained saline or alkaline soils), or a combination of both, allow for a greater than normal moisture regime. In many situations, the fine textured soils have resulted in a perched water table. Sites range in elevation from 655 to 1,067 m (2,150 to 3,500 ft).

FLORISTIC CHARACTERISTICS

Floristically, sites appear similar to the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type with the substitution of *Sarcobatus vermiculatus* (black greasewood) for *Artemisia cana* (silver sagebrush). The *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type is dominated by *Sarcobatus vermiculatus* (black greasewood) in the shrub layer and *Agropyron smithii* (western wheatgrass) in the herbaceous layer. Canopy cover of *Sarcobatus vermiculatus* (black greasewood) may be low, yet the stature of the plant compared to associated vegetation creates a shrubland appearance. *Sarcobatus vermiculatus* (black greasewood) is among the most alkali tolerant of the native shrubs (Johnson and Nichols 1982).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy

Shrubs			
Sarcobatus vermiculatus (black greasewood)	38	20-60	100
Graminoids			
Agropyron smithii (western wheatgrass)	46	0-60	64
Bromus japonicus (Japanese brome)	57	0-80	55
Hordeum jubatum (foxtail barley)	17	0-60	45
Poa pratensis (Kentucky bluegrass)	29	0-80	45

SUCCESSIONAL INFORMATION

Continued overgrazing reduces the amounts of *Agropyron smithii* (western wheatgrass) while *Sarcobatus vermiculatus* (black greasewood), *Bouteloua gracilis* (blue grama), *Bromus japonicus* (Japanese brome), *Bromus tectorum* (cheatgrass), and *Achillea millefolium* (common yarrow) increase. Heavy spring and summer grazing will cause a decrease in *Sarcobatus vermiculatus* (black greasewood).

SOILS

Soils are poorly drained, saline, or alkaline. Soil texture ranges from silt to clay. *Sarcobatus Vermiculatus* (black greasewood) is among the most alkali tolerant native shrubs (Johnson and Nichols 1982). *Sarcobatus vermiculatus* (black greasewood) can tolerate surface flooding for up to 40 days before showing effects of low oxygen concentration in the rooting zone. High water tables are common, typically within 25 to 30 cm (10 to 12 in) of the soil surface.

ADJACENT COMMUNITIES

Adjacent wetter sites may be the *Distichlis spicata* (inland saltgrass) habitat type, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. In other situations, wetter sites may be dominated by cottonwoods or willows. Adjacent drier sites are dominated by a variety of upland shrub and/or grassland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production for the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type ranges from low to moderate, depending on the abundance of palatable grass species. Although not very palatable, *Sarcobatus vermiculatus* (black greasewood) may be browsed by cattle in the winter (Mueggler and Stewart 1980; Johnson and Nichols 1982). Herbage has a high alkaline content, making it advisable to augment *Sarcobatus vermiculatus* (black greasewood) feed with additional forage and to provide adequate water. *Sarcobatus vermiculatus* (black greasewood) is moderately poisonous to sheep and cattle. Sheep are often poisoned in the fall by eating large amounts of fallen leaves. Toxicity increases as the plants mature in the fall. Leaves contain oxalates of potassium and sodium which cause death of livestock in four to six hours after they have been eaten. Sheep may die after eating up to two pounds of leaves while cattle may consume three to four pounds for death to occur. Heavy spring and summer grazing will cause a decrease in *Sarcobatus vermiculatus* (black greasewood).

Agropyron smithii (western wheatgrass) is highly desired by livestock. *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982). Vigorous rhizomes make *Agropyron smithii* (western wheatgrass) one of the more tolerant of the desirable and abundant grasses to grazing pressure and drought. However, overgrazing in May and June will decrease its abundance. When growing conditions improve, as is the case following drought or overgrazing, it may rapidly colonize areas previously occupied.

Wildlife

Although not very palatable, *Sarcobatus vermiculatus* (black greasewood) may be browsed somewhat by deer and antelope in the winter (Mueggler and Stewart 1980; Johnson and Nichols 1982). *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982).

The low to moderate structural diversity of the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type provides limited thermal and hiding cover for big game and upland bird species. Big game use of this habitat type occurs primarily during the winter months (Mackie 1970).

Fire

Agropyron smithii (western wheatgrass) has a good tolerance to fire in the dormant state. In addition, it usually survives fires during the growing season but recovery may be delayed (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Care must be taken with road building across the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type. Soils typically have a high clay content, causing problems with road bed stability and travel when wet. Many motorists have learned the hard way why locals do not drive across this habitat type during or just after a rain.

Sarcobatus vermiculatus (black greasewood) may be appropriate in revegetating disturbed sites having saline or alkaline soils and high water tables. However, nursery grown stock or transplanted wildlings may be difficult to establish in the field. Growth rates are typically slow. A deeply rooting habit makes this species a good soil stabilizer.

Commonly used herbicides defoliate *Sarcobatus vermiculatus* (black greasewood), but they usually resprout causing the species to be a difficult one to control.

Agropyron smithii (western wheatgrass) is potentially valuable for revegetating disturbed or degraded riparian or wetland sites. Using transplants will speed the recovery process as seedlings are typically slow growing. However, once established, plants will quickly spread by rhizomes.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = clay pan range site, panspots range site, saline lowland range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = badlands range site, dense clay range site, saline lowland range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = clay pan range site, overflow range site, saline lowland range site, silty saline range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = dense clay range site, saline lowland range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site; Foothills and Mountains, 10-14 inch Precipitation Zone = saline lowland range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = saline lowland range site.

OTHER STUDIES

This discussion is an expanded description of the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western

wheatgrass) habitat type as defined by Hansen and Hoffman (1988).

The same habitat type was described by Mueggler and Stewart (1980) and Mackie (1970) for portions of central and eastern Montana. In addition, Jorgensen (1979) described a similar habitat type for the Yellow Triangle region of Montana with the difference being the substitution of the ecologically similar *Agropyron dasystachyum* (thick-spiked wheatgrass) for *Agropyron smithii* (western wheatgrass).

Shepherdia argentea Community Type
(Thorny Buffaloberry Community Type)

SHEARG (SHAR)
Number Of Stands Sampled = 18

LOCATION AND ASSOCIATED LANDFORMS

The *Shepherdia argentea* (thorny buffaloberry) community type is a minor type at low to mid elevations in southwestern, central, and eastern Montana. It occurs on alluvial floodplain terraces along streams and rivers throughout the region. Stands can be found along the Sun, Milk, Missouri, and Yellowstone Rivers. In addition, stands are located in V-shaped ravines and swale like depressions where overland flows provide additional moisture. However, in some instances stands may be located on the side slopes of hillsides immediately below a spring or seep. Sites range in elevation from 671 to 1,143 m (2,200 to 3,750 ft).

FLORISTIC CHARACTERISTICS

The *Shepherdia argentea* (thorny buffaloberry) community type represents a grazing disclimax. It is recognized by the dominance of the spine tipped shrub *Shepherdia argentea* (thorny buffaloberry), which forms dense, nearly impenetrable thickets often exceeding 2 m (6.5 ft) in height. The understory shrub layer generally consists of *Symphoricarpos occidentalis* (western snowberry). The understory is characterized by *Poa pratensis* (Kentucky bluegrass) and *Parietaria pensylvanica* (Pennsylvania pellitory).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Ribes odoratum (buffalo currant)	28	0-60	44
Rosa woodsii (woods rose)	13	0-60	83
Shepherdia argentea (thorny buffaloberry)	73	40-98	100
Symphoricarpos occidentalis (western snowberry)	59	1-80	100
Toxicodendron rydbergii (poison ivy)	9	0-20	50
Graminoids			
Agropyron caninum (bearded wheatgrass)	14	0-20	44
Poa pratensis (Kentucky bluegrass)	60	0-98	94
Forbs			
Achillea millefolium (common yarrow)	12	0-40	56

Artemisia ludoviciana (prairie sagewort)	7	0-20	50
Monarda fistulosa (horsemint)	9	0-20	50
Parietaria pensylvanica (Pennsylvania pellitory)	30	0-80	61

SUCCESSIONAL INFORMATION

In central and eastern Montana, the *Shepherdia argentea* (thorny buffaloberry) community type represents a mid seral grazing disclimax successional stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. Careful observation of site characteristics and remnant plant species will assist in the determination of the site potential.

Disturbance by livestock and deer opens the stands thereby allowing invasion by *Symphoricarpos occidentalis* (western snowberry), *Toxicodendron rydbergii* (poison ivy), *Monarda fistulosa* (horsemint), and *Taraxacum officinale* (common dandelion).

SOILS

Soils are generally Entisols (Torrifluvents) or Mollisols (Natraquolls, Haploborolls, and Argiborolls). The *Shepherdia argentea* (thorny buffaloberry) community type occurs on a wide range of soils but is most common in moist to seasonally wet, well drained, medium to coarse textured soils. In addition, it seems to be tolerant of imperfectly drained soils and some flooding, but is intolerant of prolonged flooding and permanent high water tables.

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Shepherdia argentea* (thorny buffaloberry) community type is strongly resistant to grazing and browsing pressures due to thorny branches. Forage production for the dense, thorny, monotypic stands is quite low. As stands open, forage production increases due to the presence of *Poa pratensis* (Kentucky bluegrass). The palatability of *Shepherdia argentea* (thorny buffaloberry) is generally poor for cattle and poor to fair for sheep.

Wildlife

Forage production is rated as low for wildlife. In addition, the palatability of *Shepherdia argentea* (thorny buffaloberry) is generally rated as poor to fair for deer.

The high structural diversity of the *Shepherdia argentea* (thorny buffaloberry) community type provides both thermal and hiding cover for livestock, big game, and upland bird species. Most stands have large numbers of animal trails.

Fire

Shepherdia argentea (thorny buffaloberry) is fairly fire tolerant in the dormant state due to sprouting rootstocks (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Shepherdia argentea (thorny buffaloberry) is adapted to revegetating disturbed sites having well drained saline or alkaline soils. Nursery grown stock is readily established and growth rates are moderate. Once established, this community type provides excellent soil stabilization.

Recreational Uses and Considerations

Recreational opportunities are good to excellent for both deer and upland bird hunting. They are also excellent areas for observing various wildlife. This shrub may be valuable for plantings where a barrier is desired. The fruits are quite tasty and are eaten by birds and small animals. Native Americans and pioneers preserved the fruits for eating by drying. Today, many people use the fruits to make excellent pies, jams, and jellies.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, silty range site, subirrigated range site, thin sandy range site, thin silty range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = dense clay range site, saline lowland range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, subirrigated range site.

OTHER STUDIES

Similar communities have been described for the northern Great Plains (Boldt and others 1978; Nelson 1961; Severson and Boldt 1978; Hansen and Hoffman 1988).

Spiraea douglasii Community Type
(Douglas's Spiraea Community Type)

SPIDOU (SPDO)

Number Of Stands Sampled = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Spiraea douglasii* (Douglas's spiraea) community type is a minor type at low to mid elevations in northwestern Montana. Elevations of sampled sites range from 707 to 884 m (2,320 to 2.900 ft). It is typically located near low gradient streams on wet alluvial terraces or the wet edges of lakes or ponds.

FLORISTIC CHARACTERISTICS

The *Spiraea douglasii* (Douglas's spiraea) community type is typically comprised of dense impenetrable stands of *Spiraea douglasii* (Douglas's spiraea). Other shrub species provide limited coverages. Understory cover ranges from sparse to high. Understory species with high canopy coverages are *Carex rostrata* (beaked sedge), *Carex vesicaria* (inflated sedge), *Calamagrostis canadensis* (bluejoint reedgrass), *Phalaris arundinacea* (reed canarygrass), and *Potentilla palustris* (purple cinquefoil).

Due to the limited number of relatively undisturbed stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Alnus incana (mountain alder)	3	0-3	10
Cornus stolonifera (red-osier dogwood)	1	0-1	20
Rhamnus alnifolia (alder buckthorn)	20	0-20	10
Ribes americanum (black currant)	10	0-10	10
Rosa acicularis (prickly rose)	20	0-20	10
Rubus idaeus (red raspberry)	3	0-3	10
Salix bebbiana (Bebb willow)	3	0-3	10
Salexi exigua (sandbar willow)	1	0-1	10
Spiraea douglasii (Douglas's spiraea)	83	40-98	100
Graminoids			
Calamagrostis canadensis (bluejoint reedgrass)	80	0-80	10
Carex lasiocarpa (slender sedge)	20	0-20	10
Carex rostrata (beaked sedge)	60	0-80	20
Carex vesicaria (inflated sedge)	12	0-20	20
Glyceria grandis (American mannagrass)	3	0-3	20
Phalaris arundinacea (reed canarygrass)	30	0-30	10
Forbs			
Galium aparine (goose-grass)	1	0-1	10
Geum macrophyllum (large-leaved avens)	3	0-3	10
Impatiens aurella (orange balsam)	3	0-3	10
Mentha arvensis (field mint)	3	0-3	10
Parnassia fimbriata (fringed grass-of-parnassus)	10	0-10	10
Potentilla palustris (purple cinquefoil)	40	0-40	10
Stellaria spp. (starwort)	1	0-1	10

SUCCESSIONAL INFORMATION

Further sampling and stand data analysis is needed to determine whether the *Spiraea douglasii* (Douglas's spiraea) community type is seral or climax. Kovalchik (1987) describes an *Alnus incana/Spiraea douglasii* (mountain alder/Douglas's spiraea) association for Oregon.

SOILS

Soils are commonly Entisols (Fluvents) or Inceptisols (Aquepts). Soil texture varies widely between silty clay to sandy loam. Profiles remain moist to wet throughout the growing season with redox concentrations (mottles) common in soils of most sites.

ADJACENT COMMUNITIES

Adjacent wetter communities include the *Phalaris arundinacea* (reed canarygrass), *Carex rostrata* (beaked sedge), and *Equisetum fluviatile* (water horsetail) habitat types or open water. Adjacent drier communities range from communities

dominated by *Scirpus microcarpus* (small-flowered bulrush) to sites supporting habitat types from the *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), and *Picea* (spruce) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Spiraea douglasii* (Douglas's spiraea) community type is of limited value for livestock because of the typically dense shrub layer and high water tables. Use of *Spiraea douglasii* (Douglas's spiraea) by livestock is normally minor (USDA Forest Service 1937). The species often retains its leaves well into the fall, and some browsing may occur at that time.

Understory production depends on the density of overstory shrubs and the water level. Livestock forage value of *Carex rostrata* (beaked sedge) is variable, depending upon season, previous grazing use, and the extent of the site. *Carex vesicaria* (inflated sedge) appears to be more palatable and may be grazed in mid to late summer, especially as upland vegetation dries. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland plants are cured, or where livestock distribution and stocking rate problems occur. Herbage production from *Phalaris arundinacea* (reed canarygrass) is high. However, the palatability of the coarse *Phalaris arundinacea* (reed canarygrass) is only low to moderate.

Wildlife

Species of *Spiraea* are generally not used by elk (Gaffney 1941).

Fire

Spiraea douglasii (Douglas's spiraea) readily sprouts following fire.

Soil Management and Rehabilitation Opportunities

Sites with fine textured soils are highly susceptible to compaction associated with livestock and vehicular traffic. This community type is subject to recurring scouring by floods and alluvial deposition. Stands are relatively stable because of strong roots and stems of sites with good vegetational cover.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Communities not dominated by *Spiraea douglasii* (Douglas's spiraea) but with high amounts of *Spiraea douglasii* (Douglas's spiraea) have been described by Kovalchik (1986) for central Oregon and by Youngblood and others (1985) for eastern Idaho and western Wyoming.

Symphoricarpos occidentalis Community Type
(Western Snowberry Community Type)

SYMOCC (SYOC)
Number Of Stands Sampled = 55

CAUTION — Not all sites currently dominated by *Symphoricarpos occidentalis* (western snowberry) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Symphoricarpos occidentalis* (western snowberry) community type is a major type at low to mid elevations in Montana. It occurs on alluvial floodplain terraces along streams and rivers. In addition, stands are located in V-shaped ravines and swale like depressions where overland flows provide additional moisture. However, in some instances stands may be located on the side slopes of hillsides immediately below a spring or seep. Sites range in elevation from 594 to 1,143 m (1,950 to 3,750 ft).

FLORISTIC CHARACTERISTICS

Typically, the roots of *Symphoricarpos occidentalis* (western snowberry) are densely branched and found mostly near the soil surface. They are intermixed with stout, spreading rhizomes, thereby forming dense, thickets. Large, dense patches often exclude other forms of vegetation. *Symphoricarpos occidentalis* (western snowberry) thrives in nearly full sunlight. The undergrowth (if there is any at all) is comprised of depauperate looking *Poa pratensis* (Kentucky bluegrass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Rosa woodsii (woods rose)	17	0-60	51
Symphoricarpos albus (common snowberry)	21	0-80	7
Symphoricarpos occidentalis (western snowberry)	66	0-98	91
Graminoids			
Poa pratensis (Kentucky bluegrass)	28	0-80	60

SUCCESSIONAL INFORMATION

The successional status of the *Symphoricarpos occidentalis* (western snowberry) community type is confusing. At many sites in central and eastern Montana, the *Symphoricarpos occidentalis* (western snowberry) community type generally represents a mid seral grazing disclimax successional stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. At other locations, the *Symphoricarpos occidentalis* (western snowberry) community type seems to represent a long-lived mid seral stage that was not influenced by heavy grazing pressures. Future work may bring insight into the ecological

status of this community type.

Disturbance Stages
Heavy grazing or browsing pressures will open up stands allowing disturbance species such as *Poa pratensis* (Kentucky bluegrass) to increase. In addition, weedy species such as *Bromus japonicus* (Japanese brome), *B. tectorum* (cheatgrass), or *Achillea millefolium* (common yarrow) may invade.

SOILS

Soils are quite variable and include Entisols (Torrifluvents), and Mollisols (Haploborolls, and Argiborolls). The *Symphoricarpos occidentalis* (western snowberry) community type occurs on virtually all soil textures except sand. This community type is also tolerant of imperfectly drained soils and short duration floods, but is intolerant of prolonged floods and permanent high water tables. Soil reaction ranges between slightly acid to mildly alkaline (pH 6.0 to 8.0) (Wasser 1982).

ADJACENT COMMUNITIES

Adjacent wetter communities may include the cottonwood, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types, or the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) or *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat types. Some wetter communities may include the *Salix lutea* (yellow willow) dominated habitat types. Adjacent drier communities are typically dominated by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock
Forage production for dense, monotypic stands is low. As stands open, forage production increases accordingly due to the presence of *Agropyron smithii* (western wheatgrass) and *Poa pratensis* (Kentucky bluegrass). The palatability of *Symphoricarpos occidentalis* (western snowberry) ranges from low to fair for cattle and sheep (Wasser 1982; Johnson and Nichols 1982).

Wildlife
The moderate structural diversity of the *Symphoricarpos occidentalis* (western snowberry) community type provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (western snowberry) is rated as good for deer and elk (Wasser 1982; Johnson and Nichols 1982).

Fisheries
This community type offers excellent streambank stabilization due to the rhizomatous nature of *Symphoricarpos occidentalis* (western snowberry).

Fire
Symphoricarpos occidentalis (western snowberry) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation.

Soil Management and Rehabilitation Opportunities
Symphoricarpos occidentalis (western snowberry) is well adapted for revegetating sites. Commonly growing in dense colony stands makes it suitable for disturbed land stabilization. It does best on moist, well drained soils which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erosive sites may need complete exclusion from grazing during establishment, and animal populations and stacking rates should be balanced with forage

supply on noncritical sites after establishment (Wasser 1982).

Recreational Uses and Considerations

Recreational opportunities are good to excellent for both big game and upland bird hunting. Because the fruits persist into the winter, *Symphoricarpos occidentalis* (western snowberry) is an important food source for upland birds.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, silty range site, subirrigated range site, thin silty range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, thin clayey range site, thin sandy range site, thin silty range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valley Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

Similar communities have been described for Minnesota (Pelton 1953) and the northern Great Plains (Hansen and others 1984; Hansen and Hoffman 1988).

Tamarix chinensis Community Type
(Salt Cedar Community Type)

TAMCHI (TACH)

Number Of Stands Sampled = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Tamarix chinensis* (salt cedar) community type is an incidental type at low elevations on floodplains of the major rivers and streams in central and eastern Montana. Throughout its current distribution in both Canada and the United States, *Tamarix chinensis* (salt cedar) has not become a major problem along colder, high elevation streams in Canada and the United States or along low elevational streams in northern Canada. *Tamarix chinensis* (salt cedar) generally grows best in the warmer climate of the semiarid Southwestern United States, reaching its greatest extent along major lowland watercourses such as the Colorado and Rio Grande Rivers and many of their tributaries such as the Pecos and Salt Rivers (Kunzmann and Bennett 1989). In Montana, stands of this community type are located along the Yellowstone River and some of its major tributaries (Powder River, Tongue River, Bighorn River, and Little Bighorn River) and along the Missouri River north of

Lewistown. In addition, stands can be found along the shoreline of the Fort Peck Reservoir and some of its tributaries including Bug Creek and Hell Creek south of Glasgow.

GENERAL CHARACTERISTICS

Tamarix chinensis (salt cedar), a shrub native to the Mediterranean area, was first introduced into the United States in the early 1800's (Robinson 1958) and soon spread throughout the United States. The first plants were apparently introduced by nurserymen who planted them as ornamentals, windbreaks, and for stabilizing streambanks. It was the latter practice and the ability of *Tamarix chinensis* (salt cedar) to spread rapidly from seeds that allowed it to become naturalized and to become widely established as a noxious weed species. Most dramatic is its invasion of the floodplains of the Southwestern United States rivers where it has become a major vegetation type. These stands attracted little attention initially until it was realized that *Tamarix chinensis* (salt cedar) uses large amounts of water (Horton 1973).

The early pioneers to the Southwest used the *Populus* species (cottonwood), *Prosopis* species (mesquite), and other trees and larger shrubs for fuel and for building their homes. These activities soon removed or at least greatly reduced the natural wooded areas along the rivers. This resulted in the *Tamarix chinensis* (salt cedar) finding ideal conditions for rapid invasion of the floodplains (Horton 1977).

Tamarix chinensis (salt cedar) is usually found in similar locations as *Populus* species (cottonwoods) and *Salix exigua* (sandbar willow). Seeds of *Populus* species (cottonwoods) and *Salix* species (willows) have characteristics similar to *Tamarix chinensis* (salt cedar). Therefore, in theory they would be considered highly competitive. However, *Tamarix chinensis* (salt cedar) produces seeds over a much longer period and can become established in the end of the summer during low flow regimes when seeds of the other species are not present. In addition, *Tamarix chinensis* (salt cedar) seedlings tolerate drying at an earlier stage and, while often grazed, are less sought after than *Populus* species (cottonwoods) and *Salix* species (willows).

Tamarix chinensis (salt cedar) produces phenomenal quantities of seeds which are minute and readily wind dispersed. It has been estimated that a mature *Tamarix chinensis* (salt cedar) plant can produce 1-2 million seeds annually (Hoddenbach 1989). *Tamarix chinensis* (salt cedar) seeds produced during the summer remain viable for up to 45 days under ideal field conditions (moist soils and full sunlight), or as little as 24 days when exposed to full sunlight and drying conditions (Stevens 1989). Winter field longevity under ideal conditions is approximately 130 days. Seed mortality is generally due to desiccation.

Tamarix chinensis (salt cedar) seeds germinate equally well in light or dark. If seeds are not germinated during the first summer, almost none germinate the following spring. Seeds require no dormancy or light requirements but only germinate on moist soil. Seeds germinate after soaking for two hours (Stevens 1989).

Tamarix chinensis (salt cedar) seedlings may flower in their first year of growth (Warren and Turner 1975), but most begin to reproduce in their third year or later.

All of the aboveground portions of *Tamarix chinensis* (salt cedar) will develop adventitious roots and form new shrubs if kept in moist soil (Gary and Horton 1965). Gary and Horton (1965) found that 100 percent of stem cuttings would sprout at all times of the year if kept moist and warm. If stem cuttings are allowed to dry, even for as little as one day, the sprouting capability is quickly reduced. In addition, any high stress (fire, drought, chemicals, cutting, etc.) greatly increases flowering and seed production as well as plant distribution. Therefore, prolific seed production along with the ability of broken branches to take root on moist substrates has given *Tamarix chinensis* (salt cedar) a competitive edge which has aided in its rapid expansion throughout the West.

Mature *Tamarix chinensis* (salt cedar) shrubs are more drought resistant than native species. They are also long lived. In New Mexico, individual shrubs reportedly 75 to 100 years of age have not yet shown signs of deterioration due to age

(Horton 1977).

SUCCESSIONAL INFORMATION

Since the total land area occupied by *Tamarix chinensis* (salt cedar) in Montana is quite small but expanding, we are unable at this time to determine whether the extremely competitive nature of the pioneer species *Tamarix chinensis* (salt cedar) will allow normal seral plant communities to occupy the sites. We need only look at states to the south of Montana to realize the magnitude of the problem. In those states, *Tamarix chinensis* (salt cedar) has interrupted the normal successional pathways and is not only maintaining its land area, but is continuing to increase dramatically.

SOILS

Soils are Entisols or rarely Mollisols and consist of thin sandy loams overlying deep sand, gravel, or cobbles. Surface soils are usually moist in the spring and early summer; subsoils can remain saturated throughout the growing season. Stands of *Tamarix chinensis* (salt cedar) can survive in salinities exceeding 50,000 ppm (Stevens 1989).

ADJACENT COMMUNITIES

Wetter communities are usually absent. Adjacent drier communities include the *Populus trichocarpa* (black cottonwood), *Populus angustifolia* (narrowleaf cottonwood), *Populus deltoides* (Great Plains cottonwood), *Salix geyeriana* (Geyer willow), and *Poa pratensis* (Kentucky bluegrass) types. Upland communities are dominated by shrubs and grasses such as *Artemisia tridentata* (big sagebrush), *Artemisia cana* (silver sagebrush), *Sarcobatus vermiculatus* (black greasewood), *Agropyron smithii* (western wheatgrass), and *Stipa comata* (needle-and-thread).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Management problems generally associated with *Tamarix chinensis* (salt cedar) include (Hoddenbach 1989):

1) It grows up to 0.3 m (1 ft) per month with most of the growth occurring in the early spring and leveling off sharply by midsummer. This rapid growth crowds or shades out native species such as *Populus* species (cottonwoods) and *Salix* species (willows).
2) It is more resistant to drought than most native species and can therefore out compete them. This is especially a problem along streams below dams and other water diversions where flow regimes are modified.
3) *Tamarix chinensis* (salt cedar) not only tolerates excessive salinity in water or soil but also excretes salt from openings in scale like leaves. This salt falls to the ground and kills emerging grasses and seedlings of other species.
4) It is not killed by fire or cutting at the ground level followed by application of foliage herbicide. The root system must be killed in order to prevent resprouting.
5) Dense stands can block streams thereby causing increased sedimentation and flooding potentials. In optimum conditions, riparian areas may be converted to an impenetrable *Tamarix chinensis* (salt cedar) thicket in less than one decade.
6) *Tamarix chinensis* (salt cedar) is a high user of water through evapotranspiration. Dense stands of *Tamarix chinensis* (salt cedar) can transpire up to 7.2 acre feet of water per year, depending on water table depths and stage of growth.
7) Stands of *Tamarix chinensis* (salt cedar) alter wildlife habitat by reducing vegetative diversity and thereby reducing the number of wildlife species present.

Tamarix chinensis (salt cedar) seedlings, which can withstand extreme environmental stress, are more competitive than those of *Populus* species (cottonwoods) and *Salix* species (willows) (Lindauer 1983). *Tamarix chinensis* (salt cedar) also is reported to have allopathic properties that affect *Populus* species (cottonwoods), *Salix* species (willows), and other vegetation (Lindauer 1983).

Livestock

In a study of the effect of grazing on the resprouting of *Tamarix chinensis* (salt cedar), cattle removed approximately 40 percent of the foliage produced. The shrubs still grew vigorously, however, and by the second year the stand became so dense that cattle would not enter the area (Gary 1960). Cattle and sheep tend to browse heavily on young seedlings as well as the more mature plants if the stand is open.

Wildlife

Extensive stands of *Tamarix chinensis* (salt cedar) lack the structural diversity and food sources associated with mixed *Populus* species (cottonwoods) stands (Anderson and others 1978; Beidleman 1978). *Tamarix chinensis* (salt cedar) has a very low crude protein content and the dense stands shade out most understory species. Although bank beavers will eat young shoots of *Tamarix chinensis* (salt cedar), they choose *Populus* species (cottonwoods) and *Salix* species (willows) over *Tamarix chinensis* (salt cedar) by about 9 to 1, thereby continually transforming a floodplain habitat to a *Tamarix chinensis* (salt cedar) dominance (Hoddenbach 1989).

Fire

The sole use of fire to control *Tamarix chinensis* (salt cedar) is generally ineffective. High water and salt content make *Tamarix chinensis* (salt cedar) difficult to burn. In addition, the plant is very fire tolerant. Burning a *Tamarix chinensis* (salt cedar) stand will not kill the shrubs, as they tend to sprout vigorously and will grow as much as 3 to 4 m (9 to 12 ft) in a year under favorable conditions. Under stressed conditions, as many as half of the shrubs may not survive after burning (Horton 1977). A burn at Lees Ferry, Arizona (Stevens 1989) had 90 percent of the mature plants survive a hot canopy fire. Resprouting shoots exceeded 2 m (6 ft) in height within 5 months. In addition, Stevens observed the phenomenon of stress induced flowering at the burn site: 69.4 percent of 144 burned plants were blooming heavily, while only 10.9 percent of 101 unburned plants on adjacent control areas were blooming.

Along the Arkansas River floodplain, *Tamarix chinensis* (salt cedar) invasion has been compounded by an increase in the frequency of wildfires in recent decades (Snyder and Miller 1991). These fires, fueled by dense stands of *Tamarix chinensis* (salt cedar), damaged or killed many *Populus* species (cottonwoods), including whole stands, resulting in rapid regrowth of *Tamarix chinensis* (salt cedar) from rootsprouts. This adaptation by *Tamarix chinensis* (salt cedar) to resprout rapidly following fire has been credited for its rapid colonization of water courses throughout the Southwest (Crins 1989).

Soil Management

Sites with well drained, coarsely textured soils are less susceptible to compaction, although activities should be scheduled to avoid high water periods. Fine textured soils are subject to compaction when moist. During spring runoff or after storm events when water tables are high, fine textured soils are most susceptible to compaction by vehicular traffic or livestock.

Control Methods

Control of *Tamarix chinensis* (salt cedar) is difficult and expensive (Hoddenbach 1989). Any high stress (fire, drought, chemicals, cutting, etc.) greatly increases flowering and seed production as well as plant distribution. Floods do, at times, remove large areas of *Tamarix chinensis* (salt cedar). If this occurs during or just before the seeds are flying, seedlings will likely become established along the edges of the receding flows more aggressively than other species. Sometimes, such as after summer flash floods, drying is too rapid for seedling survival. Buried root crowns or above ground portions of branches and smaller stems will often sprout even if conditions are not favorable for seedling establishment. Although *Tamarix chinensis* (salt cedar) is able to survive inundation for as long as three years in cold, well oxygenated water, flooding for 24 months or for two to three growing seasons in the warm environments of southwestern United States has been shown to be 99 percent effective in controlling its survivability rate.

Manual methods of *Tamarix chinensis* (salt cedar) removal typically involve hand tools for cutting the vegetation above and below ground. Tools include axes, brush hooks, pry bars, clippers, spades, and chainsaws. Manual methods, while effective if carefully done, are time intensive activities best suited for small areas. Generally, manual techniques are not cost effective

over large areas.

Mechanical methods usually involve equipment with tractor mounted blades. These methods can be categorized based upon their potential for soil disturbance by erosion, compaction, soil mineral alteration, and nutrient loss (Kunzmann and Bennett 1989). Examples of mechanical methods would include high disturbance techniques such as mowing, chopping, shearing, scarifying, ripping, piling, raking, and slope disking. Equipment availability, operating costs, site location, and topography limit and reduce the cost effectiveness of these techniques. Great care must be taken due to the tremendous resprouting capability of *Tamarix chinensis* (salt cedar).

Limited control of *Tamarix chinensis* (salt cedar) can be obtained using a specific repeat burning regime (Hoddenbach 1989). Burning every other year was found to reduce the competitive ability of *Tamarix chinensis* (salt cedar) on the Ouray National Wildlife Refuge, Vernal, Utah. Very hot burns may kill the plant. July fires at the Ouray National Wildlife Refuge prevented resprouting by 64 percent in the year following the burn, while September and October fires prevented resprouting by only 9 percent and 4 percent respectively. Spraying following the July fire prevented 99 percent of resprouting. Spraying following the September and October burns prevented resprouting by 12 percent and 5 percent, respectively. The difference in fire response may be due in part to morphological or physiological condition of the plants and/or a different heat intensity associated with each fire. The July fire was a hotter fire due to lower wind speed and a lower moisture content of the fuel. Spraying after the July burn was effective because the plants were defoliated, the root crown buds sprouted, and the chemical (2,4-D) was readily translocated to the roots. Previous efforts to control *Tamarix chinensis* (salt cedar) by burning showed limited success because the plants were dormant at the time of the burn and were able to resprout from basal stem buds. In general, most fires tend to be too cool to do serious damage to the basal stem buds (Hoddenbach 1989).

Tamarix chinensis (salt cedar) shrubs along frequently flooding streams and rivers can be very difficult to kill with herbicides and may require repeated treatments. *Tamarix chinensis* (salt cedar) on moist floodplains may be more difficult to kill and require at least three treatments. The root systems are more extensively developed near the ground surface, due to repeated scouring and removal of limbs by floods, and can send up shoots where none existed at the time of initial treatment (Neill 1989). When surveying resprout densities, it is important to remember that without herbicides, each cut stump can send up 10 to 30 shoots. Therefore, if a treated stump produces only one or several resprouts, then the herbicide has performed quite well by killing most of the root system. Any high stress (fire, drought, chemicals, cutting, etc.) greatly increases flowering and seed production as well as plant distribution. Therefore systemic herbicides need to be used ***BEFORE*** the flowers mature. In southwestern United States, Hoddenbach (1989) states that the best time for herbicide treatment is in the winter because *Tamarix chinensis* (salt cedar) is dormant and not translocating large quantities of water from the roots due to high evapotranspiration rates. Spring is least desirable due to the large upward flow of sap and the lack of translocation of the herbicides to the root system.

A combination of root plowing, raking, burning, and chemical treatment may be an acceptable control method. However, it must include a program of repeated treatments for successful control and management.

Finally, another effective removal involves the mechanical uprooting of the shrubs followed by cutting at the ground level. The stump is then treated with an application of systemic herbicide. The cut stump application, although costly, is very controlled, doesn't effect nontarget organisms, and causes the least environmental impact. Foliar applications are less expensive, but the degree of control is much more variable.

Rehabilitation Opportunities

Replacing *Tamarix chinensis* (salt cedar) with native species may lessen or delay recolonization. *Tamarix chinensis* (salt cedar) is classified as an invader or an increaser species. After *Tamarix chinensis* (salt cedar) invades an area, it alters the habitat so other native species may not survive. Habitat alteration favorable to *Tamarix chinensis* (salt cedar) includes the salinization of soil surfaces from the leaves.

Preliminary results and field observations by Stevens (1989) indicate that older *Tamarix chinensis* (salt cedar) are tolerant of water and nutrient stresses, but are highly susceptible to shading. Shaded plants have greatly altered leaf morphology and reduced reproductive efficiency. In southern New Mexico, Campbell and Dick-Peddie (1964) observed that *Populus* species (cottonwood) assume dominance over *Tamarix chinensis* (salt cedar) if the *Populus* species (cottonwood) is left to develop into a full tree without disturbance. Dense stands of *Salix* species (willows) can greatly reduce the growth of *Tamarix chinensis* (salt cedar) (Hoddenbach 1989). In mature stands of *Populus* species (cottonwood), *Tamarix chinensis* (salt cedar) grows only in natural openings and along the outer edge of the stand.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, thin clayey range site, thin sandy range site, thin silty range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site, wet meadow range site.

OTHER STUDIES

Similar communities have been described along the South Platte and Arkansas Rivers in eastern Colorado (Lindauer 1983; Synder and Miller 1991). In addition, numerous locations throughout southwestern United States were described in a proceedings on tamarisk control (Kunzmann and others 1989).

Carex aquatilis Habitat Type
(Water Sedge Habitat Type)

CARAQU (CAAQ)
Number Of Stands Sampled = 68

(*Carex aquatilis* (Water Sedge) Phase = 39 stands)
(*Deschampsia cespitosa* (Tufted Hairgrass) Phase = 29 stands)

Note: The *Carex aquatilis* (water sedge) habitat type includes all combinations of *Carex aquatilis* (water sedge) and *Carex lenticularis* (lentil-fruit sedge) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex aquatilis* (water sedge) habitat type is a minor type throughout Montana. Sites range in elevation from 701 to 2,265 m (2,300 to 7,340 ft). It occurs on broad flat benches or valley bottoms immediately adjacent to open water. It may grade into the *Carex rostrata* (beaked sedge) habitat type with a slight increase in the water table. Like the *Carex rostrata* (beaked sedge) habitat type, sites are often silted in beaver ponds, old oxbow lakes, depressions left by migrating stream channels, or narrow bands adjacent to small streams.

FLORISTIC CHARACTERISTICS

Two phases have been identified for the *Carex aquatilis* (water sedge) habitat type. The *Carex aquatilis* (water sedge) phase occurs on slightly wetter sites than the *Deschampsia cespitosa* (tufted hairgrass) phase. The *Carex aquatilis* (water sedge) phase includes *Carex aquatilis* (water sedge) and *Calamagrostis stricta* (narrow-spiked reedgrass). Within the *Deschampsia cespitosa* (tufted hairgrass) phase, *Deschampsia cespitosa* (tufted hairgrass) is the major graminoid.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Carex aquatilis (water sedge) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula glandulosa (bog birch)	1	0-1	4
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	4
Rosa spp. (rose)	1	0-1	4
Salix bebbiana (Bebb willow)	3	0-3	4
Salix boothii (Booth willow)	2	0-3	8
Salix candida (hoary willow)	3	0-3	4
Salix drummondiana (Drummond willow)	1	0-1	4
Salix geyeriana (Geyer willow)	2	0-3	13
Salix planifolia (planeleaf willow)	1	0-3	13
Graminoids			
Agrostis humilis (alpine bentgrass)	1	0-1	4
Calamagrostis stricta (narrow-spiked reedgrass)	2	0-3	8
Carex aperta (Columbia sedge)	94	0-98	8

Carex aquatilis (water sedge)	69	0-98	88
Carex canescens (gray sedge)	3	0-3	4
Carex diandra (lesser-panicled sedge)	3	0-3	4
Carex illota (sheep sedge)	1	0-1	4
Carex lenticularis (lentil-fruited sedge)	80	0-80	4
Carex rostrata (beaked sedge)	12	0-20	29
Carex saxatilis (russet sedge)	30	0-30	4
Carex simulata (short-beaked sedge)	37	0-60	13
Carex vesicaria (inflated sedge)	14	0-20	13
Deschampsia cespitosa (tufted hairgrass)	2	0-3	25
Eleocharis palustris (common spikesedge)	1	0-1	4
Glyceria striata (fowl mannagrass)	1	0-1	4
Juncus balticus (Baltic rush)	2	0-3	10
Juncus regelii (Regel's rush)	10	0-10	4
Phleum alpinum (alpine timothy)	1	0-1	4
Poa palustris (fowl bluegrass)	1	0-1	4
Forbs			
Aster occidentalis (western aster)	1	0-1	4
Caltha leptosepala (elkslip marshmarigold)	3	0-3	4
Dodecatheon pulchellum (few-flowered shooting star)	1	0-1	4
Epilobium ciliatum (common willow-herb)	1	0-1	13
Epilobium palustre (swamp willow-herb)	2	0-3	8
Galium trifidum (small bedstraw)	1	0-1	4
Geum macrophyllum (large-leaved avens)	2	0-3	8
Mentha arvensis (field mint)	3	0-3	4
Mentha spp. (mint)	3	0-3	4
Pedicularis groenlandica (elephant's head)	3	0-3	4
Polemonium occidentale (western polemonium)	1	0-1	4
Polygonum amphibium (water smartweed)	3	0-3	4
Potentilla gracilis (slender cinquefoil)	10	0-10	4
Potentilla spp. (cinquefoil)	3	0-3	4
Ranunculus natans (floating water-buttercup)	3	0-3	4
Rumex crispus (curly dock)	2	0-3	8
Senecio hydrophilus (alkali-marsh butterweed)	1	0-1	4
Stellaria longipes (longstalk starwort)	1	0-1	4
Triglochin maritimum (seaside arrow-grass)	1	0-1	4
Typha latifolia (common cattail)	1	0-1	4
Viola spp. (violet)	1	0-1	8
Ferns and Allies			
Equisetum fluviatile (water horsetail)	20	0-20	4

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Deschampsia cespitosa (tufted hairgrass) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

	% Canopy Cover		
Species	**Average**	**Range**	**Constancy**

Shrubs			
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	17
Salix bebbiana (Bebb willow)	3	0-3	17
Salix boothii (Booth willow)	1	0-1	17
Salix geyeriana (Geyer willow)	1	0-1	17
Salix lasiandra (Pacific willow)	3	0-3	17
Salix planifolia (planeleaf willow)	1	0-1	17
Graminoids			
Alopecurus alpinus (alpine foxtail)	1	0-1	17
Beckmannia syzigachne (American sloughgrass)	1	0-1	17
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	33
Carex aquatilis (water sedge)	60	30-90	100
Carex canescens (gray sedge)	1	0-1	17
Carex lenticularis (lentil-fruit sedge)	47	0-90	10
Carex simulata (short-beaked sedge)	30	0-30	17
Carex spp. (sedge species)	1	0-1	17
Deschampsia cespitosa (tufted hairgrass)	28	10-60	100
Eleocharis palustris (common spikesedge)	3	0-3	17
Hordeum brachyantherum (meadow barley)	1	0-1	17
Juncus balticus (Baltic rush)	1	0-1	17
Phleum alpinum (alpine timothy)	1	0-1	17
Poa cusickii (Cusick's bluegrass)	1	0-1	17
Poa palustris (fowl bluegrass)	20	0-20	17
Forbs			
Achillea millefolium (common yarrow)	1	0-1	17
Aster occidentalis (western aster)	1	0-1	50
Epilobium spp. (willow-herb)	1	0-1	17
Erigeron peregrinus (subalpine daisy)	1	0-1	17
Galium trifidum (small bedstraw)	1	0-1	17
Geum macrophyllum (large-leaved avens)	1	0-1	33
Mentha arvensis (field mint)	3	0-3	33
Pedicularis groenlandica (elephant's head)	3	0-3	17
Polemonium occidentale (western polemonium)	1	0-1	17
Polygonum amphibium (water smartweed)	1	0-1	17
Potentilla gracilis (slender cinquefoil)	1	0-1	50
Senecio cymbalarioides (few-leaved groundsel)	1	0-1	17
Senecio hydrophilus (alkali-marsh butterweed)	1	0-1	17
Senecio integerrimus (western groundsel)	1	0-1	17
Sium suave (hemlock water-parsnip)	1	0-1	17
Stellaria longipes (longstalk starwort)	1	0-1	33
Swertia perennis (swertia)	10	0-10	17
Taraxacum officinale (common dandelion)	1	0-1	17
Viola spp. (violet)	1	0-1	17

SUCCESSIONAL INFORMATION

Carex aquatilis (water sedge) functions as a pioneer colonizer of exposed mineral substrates, such as when a beaver dam breaks, and a climax species. High water tables and a vigorous network of *Carex aquatilis* (water sedge) rhizomes limit the

successful establishment of most other species. In general, the high water table throughout the growing season tends to limit access by livestock. However, due to the palatable nature of *Carex aquatilis* (water sedge), severe grazing pressures can greatly decrease the cover of *Carex aquatilis* (water sedge) while increasing the cover of disturbance-caused herbaceous species such as *Carex nebrascensis* (Nebraska sedge), *Juncus balticus* (Baltic rush), *Poa pratensis* (Kentucky bluegrass), and others.

SOILS

Soils of the *Carex aquatilis* (water sedge) phase are typically Histosols (Borofibrists, Borohemists, and Borosaprists). Mollisols are less frequently associated with this phase. Soil texture varies from clay to sandy loam. Water tables are at or near the soil surface throughout the year. The *Deschampsia cespitosa* (tufted hairgrass) phase are only rarely associated with Histosols. Soils tend to be more coarse textured with only thin organic matter accumulations. Water tables are often lower, and can fall below 1 m (39 in) by mid-summer. Both phases appear less anaerobic than the *Carex rostrata* (beaked sedge) habitat type. Soil reaction for both phases varies little between slightly acid and neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Wetter sites support the *Carex rostrata* (beaked sedge) habitat type. Communities on adjacent drier sites include the *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge), *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass), *Juncus balticus* (Baltic rush), *Phleum pratense* (common timothy), and *Poa pratensis* (Kentucky bluegrass) types. Upland communities support a variety of types including those dominated by conifers or by *Artemisia tridentata* (big sagebrush).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Livestock forage value of *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland plants are cured, or where livestock distribution and stocking rate problems occur. On expansive *Carex aquatilis* (water sedge) sites, livestock can sometimes select more palatable species.

In general, sedges should respond satisfactorily to the more traditional grazing systems designed for upland species. However, on those sites adjacent to a stream, residual cover should be left to filter out sediments during the fall rains or spring runoff. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

Wet soils may deter animal use until soils have dried, allowing *Deschampsia cespitosa* (tufted hairgrass) to replenish its carbohydrate reserves and persist within these communities. However, if heavy grazing does occur, there will be a marked decrease in the highly palatable *Deschampsia cespitosa* (tufted hairgrass) and an increase in the less palatable *Juncus balticus* (Baltic rush). *Juncus balticus* (Baltic rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

Wildlife

Elk may graze stands of *Carex aquatilis* (water sedge), but this species is not usually a major food source. Waterfowl consume the seeds produced by associated plants in this type.

Fisheries

This type is often located adjacent to waterways supporting trout fisheries. The rhizomatous growth habit of *Carex aquatilis* (water sedge) forms a dense sod, effectively stabilizing soils and streambanks. Overhanging sod provides valuable cover and

shade for fish.

Fire

The *Carex aquatilis* (water sedge) type is suited to prescribed burning. Nonuse by livestock during the year prior to burning is essential. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition will not drastically change away from dominance by *Carex aquatilis* (water sedge) (DeBenedetti and Parsons 1984).

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning will favor the rhizomatous sedge species. Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa* (tufted hairgrass).

Care should be taken when burning stands along streambanks because of the excellent erosion protection this type provides.

Soil Management and Rehabilitation Opportunities

Mineral soils are highly susceptible to compaction when wet. Organic soils can be broken and churned by grazing animals. Productivity of sites may be lowered as soil are disturbed and become less favorable to *Carex aquatilis* (water sedge). Rutting can be severe with packstock or hiker use, often resulting in multiple parallel trails. Off road vehicles cause serious long term damage. Care should be taken to maintain existing roads to help discourage off road travel. New trails or roads should be located on adjacent uplands.

Generally, sedges offer better streambank stability than grasses, primarily due to their rhizomatous growth form. *Carex aquatilis* (water sedge) tends to form a dense, thick sod that is highly resistant to erosion. Along the stream, the sod may be undercut and sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to damage, and streambank sloughing can occur.

Deschampsia cespitosa (tufted hairgrass) has a weak, fibrous root system that is of little value for stabilizing streambanks (Youngblood and others 1985b). However, *Juncus balticus* (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes. Once established, they spread rapidly. These soil holding characteristics may make it valuable for stabilizing streambanks.

The low stream gradient and well developed floodplain associated with this type results in high rates of recovery through the bank building process. This requires residual spring cover to filter sediments. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

Recreational Uses and Considerations

Recreational use is usually confined to the associated fishery. Heavy human use in the spring and summer can result in compacted soils, bank damage, and exposed soils along stream edges. Moderate amounts of late season use have little impact.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Most of the sites are too wet to be classified using the range site classification. (The range site classification does not classify sites with this degree of wetness.) However, some of the less wet sites can be classified by the range site classification and they include the following: Eastern Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Mutz and Queiroz (1983), Mattson (1984), Youngblood and others (1985), and Chadde and others (1988) described similar *Carex aquatilis* (water sedge) communities in eastern Idaho and western Wyoming. In Utah and southeastern Idaho, Padgett and others (1989) described a similar community.

Carex lasiocarpa Habitat Type
(Slender Sedge Habitat Type)

CARLAS (CALA16)
Number Of Stands Sampled = 32

Note: The *Carex lasiocarpa* (slender sedge) habitat type includes all combinations of *Carex lasiocarpa* (slender sedge), *Carex lanuginosa* (woolly sedge), and *Carex buxbaumii* (Buxbaum's sedge) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex lasiocarpa* (slender sedge) habitat type is a minor type at mid to high elevations in the mountains of Montana. Sites range in elevation from 1,165 to 2,196 m (3,820 to 7,200 ft). This type is associated with meadows, basins, glacial depressions (kettles), and along lake margins that are anaerobically favorable to the buildup of deep organic soils.

FLORISTIC CHARACTERISTICS

The diagnostic sedges of this type include *Carex lasiocarpa* (slender sedge), *Carex lanuginosa* (woolly sedge), and *Carex buxbaumii* (Buxbaum's sedge).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Potentilla fruticosa (shrubby cinquefoil)	3	0-3	7
Rosa acicularis (prickly rose)	3	0-3	7

Salix bebbiana (Bebb willow)	1	0-1	7
Salix candida (hoary willow)	2	0-3	14
Salix planifolia (planeleaf willow)	1	0-1	7
Graminoids			
Agrostis stolonifera (redtop)	1	0-1	7
Calamagrostis stricta (narrow-spiked reedgrass)	18	0-50	21
Carex aquatilis (water sedge)	20	0-20	7
Carex atherodes (awned sedge)	10	0-10	7
Carex aurea (golden sedge)	1	0-1	7
Carex buxbaumii (Buxbaum's sedge)	40	0-40	7
Carex diandra (lesser-panicled sedge)	1	0-1	7
Carex flava (yellow sedge)	3	0-3	7
Carex interior (inland sedge)	3	0-3	7
Carex lanuginosa (woolly sedge)	46	0-98	36
Carex lasiocarpa (slender sedge)	55	0-98	79
Carex limosa (mud sedge)	20	0-20	7
Carex oederi (green sedge)	1	0-1	7
Carex paupercula (poor sedge)	60	0-60	7
Carex rostrata (beaked sedge)	8	0-10	43
Carex simulata (short-beaked sedge)	1	0-1	7
Carex vesicaria (inflated sedge)	3	0-3	7
Deschampsia cespitosa (tufted hairgrass)	7	0-10	14
Eriophorum polystachion (many-spiked cotton-grass)	10	0-10	7
Glyceria grandis (American mannagrass)	3	0-3	7
Hordeum jubatum (foxtail barley)	1	0-1	7
Muhlenbergia andina (foxtail muhly)	1	0-1	7
Phalaris arundinacea (reed canarygrass)	1	0-1	7
Poa palustris (fowl bluegrass)	1	0-1	7
Scirpus acutus (hardstem bulrush)	1	0-1	7
Scirpus pallidus (pale bulrush)	1	0-1	7
Scirpus pungens (sharp bulrush)	40	0-40	7
Forbs			
Allium schoenoprasum (chives)	1	0-1	7
Antennaria anaphaloides (tall pussy-toes)	1	0-1	7
Arnica chamissonis (meadow arnica)	3	0-3	7
Aster foliaceus (leafy aster)	1	0-1	7
Aster occidentalis (western aster)	30	0-30	7
Dodecatheon spp. (shooting star)	1	0-1	7
Epilobium ciliatum (common willow-herb)	1	0-1	7
Galium aparine (goose-grass)	1	0-1	7
Galium boreale (northern bedstraw)	1	0-1	7
Galium trifidum (small bedstraw)	1	0-1	7
Gentiana affinis (pleated gentian)	1	0-1	7
Gentianella detonsa (smaller fringed gentian)	1	0-1	7
Geum macrophyllum (large-leaved avens)	1	0-1	7
Mentha arvensis (field mint)	3	0-3	7
Menyanthes trifoliata (buckbean)	3	0-3	7
Polygonum amphibium (water smartweed)	1	0-1	7
Polygonum austinae (Austin's knotweed)	1	0-1	7

Potamogeton gramineus (grass-leaved pondweed)	1	0-1	7
Potentilla anserina (common silverweed)	40	0-40	7
Potentilla gracilis (slender cinquefoil)	10	0-10	7
Potentilla palustris (purple cinquefoil)	15	0-40	29
Ranunculus macounii (Macoun's buttercup)	1	0-1	7
Rumex crispus (curly dock)	1	0-1	7
Scutellaria galericulata (marsh skullcap)	3	0-3	7
Triglochin maritimum (seaside arrow-grass)	3	0-3	7
Viola spp. (violet)	1	0-1	7
Ferns and Allies			
Equisetum arvense (field horsetail)	40	0-40	7
Equisetum laevigatum (smooth scouring-rush)	1	0-1	7

SUCCESSIONAL INFORMATION

Moderate disturbance will increase *Juncus balticus* (Baltic rush) and associated forbs. Severe disturbance may lower the water table and cause the site to be dominated by *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), or *Agrostis stolonifera* (redtop).

Moderately disturbed sites will improve rapidly with protection due to the rhizomatous nature of *Carex lasiocarpa* (slender sedge) and *Carex lanuginosa* (woolly sedge).

SOILS

Soils are usually Histosols (Borofibrists, Borohemists, and Borosaprists), with thick accumulations of partially decomposed sedges. Soil texture is predominantly loam. Soils are poorly to very poorly drained. Sites are often flooded into July and August with water tables remaining within the root zone throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by either the *Carex rostrata* (beaked sedge) or the *Carex aquatilis* (water sedge) habitat type, or the *Carex nebrascensis* (Nebraska sedge) community type. Drier communities may be dominated by the *Deschampsia cespitosa* (tufted hairgrass) or *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) habitat type, or the *Juncus balticus* (Baltic rush) community type. Adjacent uplands are typically dominated by *Artemisia tridentata* (big sagebrush) at lower elevations and by *Abies lasiocarpa* (subalpine fir) at higher elevations.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Estimated herbage production is moderate to high ranging from 1,000 to 3,000 lbs/acre dry weight (Kovalchik 1987). *Carex lasiocarpa* (slender sedge) receives limited use by livestock due to its low palatability. However, associated species of this type, such as *Carex lanuginosa* (woolly sedge) or *Deschampsia cespitosa* (tufted hairgrass) are highly palatable to livestock and may attract earlier use than desired. Livestock tend to avoid the wet meadows or basins until they are surface dry, usually in late July or early August. *Carex lasiocarpa* (slender sedge) and *Carex lanuginosa* (woolly sedge) will rapidly reoccupy moderately disturbed sites with rest and late season grazing. Livestock should be removed before 40 percent of the summer/fall forage has been utilized to insure an upward trend in ecological status (Kovalchik 1987).

Wildlife

The *Carex lasiocarpa* (slender sedge) habitat type is generally flooded long enough to provide nesting habitat for waterfowl.

However, is has limited use by songbirds and small mammals because of the lack of diversity and flooded soils. It is an important habitat for raptors, deer, and elk. Deer use the type for fawning.

Fire

High water tables make burning difficult. However, meadows and basins can be burned in the late summer. Fire can be used in late spring or early summer on sites adjacent to floodplains. Fire will help reduce litter accumulations and competitors. Dominant sedges of this habitat type are resistant to damage by fire except where hot fires penetrate the peat soil.

Soil Management and Rehabilitation Opportunities

Mechanical use should be avoided because of the fragile nature of wet, organic soils. Livestock should be kept off these sites until the surface soils are dry. Trails and roads should be located on the adjacent uplands.

Carex lasiocarpa (slender sedge) and *Carex lanuginosa* (woolly sedge) are useful for improving degraded sites. Their long, creeping rhizomes form a dense mat, effectively stabilizing streambank soils.

Recreational Uses and Considerations

The sites provide good opportunities for viewing deer, elk, and waterfowl. Floodplain sites adjacent to streams are often used as fishing access points.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded to seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Carex lasiocarpa* (slender sedge) habitat type is similar to the *Carex lanuginosa* (woolly sedge) and the *Carex lasiocarpa* (slender sedge) associations described by Kovalchik (1987) for central Oregon, and the *Carex buxbaumii* (Buxbaum's sedge) series described by Mattson (1984) for central Yellowstone National Park. In addition, Padgett and others (1989) described a similar community for Utah and southeastern Idaho.

Carex limosa Habitat Type
(Mud Sedge Habitat Type)

CARLIM (CALI7)

Number Of Stands Sampled = 15

LOCATION AND ASSOCIATED LANDFORMS

The *Carex limosa* (mud sedge) habitat type is a minor type at mid to high elevations in the mountains of Montana. Sites range in elevation from 1,787 to 2,425 m (5,860 to 7,950 ft). This type is associated with pond and lake margins, and typically develops floating or quaking mats. In some instances, it may occur on low gradient inflows or outflows of ponds or lakes.

FLORISTIC CHARACTERISTICS

Due to saturated and anaerobic conditions, the sites are generally monotypic in nature. The diagnostic sedge of this type is *Carex limosa* (mud sedge).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula glandulosa (bog birch)	1	0-1	14
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	14
Salix candida (hoary willow)	3	0-3	14
Salix planifolia (planeleaf willow)	1	0-1	14
Graminoids			
Calamagrostis stricta (narrow-spiked reedgrass)	3	0-3	14
Carex aquatilis (water sedge)	10	0-10	14
Carex buxbaumii (Buxbaum's sedge)	10	0-10	14
Carex lasiocarpa (slender sedge)	10	0-10	14
Carex limosa (mud sedge)	39	20-90	100
Carex livida (pale sedge)	20	0-20	14
Carex rostrata (beaked sedge)	8	0-10	43
Dulichium arundinaceum (dulichium)	1	0-1	14
Eriophorum chamissonis (Chamisso cotton-grass)	1	0-1	14
Juncus nodosus (tuberous rush)	1	0-1	14
Forbs			
Drosera linearis (linear-leaved sundew)	10	0-10	14
Lysimachia thyrsiflora (tufted loosestrife)	1	0-1	14
Menyanthes trifoliata (buckbean)	20	0-30	29
Scheuchzeria palustris (scheuchzeria)	10	0-10	14

SUCCESSIONAL INFORMATION

Due to the saturated soils with water levels either above or near the soil surface throughout the growing season, the sites are generally minimally impacted.

SOILS

Soils are commonly Histosols (Typic Borofibrists) consisting of deep fibric peat, persistently saturated, with standing water in spring. These soils are very poorly drained. Saturated conditions retard plant decomposition and favor organic matter accumulation.

ADJACENT COMMUNITIES

Adjacent wetter sites include the *Eleocharis pauciflora* (few-flowered spike-rush) habitat type or open water. Adjacent drier sites include either the *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), *Carex lasiocarpa* (slender sedge), or the *Scirpus acutus* (hardstem bulrush) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is low to moderate. Grazing value for domestic livestock is minimal due to submerged or saturated soils.

Wildlife

Herbage production is low to moderate. Grazing value for wildlife is minimal due to submerged or saturated soils. Otters, sandhill cranes, and waterfowl use this type for bedding and foraging areas (Mattson 1984).

Fisheries

The floating mats of the *Carex limosa* (mud sedge) habitat type can provide hiding cover and detritus for fish, provided the ponds or lakes are not too acidic.

Fire

Wildfire is rare in this habitat type.

Soil Management and Rehabilitation Opportunities

These sites are generally so wet as to preclude most types of use.

Recreational Uses and Considerations

The sites are generally so wet as to preclude most types of recreational uses except fishing. The sites may provide good opportunities for viewing waterfowl.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded to seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

Mattson (1984) describes a similar community in the central portion of Yellowstone National Park. In addition, Padgett and others (1989) described a similar community for Utah and southeastern Idaho.

Carex nebrascensis Community Type
(Nebraska Sedge Community Type)

CARNEB (CANE2)
Number Of Stands Sampled = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Carex nebrascensis* (Nebraska sedge) community type is an minor type at low to mid elevations throughout Montana. Sites range from 1,006 to 2,028 m (3,300 to 6,650 ft). The type is located on flat or gently sloping surfaces, wide meadows and lower slopes with a variety of aspects. It may also occur adjacent to streams and rivers.

FLORISTIC CHARACTERISTICS

The *Carex nebrascensis* (Nebraska sedge) community type represents a grazing disclimax. *Carex nebrascensis* (Nebraska sedge) is the dominant sedge. Other species often present in small amounts include *Calamagrostis stricta* (narrow-spiked reedgrass) and *Triglochin maritimum* (seaside arrow-grass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Carex nebrascensis (Nebraska sedge)	76	20-98	100

SUCCESSIONAL INFORMATION

The *Carex nebrascensis* (Nebraska sedge) community type is a grazing disclimax typically representing an early/ mid-seral secondary successional type. It is strongly rhizomatous with high underground biomass that, while being highly palatable to livestock, appears to withstand moderate to heavy grazing pressures. Under continued season long grazing, *Carex nebrascensis* (Nebraska sedge) acts as an increaser, replacing former climax dominants (Youngblood and others 1985b; Kovalchik 1986; Kovalchik 1987). Due to its palatability and soil holding root mat, however, replacement of *Carex nebrascensis* (Nebraska sedge) by former climax species may not occur, or will occur over a long period of time.

The *Carex nebrascensis* (Nebraska sedge) community type occupies positions intermediate to the *Carex rostrata* (beaked sedge) and *Deschampsia cespitosa* (tufted hairgrass) habitat types (Youngblood and others 1985). In some cases it represents a grazing disclimax of the *Typha latifolia* (common cattail) habitat type.

SOILS

Limited data is available for this type. Soils are commonly Mollisols. Soil texture varies little between clay loam and loam. Water tables are typically at or near the soil surface early in the growing season. Soils often remain saturated throughout summer, but water tables occasionally drop below 1 m (39 in) of the soil surface at the end of the growing season. Estimates of available water are between moderate and high.

ADJACENT COMMUNITIES

Adjacent wetter sites are the *Scirpus acutus* (hardstem bulrush) and *Carex rostrata* (beaked sedge) habitat types or various *Salix* (willow) types. Drier wetland communities include the *Deschampsia cespitosa* (tufted hairgrass), *Juncus balticus* (Baltic rush), and *Poa pratensis* (Kentucky bluegrass) types. Upland communities are dominated by a variety of types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is high in this community type. As a result, grazing levels have often been heavy. *Carex nebrascensis* (Nebraska sedge) is very palatable to cattle and horses, especially in the spring and early summer when stems and leaves are tender (Lewis 1958; Hermann 1970). *Carex nebrascensis* (Nebraska sedge) withstands heavy utilization without apparent damage, primarily due to its rhizomatous habit and favorable site moisture conditions (USDA Forest Service 1937). However, repeated defoliation during the period of early shoot growth depletes root carbohydrate reserves and lessens plant vigor (Steele and others 1984).

Late season grazing of this type, after surface soils have begun to dry, will lessen trampling damage to plant rhizomes and will allow degraded streambanks to stabilize. However, on those stands adjacent to a stream, residual cover should be left to filter out sediments during the fall rains or spring runoff. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

Wildlife

Carex nebrascensis (Nebraska sedge) is palatable to elk, and provides food and cover for waterfowl.

Fire

Preliminary information suggests the *Carex nebrascensis* (Nebraska sedge) community type is suited to prescribed burning. Nonuse by livestock during the year prior to burning is essential. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition probably will not drastically change away from dominance by *Carex nebrascensis* (Nebraska sedge).

Care should be taken when burning stands along streambanks because of the excellent erosion protection this type provides. Removal of *Carex nebrascensis* (Nebraska sedge) may increase the susceptibility of soil erosion from overland flows during fall rains or spring runoff.

Soil Management and Rehabilitation Opportunities

The strongly rhizomatous nature of this type makes it valuable for streambank stabilization and provides protective overhanging sod on undercut banks. These fine textured soils are typically saturated to the surface in spring and early summer, making them highly susceptible to compaction by livestock and mechanical damage. Human trampling damage also occurs around popular fishing areas. Heavy machinery use should be avoided.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated

range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar *Carex nebrascensis* (Nebraska sedge) communities have been identified by Norton (1981), Ratliff (1982), Mutz and Queiroz (1983), Youngblood and others (1985), and by Padgett and others (1989).

Carex rostrata Habitat Type
(Beaked Sedge Habitat Type)

CARROS (CARO6)
Number Of Stands Sampled = 233

(*Carex aquatilis* (Water Sedge) Phase = 45 stands)
(*Carex rostrata* (Beaked Sedge) Phase = 142 stands)
(*Deschampsia cespitosa* (Tufted Hairgrass) Phase = 46 stands)

Note: The *Carex rostrata* (beaked sedge) habitat type includes all combinations of *Carex rostrata* (beaked sedge), *Carex vesicaria* (inflated sedge), and *Carex atherodes* (awned sedge) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Carex rostrata* (beaked sedge) habitat type is a major, widely distributed type ranging from low elevations to the subalpine zone throughout Montana. Sites range in elevation from 671 to 2,256 m (2,200 to 7,400 ft). Sites are either adjacent to low gradient streams in wide valley bottoms or associated with perennial seeps. It can occur in standing water or on sites that become relatively dry during the later part of the growing season. Many sites are located where beaver ponds have filled with sediment. The surface may occasionally be mounded. This micro topographic relief usually results from a buildup of *Carex* species (sedge) sod and downcutting of small channels by overland flow during spring runoff, or may be remnant channels used by beaver when water tables were higher. The *Carex rostrata* (beaked sedge) represents one of the wettest riparian or wetland communities.

FLORISTIC CHARACTERISTICS

Three phases of this type have been identified, generally reflecting a gradual moisture and aeration gradient (Brichta 1987) from wet to dry. In each phase, *Carex rostrata* (beaked sedge) is clearly dominant. Less commonly, *Carex atherodes* (awned sedge) and *Carex vesicaria* (inflated sedge) are intermixed or dominate similar sites.

Within the wettest, or *Carex rostrata* (beaked sedge) phase, other species are often sparse or absent. A herbaceous species common to all three phases is *Epilobium ciliatum* (common willow-herb).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Carex aquatilis (water sedge) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover Average	Range	Constancy
Trees			
Picea spp. (spruce)	1	0-1	4
Shrubs			
Betula glandulosa (bog birch)	1	0-1	4
Kalmia microphylla (small-leaved laurel)	1	0-1	4
Lonicera utahensis (Utah honeysuckle)	1	0-1	4
Salix candida (hoary willow)	1	0-3	11
Salix drummondiana (Drummond willow)	1	0-1	4
Salix geyeriana (Geyer willow)	1	0-1	4
Salix lutea (yellow willow)	3	0-3	4
Salix planifolia (planeleaf willow)	3	0-3	11
Graminoids			
Agropyron caninum (bearded wheatgrass)	1	0-1	4
Agrostis scabra (tickle-grass)	3	0-3	4
Agrostis spp. (bentgrass)	1	0-1	4
Agrostis thurberiana (Thurber bentgrass)	10	0-10	4
Alopecurus alpinus (alpine foxtail)	7	0-10	7
Bromus ciliatus (fringed brome)	3	0-3	4
Calamagrostis canadensis (bluejoint reedgrass)	22	0-40	7
Calamagrostis stricta (narrow-spiked reedgrass)	12	0-30	33
Carex aquatilis (water sedge)	36	10-80	100
Carex atherodes (awned sedge)	40	0-40	4
Carex canescens (gray sedge)	10	0-10	4
Carex lanuginosa (woolly sedge)	3	0-3	4
Carex microptera (small-winged sedge)	1	0-1	4
Carex rostrata (beaked sedge)	40	1-90	100
Carex simulata (short-beaked sedge)	1	0-1	7
Carex vesicaria (inflated sedge)	17	0-30	7
Deschampsia cespitosa (tufted hairgrass)	6	0-20	41
Eleocharis pauciflora (few-flowered spike-rush)	60	0-60	4
Eriophorum chamissonis (Chamisso cotton-grass)	10	0-10	4
Glyceria grandis (American mannagrass)	20	0-20	4
Juncus tracyi (Tracy's rush)	1	0-1	4
Luzula parviflora (small-flowered woodrush)	1	0-1	4
Phleum pratense (common timothy)	30	0-30	4
Poa palustris (fowl bluegrass)	2	0-3	7
Poa spp. (bluegrass)	1	0-1	4
Scirpus microcarpus (small-flowered bulrush)	20	0-20	4
Forbs			
Antennaria umbrinella (umber pussy-toes)	30	0-30	4
Aster foliaceus (leafy aster)	1	0-1	4
Aster occidentalis (western aster)	10	0-20	7
Aster spp. (aster)	1	0-1	7
Cardamine pensylvanica (Pennsylvania bittercress)	1	0-1	4
Draba stenoloba (slender draba)	1	0-1	4

Epilobium angustifolium (fireweed)	1	0-1	4
Epilobium ciliatum (common willow-herb)	3	0-20	37
Epilobium glaberrimum (smooth willow-herb)	1	0-1	4
Epilobium spp. (willow-herb)	1	0-1	4
Galium trifidum (small bedstraw)	1	0-1	22
Galium triflorum (sweetscented bedstraw)	1	0-1	4
Geranium richardsonii (white geranium)	1	0-1	4
Geranium viscosissimum (sticky geranium)	1	0-1	4
Geum macrophyllum (large-leaved avens)	1	0-3	15
Heracleum lanatum (cow-parsnip)	1	0-1	4
Ligusticum tenuifolium (slender-leafed licorice-root)	10	0-10	4
Mimulus guttatus (common monkey-flower)	1	0-1	4
Pedicularis groenlandica (elephant's head)	1	0-1	4
Penstemon rydbergii (Rydberg's penstemon)	1	0-1	7
Petasites sagittatus (arrowleaf coltsfoot)	1	0-1	4
Polygonum hydropiper (marshpepper smartweed)	10	0-10	4
Potentilla gracilis (slender cinquefoil)	20	0-20	4
Potentilla palustris (purple cinquefoil)	5	0-10	7
Ranunculus natans (floating water-buttercup)	20	0-20	4
Scutellaria galericulata (marsh skullcap)	10	0-10	4
Senecio hydrophilus (alkali-marsh butterweed)	2	0-3	7
Senecio triangularis (arrowleaf groundsel)	1	0-1	4
Sium suave (hemlock water-parsnip)	10	0-10	4
Spiranthes romanzoffiana (hooded ladies-tresses)	1	0-1	4
Thalictrum fendleri (Fendler's meadowrue)	1	0-1	4
Veronica catenata (chain speedwell)	1	0-1	7
Viola spp. (violet)	1	0-3	11
Ferns and Allies			
Equisetum arvense (field horsetail)	2	0-3	7
Equisetum fluviatile (water horsetail)	20	0-20	4
Equisetum laevigatum (smooth scouring-rush)	1	0-1	4
Equisetum pratense (meadow horsetail)	1	0-1	4

Within the intermediate *Carex aquatilis* (water sedge) phase, *Carex aquatilis* (water sedge) and *Carex rostrata* (beaked sedge) are typically codominant. Small amounts of *Deschampsia cespitosa* (tufted hairgrass) may also occur. A herbaceous species common to all three phases is *Epilobium ciliatum* (common willow-herb).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Carex rostrata (beaked sedge) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Kalmia microphylla (small-leaved laurel)	1	0-1	1
Salix boothii (Booth willow)	1	0-1	1

Salix candida (hoary willow)	1	0-1	1
Salix drummondiana (Drummond willow)	1	0-1	2
Salix geyeriana (Geyer willow)	1	0-1	2
Salix planifolia (planeleaf willow)	1	0-3	3
Graminoids			
Agrostis exarata (spike bentgrass)	1	0-1	1
Agrostis scabra (tickle-grass)	1	0-3	3
Alopecurus aequalis (short-awn foxtail)	1	0-1	1
Beckmannia syzigachne (American sloughgrass)	1	0-1	3
Calamagrostis canadensis (bluejoint reedgrass)	1	0-3	3
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-3	5
Carex amplifolia (bigleaf sedge)	20	0-20	1
Carex aquatilis (water sedge)	2	0-3	11
Carex atherodes (awned sedge)	79	0-98	10
Carex canescens (gray sedge)	20	0-50	3
Carex capillaris (hair sedge)	1	0-1	1
Carex diandra (lesser-panicled sedge)	3	0-3	1
Carex interior (inland sedge)	1	0-1	1
Carex lanuginosa (woolly sedge)	3	0-3	1
Carex lasiocarpa (slender sedge)	10	0-10	2
Carex lenticularis (lentil-fruit sedge)	3	0-3	1
Carex limosa (mud sedge)	30	0-40	2
Carex microptera (small-winged sedge)	20	0-40	2
Carex nebrascensis (Nebraska sedge)	20	0-40	2
Carex praticola (meadow sedge)	20	0-20	1
Carex rostrata (beaked sedge)	67	0-98	70
Carex scopulorum (Holm's Rocky Mountain sedge)	10	0-10	2
Carex simulata (short-beaked sedge)	20	0-20	1
Carex vesicaria (inflated sedge)	68	0-98	31
Deschampsia cespitosa (tufted hairgrass)	2	0-3	3
Eleocharis acicularis (needle spike-rush)	3	0-3	1
Eleocharis palustris (common spikesedge)	9	0-20	6
Eleocharis pauciflora (few-flowered spike-rush)	17	0-30	3
Eleocharis spp. (spike-rush)	1	0-1	1
Eriophorum chamissonis (Chamisso cotton-grass)	20	0-20	1
Eriophorum polystachion (many-spiked cotton-grass)	3	0-3	1
Glyceria grandis (American mannagrass)	1	0-1	4
Glyceria striata (fowl mannagrass)	1	0-1	1
Juncus hallii (Hall's rush)	3	0-3	1
Phalaris arundinacea (reed canarygrass)	1	0-1	3
Poa palustris (fowl bluegrass)	1	0-1	1
Scirpus acutus (hardstem bulrush)	13	0-20	5
Scirpus pallidus (pale bulrush)	1	0-1	1
Scolochloa festucacea (sprangletop)	80	0-80	1
Forbs			
Alisma triviale (American waterplantain)	1	0-1	1
Aster spp. (aster)	1	0-1	1
Caltha leptosepala (elkslip marshmarigold)	10	0-10	1
Cardamine pensylvanica (Pennsylvania bittercress)	3	0-3	1

Cicuta maculata (spotted water-hemlock)	1	0-1	4
Draba stenoloba (slender draba)	1	0-1	1
Elodea nuttallii (Nutall's waterweed)	3	0-3	1
Epilobium ciliatum (common willow-herb)	7	0-40	14
Epilobium glaberrimum (smooth willow-herb)	1	0-1	1
Galium aparine (goose-grass)	1	0-1	3
Galium trifidum (small bedstraw)	1	0-3	8
Galium triflorum (sweetscented bedstraw)	1	0-1	1
Geum macrophyllum (large-leaved avens)	1	0-3	5
Geum rivale (water avens)	3	0-3	1
Hippuris vulgaris (common mare's-tail)	1	0-1	4
Lemna minor (water lentil)	5	0-10	2
Lepidium virginicum (tall pepperweed)	1	0-1	1
Ligusticum tenuifolium (slender-leafed licorice-root)	1	0-1	1
Lysimachia ciliata (fringed loosestrife)	10	0-10	1
Mentha arvensis (field mint)	3	0-3	5
Menyanthes trifoliata (buckbean)	3	0-3	1
Myosotis laxa (small-flowered forget-me-not)	1	0-1	1
Polygonum amphibium (water smartweed)	13	0-80	14
Polygonum hydropiper (marshpepper smartweed)	1	0-3	3
Potamogeton pectinatus (fennel-leaved pondweed)	3	0-3	1
Potentilla anserina (common silverweed)	2	0-3	3
Potentilla gracilis (slender cinquefoil)	7	0-10	3
Potentilla palustris (purple cinquefoil)	22	0-60	10
Ranunculus flammula (creeping buttercup)	10	0-20	2
Ranunculus gmelinii (small yellow water-buttercup)	40	0-40	1
Ranunculus macounii (Macoun's buttercup)	1	0-1	1
Ranunculus spp. (buttercup)	1	0-1	1
Rorippa palustris (marsh yellowcress)	2	0-3	5
Rumex crispus (curly dock)	1	0-1	3
Rumex maritimus (golden dock)	3	0-3	1
Sagittaria latifolia (wapato)	3	0-3	1
Senecio cymbalarioides (few-leaved groundsel)	1	0-1	1
Senecio foetidus (sweet-marsh butterweed)	1	0-1	1
Senecio hydrophilus (alkali-marsh butterweed)	1	0-1	1
Sium suave (hemlock water-parsnip)	4	0-3	5
Solidago canadensis (Canada goldenrod)	1	0-1	1
Stachys palustris (swamp hedge-nettle)	1	0-1	1
Thlaspi arvense (field pennycress)	3	0-3	1
Triglochin maritimum (seaside arrow-grass)	1	0-1	1
Typha latifolia (common cattail)	32	0-60	2
Veronica scutellata (marsh speedwell)	3	0-3	1
Ferns and Allies			
Equisetum arvense (field horsetail)	14	0-40	3
Equisetum fluviatile (water horsetail)	19	0-80	9
Equisetum laevigatum (smooth scouring-rush)	1	0-3	4

The driest, or *Deschampsia cespitosa* (tufted hairgrass) phase, contains appreciable amounts of *Deschampsia cespitosa* (tufted hairgrass) and *Juncus balticus* (Baltic rush). A herbaceous species common to all three phases is *Epilobium ciliatum* (common willow-herb).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands of the *Deschampsia cespitosa* (tufted hairgrass) phase. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Carex aquatilis (water sedge)	3	0-3	2
Carex atherodes (awned sedge)	39	0-70	20
Carex lenticularis (lentil-fruit sedge)	1	0-1	2
Carex rostrata (beaked sedge)	42	0-98	78
Carex vesicaria (inflated sedge)	50	0-80	20
Juncus balticus (Baltic rush)	27	0-80	22

SUCCESSIONAL INFORMATION

Carex rostrata (beaked sedge) functions as a pioneer colonizer of exposed mineral substrates, such as when a beaver dam breaks, and a climax species. High water tables and a vigorous network of *Carex rostrata* (beaked sedge) rhizomes limit the successful establishment of most other species. In general, the high water table throughout the growing season tends to limit access by livestock. In general, these sites tend to be wet throughout the growing season thereby limiting impacts by various forms of disturbance. However, severe grazing pressures can greatly decrease the cover of *Carex rostrata* (beaked sedge) while increasing the cover of disturbance-caused herbaceous species such as *Carex nebrascensis* (Nebraska sedge), *Juncus balticus* (Baltic rush), *Poa pratensis* (Kentucky bluegrass), and others.

SOILS

A wide range of soils are associated with this type. Histosols (Borohemists, Borosaprists, and Borofibrists) are most common and often have organic accumulations greater than 1 m (39 in) thick (Brichta 1987). Mollisols (Aquolls and Borolls) and Entisols are also associated with this type. Soil texture varies widely from loamy clay to sandy loam. Redoximorphic features (mottling or gleyed soil) are common in subsurface mineral soils. Water tables are typically at or above the soil surface throughout the growing season. Empirically these soils appear more anaerobic than those of the *Carex aquatilis* (water sedge) habitat type. Available water is estimated between moderate and high. Soil reaction is slightly acid to neutral (pH 6.5 to 7.0).

ADJACENT COMMUNITIES

Wetter sites are often absent but *Scirpus acutus* (hardstem bulrush) or *Typha latifolia* (common cattail) may be present on pond margins. Adjacent slightly drier sites support a variety of types, including those dominated by *Carex aquatilis* (water sedge), *Salix geyeriana* (Geyer willow), *Potentilla fruticosa* (shrubby cinquefoil), *Juncus balticus* (Baltic rush), and *Poa palustris* (fowl bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Livestock forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. *Carex atherodes* (awned sedge) and *Carex vesicaria* (inflated sedge) appear to be more palatable and may be grazed in mid to late summer, especially as upland vegetation dries. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland plants are cured, or where livestock distribution and stocking rate problems occur. On expansive *Carex rostrata* (beaked sedge) sites, livestock can sometimes select more palatable species.

In general, sedges should respond satisfactorily to the more traditional grazing systems designed for upland species. However, on those sites adjacent to a stream, residual cover should be left to filter out sediments during the fall rains or spring runoff. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

Wet soils may deter animal use until soils have dried, allowing *Deschampsia cespitosa* (tufted hairgrass) to replenish its carbohydrate reserves and persist within these communities. However, if heavy grazing does occur, there will be a marked decrease in the highly palatable *Deschampsia cespitosa* (tufted hairgrass) and an increase in the less palatable *Juncus balticus* (Baltic rush). *Juncus balticus* (Baltic rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

Wildlife

Elk and moose may graze stands of this type, especially where *Carex atherodes* (awned sedge) and *Carex vesicaria* (inflated sedge) are abundant.

Fisheries

The dense network of roots from the rhizomatous *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish.

Fire

The *Carex rostrata* (beaked sedge) type is suited to prescribed burning. Nonuse by livestock during the year prior to burning is essential. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition will not drastically change away from dominance by *Carex rostrata* (beaked sedge) (DeBenedetti and Parsons 1984).

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning will favor the rhizomatous sedge species. Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa* (tufted hairgrass).

Care should be taken when burning stands along streambanks because of the excellent erosion protection this type provides.

Soil Management and Rehabilitation Opportunities

Organic soils are easily trampled and compacted by grazing animals. Mineral soils are also easily damaged if use occurs when soils are moist. Rutting can be severe with packstock or hiker use, often resulting in multiple parallel trails. Off road vehicles cause serious long term damage. Care should be taken to maintain existing roads to help discourage off road travel. New trails or roads should be located on adjacent uplands.

In general, sedges offer better streambank stability than grasses, primarily due to their rhizomatous growth form. *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge) all tend to form a dense, thick

sod that is highly resistant to erosion. Along the stream, the sod may be undercut and sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to damage, and streambank sloughing can occur.

Deschampsia cespitosa (tufted hairgrass) has a weak, fibrous root system that is of little value for stabilizing streambanks (Youngblood and others 1985b). However, *Juncus balticus* (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes. Once established, they spread rapidly. These soil holding characteristics may make it valuable for stabilizing streambanks.

The low stream gradient and well developed floodplain associated with this type results in high rates of recovery through the bank building process. This requires residual spring cover to filter sediments. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded to seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Most of the sites are too wet to be classified using the range site classification. (The range site classification does not classify sites with this degree of wetness.) However, some of the less wet sites can be classified by the range site classification and they include the following: Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Numerous other studies have identified similar communities, reflective of the widespread distribution of this type: Norton (1981), Ratliff (1983), Tuhy and Jensen (1982), Mutz and Queiroz (1983), Mattson (1984), Youngblood and others (1985), Chadde and others (1988), and Padgett and others (1989).

Carex scopulorum Habitat Type
(Holm's Rocky Mountain Sedge Habitat Type)

CARSCO (CASC12)

Number Of Stands Sampled = 20

LOCATION AND ASSOCIATED LANDFORMS

The *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type is a minor type at mid to high elevations in the mountains Montana. Sites range in elevation from 1,983 to 2,532 m (6,500 to 8,300 ft) with slopes ranging from 0 to 8 percent. This habitat type occurs in cold, moist, low to moderate gradient mountain meadows or basins, seeps, and on alluvial terraces of first to second order streams or lake margins in subalpine to alpine areas. The snow free season may be only two or three months long.

FLORISTIC CHARACTERISTICS

Carex scopulorum (Holm's Rocky Mountain sedge) is the diagnostic sedge of this type. *Deschampsia cespitosa* (tufted hairgrass) may be locally abundant. The forb layer consists of a diverse mixture including *Caltha leptosepala* (elkslip marshmarigold), *Dodecatheon jeffreyi* (tall mountain shooting star), and *Ligusticum tenuifolium* (slender-leafed licorice-root).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Pinus contorta (lodgepole pine)	1	0-1	7
Shrubs			
Gaultheria humifusa (alpine wintergreen)	1	0-1	7
Kalmia microphylla (small-leaved laurel)	1	0-1	14
Ledum glandulosum (Labrador tea)	10	0-10	7
Lonicera utahensis (Utah honeysuckle)	1	0-1	7
Phyllodoce empetriformis (red mountain-heath)	10	0-10	7
Vaccinium scoparium (whortleberry)	1	0-1	7
Graminoids			
Agrostis humilis (alpine bentgrass)	15	0-30	14
Agrostis scabra (tickle-grass)	2	0-3	14
Agrostis thurberiana (Thurber bentgrass)	18	0-30	36
Alopecurus alpinus (alpine foxtail)	40	0-40	7
Carex aquatilis (water sedge)	1	0-1	7
Carex canescens (gray sedge)	1	0-1	7
Carex illota (sheep sedge)	18	0-30	29
Carex luzulina (woodrush sedge)	18	0-30	29
Carex microptera (small-winged sedge)	3	0-3	7
Carex nigricans (black alpine sedge)	20	0-30	14
Carex phaeocephala (Dunhead sedge)	50	0-50	7
Carex rostrata (beaked sedge)	20	0-20	7
Carex scopulorum (Holm's Rocky Mountain sedge)	32	3-70	100
Danthonia intermedia (oatgrass)	10	0-10	21
Deschampsia cespitosa (tufted hairgrass)	14	0-40	93
Eleocharis pauciflora (few-flowered spike-rush)	18	0-60	57
Juncus drummondii (Drummond's rush)	10	0-20	14
Juncus longistylis (long-style rush)	1	0-1	7
Juncus mertensianus (Merten's rush)	13	0-30	29

Luzula campestris (field woodrush)	4	0-10	21
Phleum alpinum (alpine timothy)	9	0-20	43
Poa glaucifolia (pale-leaf bluegrass)	1	0-1	7
Trisetum wolfii (Wolf's trisetum)	1	0-1	7
Forbs			
Agoseris glauca (pale agoseris)	1	0-1	7
Antennaria anaphaloides (tall pussy-toes)	10	0-10	7
Antennaria corymbosa (meadow pussy-toes)	1	0-1	7
Antennaria umbrinella (umber pussy-toes)	5	0-10	14
Arnica mollis (hairy arnica)	1	0-1	7
Aster foliaceus (leafy aster)	20	0-30	29
Aster occidentalis (western aster)	9	0-20	43
Caltha leptosepala (elkslip marshmarigold)	28	0-50	57
Dodecatheon jeffreyi (tall mountain shooting star)	23	0-50	57
Dodecatheon spp. (shooting star)	1	0-1	7
Epilobium ciliatum (common willow-herb)	1	0-1	7
Epilobium glaberrimum (smooth willow-herb)	7	0-10	10
Erigeron peregrinus (subalpine daisy)	1	0-1	7
Gaura parviflora (small-flowered gaura)	1	0-1	7
Gentiana affinis (pleated gentian)	3	0-3	7
Gentiana calycosa (explorer's gentian)	16	0-30	43
Habenaria hyperborea (northern green bog-orchid)	1	0-1	7
Ligusticum tenuifolium (slender-leafed licorice-root)	17	0-30	50
Microseris nigrescens (black-hairy microseris)	1	0-1	7
Parnassia fimbriata (fringed grass-of-parnassus)	30	0-30	7
Pedicularis groenlandica (elephant's head)	12	0-20	43
Polygonum bistortoides (American bistort)	3	0-3	7
Potentilla diversifolia (diverse-leaved cinquefoil)	1	0-1	7
Senecio cymbalarioides (few-leaved groundsel)	11	0-40	43
Senecio integerrimus (western groundsel)	2	0-3	21
Senecio sphaerocephalus (mountain-marsh butterweed)	20	0-20	7
Senecio triangularis (arrowleaf groundsel)	1	0-1	21
Spiranthes romanzoffiana (hooded ladies-tresses)	5	0-10	29
Swertia perennis (swertia)	10	0-10	7
Tofieldia glutinosa (sticky tofieldia)	20	0-30	36
Trifolium longipes (long-stalked clover)	1	0-1	14
Trollius laxus (American globeflower)	15	0-20	14
Veronica cusickii (Cusick's speedwell)	1	0-1	7
Veronica wormskjoldii (Wormskjold speedwell)	1	0-1	7
Viola spp. (violet)	20	0-30	36
Ferns and Allies			
Equisetum arvense (field horsetail)	20	0-40	14

SUCCESSIONAL INFORMATION

Moderate grazing and trampling by livestock or big game may increase the cover of perennial forbs (Kovalchik 1987). Severe grazing pressures can greatly decrease the cover of *Carex scopulorum* (Holm's Rocky Mountain sedge) while increasing the cover of disturbance-caused herbaceous species such as *Carex nebrascensis* (Nebraska sedge), *Juncus balticus* (Baltic

rush), *Poa pratensis* (Kentucky bluegrass), and others. Continued heavy grazing may decrease the herbaceous cover with sites becoming dominated by bare ground.

Moderately disturbed sites will improve rapidly with protection due to the abundance of moisture and the dense, tough sod produced by the rhizomes of *Carex scopulorum* (Holm's Rocky Mountain sedge).

SOILS

Soils are commonly Histosols (Typic or Terric Borofibrists) composed of accumulations of partially decomposed organic material overlying bedrock (USDA Soil Conservation Service 1985, Montagne and others 1982). Soils are poorly to very poorly drained. Standing water usually occupies these sites until late into summer. Saturated soil throughout the growing season retards plant decomposition and favors organic matter accumulation. Alluvial sites typically have coarse textured mineral soils, often with buried organic horizons. Flooding during spring runoff is common and water tables remain within the root zone throughout the summer. Soil reaction is typically strongly acid (pH 5.0).

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by the *Eleocharis pauciflora* (few-flowered spike-rush) habitat type or aquatic sites. Adjacent drier communities may include the *Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) or the *Deschampsia cespitosa* (tufted hairgrass) habitat types, or subalpine forests dominated by the *Pinus albicaulis* (white-bark pine)-*Abies lasiocarpa* (subalpine fir) habitat types, the *Abies lasiocarpa/Vaccinium cespitosum* (subalpine fir/dwarf huckleberry) habitat type, the *Abies lasiocarpa/Vaccinium scoparium* (subalpine fir/whortleberry) habitat type, or the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type is a major type of high elevation grazing allotments in the Deerlodge and Beaverhead National Forests. However, short grazing seasons and continually wet soils limit livestock use. Estimated herbage production for the habitat type is moderate ranging from 500 to 2,000 lbs/acre dry weight. Palatability of *Carex scopulorum* (Holm's Rocky Mountain sedge) is considered moderate for livestock (Hermann 1970). On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland plants are cured, or where livestock distribution and stocking rate problems occur. On expansive *Carex scopulorum* (Holm's Rocky Mountain sedge) sites, livestock can sometimes select more palatable species.

In general, sedges should respond satisfactorily to the more traditional grazing systems designed for upland species. However, on those sites adjacent to a stream, residual cover should be left to filter out sediments during the fall rains or spring runoff. Removing cattle to allow at least 30 days for the sedge regrowth should provide sufficient residual cover (Myers 1989).

Wildlife

Landforms supporting the *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type provide important summer habitat for deer and elk.

Fisheries

The dense network of roots from the rhizomatous *Carex scopulorum* (Holm's Rocky Mountain sedge) makes it an effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish.

Fire

Preliminary information suggests the *Carex scopulorum* (Holm's Rocky Mountain sedge) type is suited to prescribed burning. Nonuse by livestock during the year prior to burning is essential. Residual cover burns well in spring, prior to the growing season. Fire will reduce litter accumulations and temporarily increase productivity. However, species composition probably will not drastically change away from dominance by *Carex scopulorum* (Holm's Rocky Mountain sedge).

Care should be taken when burning stands along streambanks because of the excellent erosion protection this type provides.

Soil Management and Rehabilitation Opportunities

The *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type on organic soils is highly susceptible to trampling by livestock, big game, packstock, and campers; on mineral soil it is moderately resistant. The sod may be undercut and sag into the water along streams, providing additional protection to streambanks; however, high soil moisture contents make these areas highly susceptible to damage from grazing and trails. Rutting can be severe on either soil type with packstock or hiker use, often resulting in multiple parallel trails. Off road vehicles cause serious long term damage. Care should be taken to maintain existing roads to help discourage off road travel. New trails or roads should be located on adjacent uplands.

Streambank building through sediment recruitment is common on low stream gradients associated with this type. Residual vegetation cover is needed to slow spring flows and filter sediments. Removing livestock at the end of the growing season, to allow at least 30 days for sedge regrowth should provide sufficient residual cover.

Recreational Uses and Considerations

The high subalpine to alpine meadows provide excellent opportunities for viewing wildlife during the summer.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities were described by Kovalchik (1987) in central Oregon, Cole (1982) in northeast Oregon, Campbell (1977) in the Cascades of Washington and Oregon, and Ramaley (1919) in northern Colorado.

Carex simulata Habitat Type
(Short-beaked Sedge Habitat Type)

CARSIM (CASI2)

Number Of Stands Sampled = 15

LOCATION AND ASSOCIATED LANDFORMS

The *Carex simulata* (short-beaked sedge) habitat type is a minor type located at mid to high elevations in the mountains of Montana. Sites range in elevation from 1,830 to 2,166 m (6,000 to 7,100 ft). The type is located in broad meadows, on gentle slopes below seeps, and on flat alluvial terraces adjacent to streams.

FLORISTIC CHARACTERISTICS

Carex simulata (short-beaked sedge) dominates the site with small amounts of *Carex aquatilis* (water sedge) usually present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Arctostaphylos uva-ursi (kinnikinnick)	1	0-1	13
Betula glandulosa (bog birch)	1	0-1	13
Potentilla fruticosa (shrubby cinquefoil)	1	0-3	50
Salix brachycarpa (short-fruited willow)	1	0-1	13
Salix candida (hoary willow)	1	0-1	25
Salix drummondiana (Drummond willow)	1	0-1	13
Salix geyeriana (Geyer willow)	2	0-3	25
Salix planifolia (planeleaf willow)	2	0-3	25
Salix wolfii (Wolf's willow)	1	0-1	38
Graminoids			
Agrostis scabra (tickle-grass)	1	0-1	13
Carex aquatilis (water sedge)	12	0-20	75
Carex aurea (golden sedge)	1	0-1	13
Carex buxbaumii (Buxbaum's sedge)	1	0-1	13
Carex interior (inland sedge)	1	0-1	13
Carex nebrascensis (Nebraska sedge)	3	0-3	13
Carex rostrata (beaked sedge)	3	0-3	25
Carex simulata (short-beaked sedge)	60	30-80	100
Deschampsia cespitosa (tufted hairgrass)	1	0-1	63
Eleocharis pauciflora (few-flowered spike-rush)	22	0-40	25
Muhlenbergia filiformis (slender muhly)	5	0-10	25
Phleum alpinum (alpine timothy)	1	0-1	13
Forbs			
Allium schoenoprasum (chives)	1	0-1	13
Antennaria microphylla (rosy pussy-toes)	3	0-3	13
Aster occidentalis (western aster)	1	0-1	13
Epilobium ciliatum (common willow-herb)	1	0-1	25
Galium trifidum (small bedstraw)	1	0-1	13
Parnassia parviflora (small-flowered grass-of-parnassus)	1	0-1	13
Pedicularis groenlandica (elephant's head)	1	0-1	25
Polygonum viviparum (alpine bistort)	1	0-1	13

Potentilla gracilis (slender cinquefoil)	3	0-3	13
Stellaria longipes (longstalk starwort)	1	0-1	13
Swertia perennis (swertia)	1	0-1	13
Thalictrum spp. (meadowrue)	1	0-1	13
Triglochin maritimum (seaside arrow-grass)	3	0-3	13
Utricularia spp. (bladderwort)	1	0-1	13
Viola nephrophylla (northern bog violet)	1	0-1	13

SUCCESSIONAL INFORMATION

Thickened organic horizons help to maintain stable, persistent *Carex simulata* (short-beaked sedge) communities. Continually high water tables limit the successful establishment of most other species. A lowered water table may result in site conditions similar to those of the *Carex rostrata* (beaked sedge) habitat type. Due to the season long high water table, the sites are only minimally disturbed.

SOILS

Soils of the *Carex simulata* (Short-beaked sedge) habitat type (typically Histosols), commonly have organic matter accumulations 30-120 cm (12-47 in) thick (Brichta 1987). This habitat type may also be found on poorly drained, fine textured, mineral soils. Redox depletions (segregated gleyed soil) or reduced matrices (gleyed throughout) are common throughout the profile of these soils. Water tables remain at or near the soil surface throughout the growing season. Soil reaction is slightly acid to neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Wetter sites are the *Scirpus acutus* (hardstem bulrush) habitat type or open water. The *Carex rostrata* (beaked sedge) and *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat types are common on drier sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is moderate. Grazing value of this type is limited by low palatability of *Carex simulata* (short-beaked sedge) and persistently wet conditions.

Wildlife

Waterfowl may use wetter extremes of this type for foraging.

Soil Management and Rehabilitation Opportunities

Persistent water at or above the soil surface limits most use or development.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Mutz and Queiroz (1983) and Youngblood and others (1985) described similar *Carex simulata* (short-beaked sedge) communities in eastern Idaho and western Wyoming. In Utah and southeastern Idaho, Padgett and others (1989) described a similar community.

Agropyron smithii Habitat Type
(Western Wheatgrass Habitat Type)

AGRSMI (AGSM)
Number Of Stands Sampled = 32

CAUTION — Not all sites currently dominated by *Agropyron smithii* (western wheatgrass) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Agropyron smithii* (western wheatgrass) habitat type is a major type at lower elevations in central and eastern Montana. Sites are swales and nearly level alluvial terraces where either overland flow or soil conditions (fine textures), or a combination of both, allow for a greater than normal moisture regime. In many situations, the fine textured soils have resulted in a perched water table. Sites range in elevation from 610 to 1,143 m (2,000 to 3,750 ft).

FLORISTIC CHARACTERISTICS

In the *Agropyron smithii* (western wheatgrass) habitat type, *Agropyron smithii* (western wheatgrass) typically occurs in nearly pure stands with limited amount of other species present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Artemisia frigida (fringed sage)	1	0-1	13
Ceratoides lanata (winterfat)	3	0-3	13
Graminoids			
Agropyron smithii (western wheatgrass)	82	80-98	100
Alopecurus carolinianus (Carolina foxtail)	20	0-20	25
Bouteloua curtipendula (sideoat grama)	1	0-1	13
Bromus inermis (smooth brome)	3	0-3	13
Bromus japonicus (Japanese brome)	1	0-1	13
Buchloe dactyloides (buffalo grass)	1	0-1	13
Poa pratensis (Kentucky bluegrass)	3	0-3	13
Stipa comata (needle-and-thread)	1	0-1	13
Stipa viridula (green needlegrass)	12	0-20	25
Forbs			
Achillea millefolium (common yarrow)	1	0-1	13
Lactuca oblongifolia (blue lettuce)	1	0-1	13
Linum perenne (blue flax)	1	0-1	13
Melilotus officinalis (yellow sweet-clover)	2	0-3	25
Plagiobothrys scouleri (Scouler's popcorn-flower)	40	0-40	13
Polygonum ramosissimum (bushy knotweed)	12	0-20	25

Polygonum spp. (smartweed)	3	0-3	13
Sphaeralcea coccinea (red globe-mallow)	3	0-3	13
Taraxacum spp. (dandelion)	3	0-3	13
Tragopogon dubius (goat's beard)	1	0-1	13
Vicia americana (American vetch)	1	0-1	13

SUCCESSIONAL INFORMATION

Overgrazing of these sites will reduce the vigor and cover of *Agropyron smithii* (western wheatgrass). Severe overgrazing will convert the site to one dominated by less desirable grass species such as *Poa pratensis* (Kentucky bluegrass), *Bouteloua gracilis* (blue grama), *Buchloe dactyloides* (buffalo grass), and *Festuca octoflora* (six-weeks fescue). Where grazing pressure is removed, sites may be invaded by either *Symphoricarpos occidentalis* (western snowberry) or *Glycyrrhiza lepidota* (American licorice). Within ungrazed overflow channels *Agropyron smithii* (western wheatgrass) is commonly found in pure swards.

SOILS

Soil texture ranges from clay to silt loam. Soils are poorly drained to very poorly drained. Seasonal flooding is common in spring following snow melt. Soil reaction varies widely from neutral to moderately alkali (pH 7.0 to 8.5). Saline soils are also common.

ADJACENT COMMUNITIES

Adjacent wetter sites include the *Spartina pectinata* (prairie cordgrass) habitat type, the *Phragmites australis* (common reed) habitat type, or the *Phalaris arundinacea* (reed canarygrass) community type. Adjacent drier sites are dominated by upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production of the *Agropyron smithii* (western wheatgrass) habitat type ranges from moderate to high. The *Agropyron smithii* (western wheatgrass) habitat type is highly desired by livestock. *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982). It is also commonly used as a hay crop. Vigorous rhizomes make *Agropyron smithii* (western wheatgrass) one of the more tolerant of the desirable and abundant grasses to grazing pressure and drought. However, overgrazing in May and June will decrease its abundance. When growing conditions improve, as is the case following drought or overgrazing, it may rapidly colonize areas previously occupied.

Wildlife

Hiding and thermal cover is limited in this site type. However, it may be used by a variety of waterfowl as nesting sites. The *Agropyron smithii* (western wheatgrass) habitat type is highly desired by wildlife such as deer and antelope. *Agropyron smithii* (western wheatgrass) is palatable and nutritious when green in the spring, and moderately so during other times of the year (Johnson and Nichols 1982).

Fire

Agropyron smithii (western wheatgrass) has a good tolerance to fire in the dormant state. In addition, it usually survives fires during the growing season but recovery may be delayed (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Agropyron smithii (western wheatgrass) is potentially valuable for revegetating some disturbed or degraded wetland sites in eastern and central Montana. Using transplants will speed the recovery process as seedlings are typically slow growing. However, once established, plants quickly spread by rhizomes.

Agropyron smithii (western wheatgrass) is tolerant of moderately severe droughts if not greatly prolonged, surviving by underground rhizomes (Wasser 1982).

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = badlands range site, clay pan range site, clayey range site, dense clay range site, overflow range site, panspots range site, saline lowland range site, silty range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = badlands range site, dense clay range site, overflow range site, panspots range site, saline lowland range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = clayey range site, overflow range site, saline lowland range site, silty range site, silty saline range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = clayey range site, overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = dense clay range site, saline lowland range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = clayey range site, dense clay range site, overflow range site, saline lowland range site, subirrigated range site; Foothills and Mountains, 10-14 inch Precipitation Zone = saline lowland range site; Northern Rocky Mountain Valley Bottoms; 10-14 inch Precipitation Zone = saline lowland range site.

OTHER STUDIES

Similar sites in the northern Great Plains have described by Hansen and others 1984 and Hansen and Hoffman 1988.

Agrostis stolonifera Community Type
(Redtop Community Type)

AGRSTO (AGST)
Number Of Stands Sampled = 1

Note: The *Agrostis stolonifera* (redtop) community type includes all combinations of *Agrostis stolonifera* (redtop) and *Agrostis scabra* (tickle-grass) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Agrostis stolonifera* (redtop) community type is a minor, widespread type at low to mid elevations. Sites range from 854 to 2,134 m (2,800 to 7,000 ft). Stands are located throughout Montana with the best examples found on recently deposited alluvial bars and wet meadows, pastures, and hay fields.

FLORISTIC CHARACTERISTICS

In addition to *Agrostis stolonifera* (redtop), associated species may include *Carex nebrascensis* (Nebraska sedge), *Festuca pratensis* (meadow fescue), *Juncus balticus* (Baltic rush), *Taraxacum officinale* (common dandelion), and *Equisetum*

hyemale (common scouring-rush). In sites on recently deposited alluvial bars, the total canopy cover of all species may be quite low (Appendix 00).

SUCCESSIONAL INFORMATION

Agrostis stolonifera (redtop) is an early seral (pioneer) species on recently exposed sediment deposits. Close observation of similar sites may give insight to the climax community for the site. In addition, overgrazing by herbivores can produce drastic changes on sites formerly dominated by native graminoids (Volland 1978). Once a suitable site is disturbed, the extensive rhizome system of *Agrostis stolonifera* (redtop) allows it to rapidly spread and establish on these areas. It also withstands high levels of utilization, making replacement by former dominants questionable.

SOILS

Soils are commonly Entisols (Fluvents) or Mollisols (Borolls). The *Agrostis stolonifera* (redtop) community type thrives best on moist to semi wet soils. It is tolerant of poorly drained wetlands and subirrigated sites, submergence, and frequent flooding. It will occur on most soil textures, provided moisture is not limiting. If moisture is limiting, it grows best on clay loam and loam soils. In addition, it is tolerant of medium acid (pH 5.5) and nutritionally poor soils low in calcium, phosphorus, and potassium (Wasser 1982). This type is also fairly tolerant of saline soils and is moderately tolerant of drought.

ADJACENT COMMUNITIES

Wetter sites include communities dominated by *Carex rostrata* (beaked sedge), *Typha latifolia* (common cattail), or *Scirpus acutus* (hardstem bulrush). Adjacent drier sites support a wide range of communities including those within the *Populus* (cottonwood), *Salix* (willow), *Potentilla fruticosa* (shrubby cinquefoil), and *Juncus balticus* (Baltic rush) types. Adjacent drier sites may be dominated by wide variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Agrostis stolonifera* (redtop) community type is moderately productive, and provides a significant amount of forage. Although *Agrostis stolonifera* (redtop) in not as palatable as other species, the community type provides forage throughout the summer due to the high water table. It is rated as having good palatability in the spring and early summer, with fair palatability after head. Palatability is rated as poor in the winter. *Agrostis stolonifera* (redtop) is rated as fairly good to good forage for livestock (USDA Forest Service 1937).

In pastures, close grazing, followed by rest in a rotation system, is recommended to keep plants producing palatable growth throughout the growing season (Vallentine 1967). *Agrostis stolonifera* (redtop) is tolerant of close use due to its somewhat prostrate growth form, rhizomatous growth habitat, and lower palatability than associated species. Plants should be cut during the early flowering stage to obtain highest quality hay.

Wildlife

Elk and deer make use of the grasses and forbs of this type. Waterfowl utilize *Agrostis stolonifera* (redtop) for food and cover.

Fisheries

The *Agrostis stolonifera* (redtop) community type is moderately effective in stabilizing streambanks due to its typically dense network of intertwining root and rhizomes. However, bank undercutting and sloughing may occur, especially when soils are wet or stands weakened by excessive grazing.

Fire

Agrostis stolonifera (redtop) is rated as only having a fair tolerance to fire (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Potential for soil compaction is greatest in spring when soils are moist. The associated graminoids of this type provide limited streambank protection, making the potential for erosional problems quite high. Managers need to pay close attention to streambanks associated with the *Agrostis stolonifera* (redtop) community type in order to detect early signs of streambank collapse.

If there is no change in management, once the stream bank starts to degrade, there is little that can be done to save it short of expensive riprap.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

A similar community type has been defined for the Upper Salmon/Middle Fork Salmon River drainages, Idaho, by Tuhy and Jensen (1982), and for meadows of the Sierra Nevada, California, by Ratliff (1982).

Bromus inermis Community Type
(Smooth Brome Community Type)

BROINE (BRIN)

Number Of Stands Sampled = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Bromus inermis* (smooth brome) community type is a minor, widespread type at low to mid elevations. Sites range from 1,094 to 2,044 m (3,590 to 6,700 ft). Stands are located throughout Montana with the best examples found on mesic alluvial terraces that were previously cultivated hay meadows or subjected to high grazing pressures.

FLORISTIC CHARACTERISTICS

Bromus inermis (smooth brome) is a European meadow grass that is widely introduced and naturalized in North America. Stands are either dominated by *Bromus inermis* (smooth brome), or have a mixture of herbaceous "weedy" species including *Carex praticola* (meadow sedge) (Appendix 00). Stands of this type represent one of the drier of the herbaceous riparian or wetland community types.

SUCCESSIONAL INFORMATION

The *Bromus inermis* (smooth brome) community type represents an early/mid seral grazing disclimax of many types including the *Deschampsia cespitosa* (tufted hairgrass) and the *Agropyron smithii* (western wheatgrass) habitat types. Once a suitable site is disturbed, the extensive rhizome system of *Bromus inermis* (smooth brome) allows it to rapidly spread and establish on these areas. It also withstands high levels of utilization, making replacement by former dominants such as *Deschampsia cespitosa* (tufted hairgrass) very difficult. Close observation of similar sites may give insight to the climax community for the site.

SOILS

Soils are typically Mollisols (Borolls) or Entisols (Fluvents). *Bromus inermis* (smooth brome) thrives on moist, well-drained, finer textured soils. It does poorly on sandy or dense clay soils. *Bromus inermis* (smooth brome) is generally intolerant of prolonged flooding, seasonally high water tables, or poor drainage. It is tolerant of weakly acidic to slightly alkaline soils.

ADJACENT COMMUNITIES

Wetter sites support a wide range of communities including those within the *Populus* (cottonwood), *Salix* (willow), *Potentilla fruticosa* (shrubby cinquefoil), *Carex rostrata* (beaked sedge), and *Juncus balticus* (Baltic rush) types. Adjacent drier sites may be dominated by wide variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Bromus inermis* (smooth brome) community type has a high forage value. *Bromus inermis* (smooth brome) is highly palatable to livestock when green, but low during the winter (USDA Forest Service 1973). Growth begins in early spring and continues into June (or later at higher elevations). During the summer, *Bromus inermis* (smooth brome) becomes semi-dormant until the onset of cooler, rainy fall weather. Fall regrowth is often abundant.

A moderate grazing intensity of the *Bromus inermis* (smooth brome) community type in the spring and fall can complement native ranges grazed during the summer. A rotation grazing system encourages more uniform grazing use. Periodic rest when *Bromus inermis* (smooth brome) is actively growing helps maintain vigorous stands (Wasser 1982).

Bromus inermis (smooth brome) is a highly competitive, sod-forming grass. It has a dense system of shallow, fibrous roots and rhizomes and an extensive network of deeper roots in well drained sites. However, high water tables that create saturated conditions within the rooting zone of *Bromus inermis* (smooth brome) causes a decrease in the number of roots leading to a reduction in the overall vigor of the plant. Dense monocultures typically become sod-bound 3-5 years after establishment (Wasser 1982).

Grazing practices influence the type of growth form present. A high density of weak, low vigor tillers results under season long grazing. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater. Streambanks associated with *Bromus inermis* (smooth brome) stands are susceptible to sloughing.

Wildlife

Elk and deer make use of the grasses and forbs of this type, especially in early spring when other forages have not yet greened (Gaffney 1941; Singer 1975). Waterfowl utilize *Bromus inermis* (smooth brome) for food and cover. Canada geese often graze young plants (Martin and others 1951). Upland game birds, small mammals and small nongame birds also use this type for cover, but species diversity is typically low (Dittberner and Olson 1983).

Fisheries

The *Bromus inermis* (smooth brome) community type is not very effective in stabilizing streambanks. Bank undercutting and sloughing may occur, especially when soils are wet or stands weakened by excessive grazing.

Fire

Bromus inermis (smooth brome) is well adapted to fire, and is able to quickly resprout following burning because of its extensive network of rhizomes. However, it is intolerant of burning during the active growth stages and can be successfully controlled by late spring burning. Fire is an effective tool to remove excessive litter accumulations common on rested or lightly grazed stands. Cool burns will have little effect on *Bromus inermis* (smooth brome) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

The potential for soil compaction is greatest in the spring when soils are moist. *Bromus inermis* (smooth brome) has an extensive rhizome system, but its shallow rooting characteristics in all but well drained sites make it only marginally effective in stabilizing streambanks. The potential for erosional problems associated with this community type can be quite high. Managers need to pay close attention to streambanks associated with *Bromus inermis* (smooth brome) community type in order to detect early signs of streambank collapse. Once the streambank starts to degrade, with no change in management, there is little that can be done to save it short of expensive riprap.

Unless water tables are restored, these sites will remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow

range site: Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Bromus inermis* (smooth brome) community type has not been described elsewhere.

Calamagrostis canadensis Habitat Type
(Bluejoint Reedgrass Habitat Type)

CALCAN (CACA4)
Number Of Stands Sampled = 39

Note: The *Calamagrostis canadensis* (bluejoint reedgrass) habitat type includes all combinations of *Calamagrostis canadensis* (bluejoint reedgrass) and *Calamagrostis stricta* (narrow-spiked reedgrass) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Calamagrostis canadensis* (bluejoint reedgrass) habitat type is a minor to incidental type at mid to high elevations in the mountains of Montana. Sites range in elevation from 1,067 to 2,327 m (3,500 to 7,630 ft). The type occurs in wet meadows, basins, forest openings, and on alluvial terraces or benches of low gradient streams. Spring flooding may be a common occurrence.

FLORISTIC CHARACTERISTICS

The diagnostic species of this habitat type are *Calamagrostis canadensis* (bluejoint reedgrass) and/or *Calamagrostis stricta* (narrow-spiked reedgrass). Associated herbaceous species may include *Viola* species (violet), *Senecio triangularis* (arrowleaf groundsel), and *Epilobium ciliatum* (common willow-herb).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	10
Picea spp. (spruce)	2	0-3	10
Pinus contorta (lodgepole pine)	1	0-1	5
Shrubs			
Alnus incana (mountain alder)	1	0-1	10
Cornus stolonifera (red-osier dogwood)	1	0-1	5
Lonicera involucrata (twin-berry)	1	0-1	5
Ribes setosum (Missouri gooseberry)	1	0-1	5
Rubus idaeus (red raspberry)	10	0-10	5
Salix boothii (Booth willow)	3	0-3	5
Salix drummondiana (Drummond willow)	1	0-1	5
Salix pseudomonticola (mountain willow)	1	0-1	5

Spiraea densiflora (subalpine spiraea)	1	0-1	5
Graminoids			
Agrostis scabra (tickle-grass)	1	0-1	5
Bromus ciliatus (fringed brome)	1	0-1	10
Calamagrostis canadensis (bluejoint reedgrass)	71	0-98	60
Calamagrostis stricta (narrow-spiked reedgrass)	76	0-98	40
Carex aquatilis (water sedge)	5	0-10	10
Carex atherodes (awned sedge)	7	0-10	10
Carex brunnescens (brownish sedge)	10	0-10	5
Carex buxbaumii (Buxbaum's sedge)	3	0-3	5
Carex capillaris (hair sedge)	3	0-3	5
Carex haydeniana (Hayden's sedge)	3	0-3	5
Carex lasiocarpa (slender sedge)	10	0-10	5
Carex lenticularis (lentil-fruit sedge)	10	0-10	5
Carex limosa (mud sedge)	1	0-1	5
Carex microptera (small-winged sedge)	2	0-3	10
Carex multicostata (many-ribbed sedge)	1	0-1	5
Carex rostrata (beaked sedge)	5	0-10	30
Carex scopulorum (Holm's Rocky Mountain sedge)	1	0-1	5
Carex vesicaria (inflated sedge)	10	0-10	5
Deschampsia cespitosa (tufted hairgrass)	15	0-30	20
Elymus glaucus (blue wildrye)	1	0-3	15
Glyceria elata (tall mannagrass)	1	0-1	5
Melica subulata (alas spiraea)	1	0-1	10
Phleum alpinum (alpine timothy)	1	0-1	5
Phleum pratense (common timothy)	1	0-1	5
Poa palustris (fowl bluegrass)	15	0-20	10
Poa pratensis (Kentucky bluegrass)	1	0-1	5
Scirpus microcarpus (small-flowered bulrush)	1	0-1	10
Trisetum wolfii (Wolf's trisetum)	10	0-10	5
Forbs			
Achillea millefolium (common yarrow)	1	0-1	5
Allium schoenoprasum (chives)	3	0-3	5
Anaphalis margaritacea (common pearly-everlasting)	1	0-1	5
Angelica arguta (sharptooth angelica)	14	0-20	15
Antennaria corymbosa (meadow pussy-toes)	10	0-20	10
Aquilegia spp. (columbine)	1	0-1	5
Arnica mollis (hairy arnica)	10	0-10	5
Arnica spp. (arnica)	20	0-20	5
Artemisia dracunculus (tarragon)	1	0-1	5
Aster eatonii (Eaton's aster)	4	0-10	15
Aster foliaceus (leafy aster)	10	0-30	15
Aster modestus (few-flowered aster)	1	0-1	5
Aster occidentalis (western aster)	10	0-20	10
Aster subspicatus (Douglas aster)	1	0-1	10
Chrysanthemum leucanthemum (oxeye-daisy)	1	0-1	5
Circaea alpina (enchanters nightshade)	1	0-1	5
Cirsium arvense (Canada thistle)	1	0-1	15

Crepis runcinata (meadow hawksbeard)	1	0-1	5
Dodecatheon jeffreyi (tall mountain shooting star)	1	0-1	5
Dodecatheon pulchellum (few-flowered shooting star)	3	0-3	5
Epilobium alpinum (alpine willow-herb)	1	0-1	5
Epilobium ciliatum (common willow-herb)	1	0-1	30
Epilobium spp. (willow-herb)	1	0-1	5
Fragaria vesca (woods strawberry)	1	0-1	5
Fragaria virginiana (Virginia strawberry)	1	0-1	10
Galium spp. (bedstraw)	1	0-1	5
Galium triflorum(sweetscented bedstraw)	1	0-1	10
Geranium richardsonii (white geranium)	1	0-3	15
Geum macrophyllum (large-leaved avens)	2	0-3	25
Geum spp. (avens)	3	0-3	5
Habernaria saccata (slender bog-orchid)	1	0-1	5
Heracleum lanatum (cow-parsnip)	14	0-30	15
Ligusticum spp. (lovage)	30	0-30	5
Ligusticum tenuifolium (slender-leafed licorice-root)	25	0-30	10
Mentha arvensis (field mint)	5	0-10	15
Mertensia ciliata (mountain bluebell)	1	0-1	10
Mitella nuda (bare-stemed mitrewort)	1	0-1	5
Parnassia fimbriata (fringed grass-of-parnassus)	3	0-3	5
Pedicularis groenlandica (elephant's head)	11	0-20	15
Polygonum amphibium (water smartweed)	1	0-1	5
Potentilla diversifolia (diverse-leaved cinquefoil)	1	0-1	5
Potentilla palustris (purple cinquefoil)	20	0-20	5
Rumex crispus (curly dock)	1	0-1	5
Scutellaria galericulata (marsh skullcap)	3	0-3	5
Senecio pseudaureus (streambank groundsel)	40	0-40	5
Senecio triangularis (arrowleaf groundsel)	17	0-50	25
Sibbaldia procumbens (creeping sibbaldia)	10	0-10	5
Stellaria longipes (longstalk starwort)	1	0-1	5
Stellaria spp. (starwort)	1	0-1	10
Stenanthium occidentale (western stenanthium)	1	0-1	5
Taraxacum ceratophorum (horned dandelion)	1	0-1	5
Taraxacum officinale (common dandelion)	1	0-1	10
Thalictrum occidentale (western meadowrue)	1	0-1	5
Trautvetteria caroliniensis (false bugbane)	1	0-1	5
Veratrum viride (green false hellebore)	3	0-3	10
Veronica scutellata (marsh speedwell)	1	0-1	5
Veronica serpyllifolia (thyme-leaved speedwell)	1	0-1	5
Veronica wormskjoldii (Wormskjold speedwell)	1	0-1	5
Viola canadensis (Canada violet)	1	0-1	5
Viola spp. (violet)	7	0-20	30
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-1	5
Botrychium multifidum (leathery grape-fern)	3	0-3	5
Equisetum arvense (field horsetail)	5	0-10	10
Equisetum pratense (meadow horsetail)	2	0-3	10
Equisetum spp. (horsetail)	1	0-1	5

SUCCESSIONAL INFORMATION

Moderate grazing reduces the reproductive potential and vigor of *Calamagrostis canadensis* (bluejoint reedgrass) through reduced seedhead production and depletion of carbohydrate reserves. Under heavy grazing, *Calamagrostis canadensis* (bluejoint reedgrass) vigor is reduced and other graminoids and forbs dominate the site. Severely disturbed dry sites are dominated by graminoids such as *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), *Agrostis stolonifera* (redtop), and *Juncus balticus* (Baltic rush), and have an abundance of forbs such as *Achillea millefolium* (common yarrow) and *Aster occidentalis* (western aster). Severely disturbed moist sites are generally dominated by *Juncus balticus* (Baltic rush), *Carex nebrascensis* (Nebraska sedge), and other sedges, and by an assortment of forbs. These disturbed stands begin to take on the appearance of the *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), *Juncus balticus* (Baltic rush), or *Carex nebrascensis* (Nebraska sedge) community types.

SOILS

Soils are commonly Entisols (Aquents and Fluvents) or Inceptisols (Aquepts), rarely Histosols (Mattson 1984). Parent materials are usually coarse textured alluvium along low gradient streams. Soil texture is finer (clay loam to sand) on sites adjacent to wet meadows. Plant available water is estimated from moderate to high and soils remain moist throughout much of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) habitat types. Adjacent drier communities may be dominated by *Deschampsia cespitosa* (tufted hairgrass) and *Salix geyeriana* (Geyer willow) dominated habitat types, and *Abies lasiocarpa* (subalpine fir) dominated habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production from the *Calamagrostis canadensis* (bluejoint reedgrass) habitat type is usually high. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Continued close utilization results in decreased *Calamagrostis canadensis* (bluejoint reedgrass) production.

The *Calamagrostis canadensis* (bluejoint reedgrass) habitat type is generally moist until mid summer and is preferred as mid to late season pasture by livestock following forage depletion on adjacent uplands. Therefore, the season of use often coincides with the maturity of *Calamagrostis canadensis* (bluejoint reedgrass) and grazing by livestock can limited impact on meadows when done with moderation. However, grazing should be restricted when soils are moist, especially along streams where bank sloughing can occur.

In order to develop an upward trend in ecological status on moderately disturbed sites, time the season of use by livestock to both the drying of the soil surface and to the maturation of the seedheads. Livestock should be removed when 40 percent or less utilization of herbaceous forage is obtained.

In addition, heavy grazing will cause a marked decrease in the highly palatable *Deschampsia cespitosa* (tufted hairgrass) and an increase in the less palatable *Juncus balticus* (Baltic rush). *Juncus balticus* (Baltic rush) is considered palatable early in the growing season when plants are young and tender. As stems mature and toughen, palatability declines (Hermann 1975).

In severely disturbed sites, more intensive rehabilitation strategies will be required due to the abundance of *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), *Juncus balticus* (Baltic rush), and *Carex nebrascensis* (Nebraska sedge).

Wildlife

Elk may make moderate summer use of *Calamagrostis canadensis* (bluejoint reedgrass), *Deschampsia cespitosa* (tufted hairgrass), and *Juncus balticus* (Baltic rush) (Kufeld 1987).

Fisheries

The rhizomatous nature of *Calamagrostis canadensis* (bluejoint reedgrass) will help provide bank stability for those sites adjacent to streams.

Fire

Fires reducing the abundance of other associated species tend to result in dramatic increases in *Calamagrostis canadensis* (bluejoint reedgrass) and other rhizomatous species (Haeussler and Coates 1986). *Calamagrostis canadensis* (bluejoint reedgrass) is an aggressive invader of burned sites.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning tends to favor rhizomatous species such as *Poa pratensis* (Kentucky bluegrass) and *Agropyron caninum* (bearded wheatgrass). Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa* (tufted hairgrass).

Soil Management and Rehabilitation Opportunities

Coarse textured soils have limited compaction problems. Sites with fine textured soils are highly susceptible to compaction and other disturbances particular when moist. In most cases roads and trails should be located on adjacent uplands.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streambanks.

Deschampsia cespitosa (tufted hairgrass) has a weak, fibrous root system that is of little value for stabilizing streambanks (Youngblood and others 1985b). However, *Juncus balticus* (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes. Once established, they spread rapidly. These soil holding characteristics may make it valuable for stabilizing streambanks.

Recreational Uses and Considerations

The sites provide opportunities for viewing big game during the summer and fall. Those sites adjacent to streams provide access points for fishing.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and

Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have been described for the central plateau of Yellowstone National Park by Mattson (1984), and Rocky Mountain National Park of Colorado by Wilson (1969). In addition, Padgett and others (1989) described a similar community for Utah and southeastern Idaho.

Deschampsia cespitosa Habitat Type
(Tufted Hairgrass Habitat Type)

DESCES (DECA5)
Number Of Stands Sampled = 35

LOCATION AND ASSOCIATED LANDFORMS

The *Deschampsia cespitosa* (tufted hairgrass) habitat type is a minor type at mid to high elevations in the mountains of Montana. Sites range in elevation from 1,533 to 3,079 m (5,030 to 8,570 ft). The type occurs on a variety of landforms including basins, wet meadows, nearly level stream terraces, and seep areas. The sites are commonly flooded by late spring and early summer snow melt.

FLORISTIC CHARACTERISTICS

Deschampsia cespitosa (tufted hairgrass) usually forms a dense stand of individual tussocks. Associated herbaceous species generally include *Carex vesicaria* (inflated sedge), *Aster occidentalis* (western aster), and *Pedicularis groenlandica* (elephant's head).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	11
Salix boothii (Booth willow)	1	0-1	11
Salix exigua (sandbar willow)	1	0-1	11
Salix planifolia (planeleaf willow)	1	0-1	11
Salix wolfii (Wolf's willow)	1	0-1	11
Graminoids			
Agrostis humilis (alpine bentgrass)	10	0-10	11
Agrostis scabra (tickle-grass)	30	0-30	11
Alopecurus alpinus (alpine foxtail)	1	0-1	11
Calamagrostis canadensis (bluejoint reedgrass)	1	0-1	11

Carex aquatilis (water sedge)	5	0-10	22
Carex atherodes (awned sedge)	10	0-10	11
Carex aurea (golden sedge)	10	0-10	11
Carex concinnoides (northwestern sedge)	3	0-3	11
Carex limosa (mud sedge)	10	0-10	11
Carex luzulina (woodrush sedge)	10	0-10	11
Carex microptera (small-winged sedge)	3	0-3	11
Carex praticola (meadow sedge)	3	0-3	11
Carex rostrata (beaked sedge)	5	0-10	33
Carex vesicaria (inflated sedge)	11	0-20	44
Danthonia intermedia (oatgrass)	40	0-40	11
Deschampsia cespitosa (tufted hairgrass)	42	30-80	100
Eleocharis pauciflora (few-flowered spike-rush)	3	0-3	11
Festuca spp. (fescue)	20	0-20	11
Hordeum jubatum (foxtail barley)	3	0-3	22
Juncus balticus (Baltic rush)	1	0-1	11
Luzula campestris (field woodrush)	1	0-1	11
Phleum alpinum (alpine timothy)	11	0-20	33
Poa leptocoma (bog bluegrass)	1	0-1	11
Trisetum wolfii (Wolf's trisetum)	1	0-1	11
Forbs			
Allium schoenoprasum (chives)	10	0-10	11
Antennaria corymbosa (meadow pussy-toes)	1	0-1	11
Antennaria umbrinella (umber pussy-toes)	10	0-10	11
Arnica chamissonis (meadow arnica)	20	0-30	22
Arnica rydbergii (Rydberg's arnica)	1	0-1	22
Aster chilensis (long-leaved aster)	40	0-40	11
Aster foliaceus (leafy aster)	30	0-30	11
Aster occidentalis (western aster)	8	0-20	44
Caltha leptosepala (elkslip marshmarigold)	50	0-50	11
Epilobium ciliatum (common willow-herb)	1	0-1	11
Gentiana calycosa(explorer's gentian)	10	0-10	11
Geum macrophyllum (large-leaved avens)	10	0-20	22
Ligusticum tenuifolium (slender-leafed licorice-root)	14	0-20	33
Microseris nigrescens (black-hairy microseris)	10	0-10	11
Pedicularis groenlandica (elephant's head)	3	0-10	44
Petasites sagittatus (arrowleaf coltsfoot)	1	0-1	11
Polygonum bistortoides (American bistort)	1	0-1	22
Potentilla diversifolia (diverse-leaved cinquefoil)	5	0-10	22
Potentilla gracilis (slender cinquefoil)	1	0-1	11
Senecio cymbalarioides (few-leaved groundsel)	10	0-10	11
Senecio integerrimus (western groundsel)	10	0-30	33
Stellaria longipes (longstalk starwort)	1	0-1	22
Trifolium longipes (long-stalked clover)	1	0-1	11
Veronica cusickii (Cusick's speedwell)	1	0-1	11

SUCCESSIONAL INFORMATION

It is felt that *Deschampsia cespitosa* (tufted hairgrass) once occupied much larger acreages, but through long term heavy

grazing, has been eliminated from many of its former locations. On relatively undisturbed sites, *Deschampsia cespitosa* (tufted hairgrass) is dominant over other graminoids and forbs. Litter is thick on drier sites but may be absent on moist sites. Moderate grazing reduces the reproductive potential and vigor of *Deschampsia cespitosa* (tufted hairgrass) through reduced seedhead production and depletion of carbohydrate reserves. Under heavy grazing, *Deschampsia cespitosa* (tufted hairgrass) vigor is further reduced and other graminoids and forbs dominate the site. Severely disturbed dry sites are dominated by graminoids such as *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), *Agrostis stolonifera* (redtop), and *Juncus balticus* (Baltic rush), and have an abundance of forbs such as *Achillea millefolium* (common yarrow) and *Aster occidentalis* (western aster). Severely disturbed moist sites are generally dominated by *Juncus balticus* (Baltic rush), *Carex nebrascensis* (Nebraska sedge), and other sedges, and by an assortment of forbs. These disturbed stands begin to take on the appearance of the *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), *Juncus balticus* (Baltic rush), or *Carex nebrascensis* (Nebraska sedge) community types.

SOILS

Soils are generally Mollisols (Aquolls or Borolls) and Entisols. Soil texture is commonly silt loam. Water tables at or slightly above the soil surface is common in spring, often dropping below 1 m (39 in) of the surface in summer on the drier stands. Wetter stands, having year long water tables above 1 m (39 in) depth, commonly have some accumulation of organic material at the soil surface. Redox concentrations (mottles) near the soil surface are common as evidence of a seasonally high water table.

ADJACENT COMMUNITIES

Adjacent wetter communities at mid elevation includes the *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) habitat types. High elevations may include the *Carex scopulorum* (Holm's Rocky Mountain sedge) habitat type. Adjacent drier communities include a variety of shrub and herbaceous types such as the *Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) and *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat types, or the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types. Adjacent drier sites may also include conifer dominated communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is high, ranging from 500 to 3,000 lbs/acre dry weight at lower elevations, and ranging from 500 to 1,500 lbs/acre at higher elevations (Kovalchik 1987). Sites of the *Deschampsia cespitosa* (tufted hairgrass) habitat type are among the best summer range for cattle in western Montana (Mueggler and Steward 1980). However, in general, sites receive heavy livestock pressure because it typically dries in the upper soil and is relatively palatable, especially to cattle. Suitability for sheep is not as great because of the predominantly graminoid vegetation. Under season long grazing, *Deschampsia cespitosa* (tufted hairgrass) may be replaced by *Juncus balticus* (Baltic rush) and *Poa pratensis* (Kentucky bluegrass). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry. Proper levels of grazing should range from light to moderate.

In order to develop an upward trend in ecological status on moderately disturbed sites, time the season of use by livestock to both the drying of the soil surface and to the maturation of the seedheads (Kovalchik 1987). Livestock should be removed when 40 percent or less utilization of herbaceous forage is obtained.

In severely disturbed sites, more intensive rehabilitation strategies will be required due to the abundance of *Poa pratensis* (Kentucky bluegrass), *Poa palustris* (fowl bluegrass), and *Juncus balticus* (Baltic rush).

Wildlife

Landforms supporting the *Deschampsia cespitosa* (tufted hairgrass) habitat type provide important summer habitat for deer and elk. This type also provides food and cover for waterfowl (Dittberner and Olson 1983). Care should be taken to avoid use conflicts between livestock and wildlife.

Fisheries

This type is usually separated from open water by a zone dominated by *Salix* species (willow) or *Carex* species (sedge). However, where it is adjacent to streams, the weak, fibrous root system of *Deschampsia cespitosa* (tufted hairgrass) has little value for stabilizing streambanks (Youngblood and others 1985b). If downcutting is severe, water tables will drop, resulting in a change in the community.

Fire

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning of this habitat type favors rhizomatous species such as *Poa pratensis* (Kentucky bluegrass) and *Agropyron caninum* (bearded wheatgrass). Burning should be postponed if livestock are present to avoid attracting animals to young, palatable regrowth of *Deschampsia cespitosa* (tufted hairgrass).

Soil Management and Rehabilitation Opportunities

Moist soils are readily compacted by livestock and vehicular traffic. Seasonally high water tables common to this type can make soils particularly susceptible to compaction problems. In most cases, roads and trails should be located on the uplands adjacent to this type.

Although widely recommended for use in alpine and subalpine mine reclamation and revegetation efforts, *Deschampsia cespitosa* (tufted hairgrass) shows little potential for use in streambank rehabilitation projects due to its thin fibrous root structure (Youngblood and others 1985). However, *Juncus balticus* (Baltic rush) produces a deep and fibrous root system, with a mass of coarse and creeping rhizomes. Once established, they spread rapidly. These soil holding characteristics may make it valuable for stabilizing streambanks.

Recreational Uses and Considerations

The sites provide opportunities for viewing big game during the summer and fall. Those sites adjacent to streams provide access points for fishing.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet

meadow range site.

OTHER STUDIES

Similar communities have been described by Mueggler and Steward (1980) for western Montana (*Deschampsia cespitosa/Carex* species [tufted hairgrass/sedge habitat type]), Youngblood and others (1985) for eastern Idaho and western Wyoming, Kovalchik (1987) for central Oregon, Tuhy and Jensen (1982) for Idaho, Padgett and others (1989) for Utah and southeastern Idaho, Ratliff (1982) for the Sierra Nevada's in California, and Franklin and Dyrness (1973) for Oregon and Washington.

Distichlis spicata Habitat Type
(Inland Saltgrass Habitat Type)

DISSPI (DISP)
Number Of Stands Sampled = 21

LOCATION AND ASSOCIATED LANDFORMS

The *Distichlis spicata* (inland saltgrass) habitat type is an minor type at lower elevations in central and eastern Montana, and incidental in the valleys of southwestern Montana. The type occupies saline or alkali basins, swales, pond and lake margins, and seep areas. Sites range in elevation from 835 to 1,173 m (2,740 to 3,850 ft).

FLORISTIC CHARACTERISTICS

The *Distichlis spicata* (inland saltgrass) habitat type is usually identified by a relatively pure stand of *Distichlis spicata* (inland saltgrass) with scattered patches of *Puccinellia nuttalliana* (Nuttall alkaligrass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Agropyron intermedium (intermediate wheatgrass)	10	0-10	11
Agropyron repens (quackgrass)	10	0-10	11
Dactylis glomerata (orchard-grass)	3	0-3	11
Distichlis spicata (inland saltgrass)	57	10-80	100
Festuca pratensis (meadow fescue)	70	0-70	11
Poa nevadensis (Nevada bluegrass)	10	0-10	11
Puccinellia nuttalliana (Nuttall alkaligrass)	28	0-80	67
Forbs			
Salicornia rubra (red glasswort)	3	0-3	22
Suaeda depressa (pahute weed)	2	0-3	33
Triglochin maritimum (seaside arrow-grass)	3	0-3	22

SUCCESSIONAL INFORMATION

High use of this habitat type will normally weaken associated perennial grasses, such as *Puccinellia nuttalliana* (Nuttall alkaligrass). With prolonged heavy use, *Hordeum jubatum* (foxtail barley) may replace *Distichlis spicata* (inland saltgrass).

SOILS

Parent material is commonly alluvium. Soils are classified as Aquolls or Borolls of cold, wet basins, and Argiborolls or Haploborolls on Piedmont glacial moraines (USDA Soil Conservation Service 1985; Montagne and others 1982). Soil texture ranges from clay to silt loam. Water tables usually remain at or slightly below the soil surface. Soil reaction is commonly alkaline (pH 8.0). Soils of this type characteristically have high concentrations of soluble salts (saline soils).

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by the *Scirpus acutus* (hardstem bulrush) habitat type, *Scirpus nevadensis* (Nevada bulrush) or open water. Drier communities may be dominated by *Sarcobatus vermiculatus* (black greasewood) or a variety of upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production in this type rates as low. *Distichlis spicata* (inland saltgrass) is not particularly palatable, but as other forages dry up, livestock may make considerable use of it (Johnson and Nichols 1982). On the other hand, the associated grass *Puccinellia nuttalliana* (Nuttall alkaligrass) is moderately palatable to livestock. With prolonged heavy use, *Hordeum jubatum* (foxtail barley) may replace *Distichlis spicata* (inland saltgrass) and *Puccinellia nuttalliana* (Nuttall alkaligrass).

Wildlife

Due to the short stature of plants of the *Distichlis spicata* (inland saltgrass) habitat type, it is of limited value to wildlife.

Fire

Fire is not much of a problem in this type due to the limited amounts of flammable fuels.

Soil Management and Rehabilitation Opportunities

The high clay content and saline nature common to theses soils make them extremely susceptible to compaction problems and development limitations. New trails or roads should be located on the adjacent uplands.

On degraded saline/alkaline sites, *Distichlis spicata* (inland saltgrass) can be transplanted. Its rhizomatous growth form allows it to quickly spread across suitable sites.

Recreational Uses and Considerations

Recreational use of this type is extremely limited. However, campsites or associated roads should located elsewhere due to the high clay content of this type (rainfall or high water tables can cause severe problems).

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = saline lowland range site; Western Glaciated Plains, 10-14 inch

Precipitation Zone = saline lowland range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site, silty saline range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = saline lowland range site. Western Sedimentary Plains; 5-9 inch Precipitation Zone = dense clay range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site; Foothills and Mountains, 10-14 inch Precipitation Zone = saline lowland range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = saline lowland range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = saline lowland range site.

OTHER STUDIES

Hanson and Whitman (1938) described a similar type for western North Dakota. Daubenmire (1970) described a *Distichlis spicata* (inland saltgrass) habitat type consisting of a pure stand of *Distichlis spicata* (inland saltgrass), and occurring in saline/alkaline areas of eastern Washington.

Eleocharis palustris Habitat Type
(Common Spikesedge Habitat Type)

ELEPAL (ELPA3)
Number Of Stands Sampled = 57

Note: The *Eleocharis palustris* (common spikesedge) habitat type includes all combinations of *Eleocharis palustris* (common spikesedge) and *Eleocharis acicularis* (needle spike-rush) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Eleocharis palustris* (common spikesedge) habitat type is a major type located at low to mid elevations throughout Montana. Sites range in elevation from 671 to 2,477 m (2,200 to 5,600 ft). It typically occurs on sites prone to yearly flooding, along stream, rivers, and lake margins, and reservoirs. Sites are generally classified as seasonally flooded.

FLORISTIC CHARACTERISTICS

Eleocharis palustris (common spikesedge) is the dominant graminoid. The small statured *Eleocharis acicularis* (needle spike-rush) is also common.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Graminoids			
Beckmannia syzigachne (American sloughgrass)	2	0-3	17
Carex aquatilis (water sedge)	1	0-1	8
Carex vesicaria (inflated sedge)	2	0-3	17
Deschampsia cespitosa (tufted hairgrass)	3	0-3	8
Eleocharis acicularis (needle spike-rush)	94	0-98	17
Eleocharis palustris (common spikesedge)	85	0-98	83
Glyceria spp. (mannagrass)	1	0-1	8
Hordeum jubatum (foxtail barley)	1	0-3	25

Scirpus acutus (hardstem bulrush)	1	0-1	8
Scirpus maritimus (alkali bulrush)	3	0-3	8
Forbs			
Mentha arvensis (field mint)	1	0-1	8
Polygonum amphibium (water smartweed)	1	0-1	17
Rumex crispus (curly dock)	10	0-20	17

SUCCESSIONAL INFORMATION

Eleocharis palustris (common spikesedge) is an early colonizer of suitable habitats and are able to persist under wet conditions. Due to the continually saturated conditions and the aggressive characteristic of *Eleocharis palustris* (common spikesedge), most other species are precluded.

SOILS

Soils of this type vary widely including Histosols, Mollisols, and occasionally Entisols. Organic accumulations at the surface are common. Soil texture is commonly fine silt or clay resulting from pond or stream siltation. These sites are generally ponded throughout much of the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites support stands of the *Scirpus acutus* (hardstem bulrush) habitat type or aquatic communities. Slightly drier riparian or wetland sites are dominated by graminoids such as *Carex rostrata* (beaked sedge), *Juncus balticus* (Baltic rush), and *Poa palustris* (fowl bluegrass). Upland communities are dominated by a wide variety of types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Seasonally wet conditions and the low palatability of *Eleocharis palustris* (common spikesedge) and *E. acicularis* (needle spike-rush) limit the grazing value of this type for livestock. Use of this type is often greater in drought years due to the limited availability and palatability of upland forage.

Wildlife

Broad zones of this type along streams, rivers, lakes, and reservoirs provide valuable feeding and nesting areas for waterfowl. *Eleocharis palustris* (common spikesedge) and associated plants are a valuable source of food and cover for waterfowl.

Soil Management and Rehabilitation Opportunities

These sites are generally so wet as to preclude most development. Trampling damage and soil churning occurs readily with livestock use.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded to seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = wet meadow range site.

OTHER STUDIES

Similar communities have been described by Kovalchik (1987), Ratliff (1982), Chadde and others (1988), and by Padgett and others (1989).

Eleocharis pauciflora Habitat Type
(Few-flowered Spike-rush Habitat Type)

ELEPAU (ELPA6)
Number Of Stands Sampled = 18

Note: The *Eleocharis pauciflora* (few-flowered spike-rush) habitat type includes all combinations of *Eleocharis pauciflora* (few-flowered spike-rush) and *Eleocharis rostellata* (beaked spike-rush) due to similarities in management concerns and environmental conditions.

LOCATION AND ASSOCIATED LANDFORMS

The *Eleocharis pauciflora* (few-flowered spike-rush) habitat type is a minor type of mid to high elevations in the mountains of central and southwestern Montana. Sites range in elevation from 1,506 to 2,538 m (4,940 to 8,320 ft). It occurs in wet basins and adjacent to streams, rivers, and ponds. Sites are generally classified as seasonally flooded.

FLORISTIC CHARACTERISTICS

Eleocharis pauciflora (few-flowered spike-rush) and/or *Eleocharis rostellata* (beaked spike-rush) dominates a low (less than 30 cm) herbaceous layer.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Kalmia microphylla (small-leaved laurel)	3	0-3	10
Salix planifolia (planeleaf willow)	1	0-1	10
Graminoids			
Agrostis scabra (tickle-grass)	3	0-3	10
Agrostis stolonifera (redtop)	1	0-1	10
Carex aquatilis (water sedge)	6	0-10	50
Carex buxbaumii (Buxbaum's sedge)	20	0-20	10

Carex canescens (gray sedge)	1	0-1	10
Carex rostrata (beaked sedge)	11	0-20	30
Deschampsia cespitosa (tufted hairgrass)	4	0-10	40
Eleocharis pauciflora (few-flowered spike-rush)	45	0-70	80
Eleocharis rostellata (beaked spike-rush)	89	0-98	20
Juncus torreyi (Torrey's rush)	1	0-1	10
Muhlenbergia asperifolia (alkali muhly)	1	0-1	10
Phleum alpinum (alpine timothy)	1	0-1	10
Polypogon monspeliensis (rabbitfoot polypogon)	1	0-1	10
Scirpus acutus (hardstem bulrush)	2	0-3	20
Scirpus americanus (American bulrush)	3	0-3	10
Spartina gracilis (alkali cordgrass)	1	0-1	10
Forbs			
Antennaria corymbosa (meadow pussy-toes)	1	0-1	10
Aster eatonii (Eaton's aster)	1	0-1	20
Aster occidentalis (western aster)	1	0-1	20
Caltha leptosepala (elkslip marshmarigold)	1	0-1	10
Epilobium angustifolium (fireweed)	1	0-1	10
Epilobium ciliatum (common willow-herb)	1	0-1	10
Helianthus nuttallii (Nuttall's sunflower)	1	0-1	20
Mimulus primuloides (primrose monkey-flower)	1	0-1	10
Parnassia spp. (grass-of-parnassus)	1	0-1	10
Pedicularis groenlandica (elephant's head)	1	0-1	30
Potentilla palustris (purple cinquefoil)	1	0-1	10
Senecio cymbalarioides (few-leaved groundsel)	1	0-3	40
Spiranthes romanzoffiana (hooded ladies-tresses)	1	0-1	20
Swertia perennis (swertia)	1	0-1	20
Triglochin maritimum (seaside arrow-grass)	10	0-20	20
Viola spp. (violet)	1	0-1	10

SUCCESSIONAL INFORMATION

Eleocharis pauciflora (few-flowered spike-rush) is an early colonizer of suitable habitats and are able to persist under wet conditions. Grazing animals may seek out the forage offered by associated species such as *Deschampsia cespitosa* (tufted hairgrass), and *Phleum alpinum* (alpine timothy).

SOILS

Soils are typically Borofibrists, Borohemists, and Borosaprists. Water tables remain at or near the surface year round. Soil reaction varies little from slightly acid to neutral (pH 6.0 to 7.0)

ADJACENT COMMUNITIES

Adjacent sites may support the *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) habitat types. The *Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) habitat type may occur on slightly drier sites. Within the subalpine zone, *Abies lasiocarpa* (subalpine fir) and *Pinus albicaulis* (white-bark pine) often dominate adjacent uplands. At lower elevations, *Picea engelmannii* (Engelmann spruce) is common.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock
If sites dry in the summer, livestock may graze forage plants of this type. Overgrazing can cause compositional changes to species of lower palatability.

Wildlife
This type is a source of green forage early in the spring, attracting wildlife, and can result in heavy use by ungulates. However, waterfowl may feed on the small seeds of *Eleocharis pauciflora* (few-flowered spike-rush).

Soil Management and Rehabilitation Opportunities
Wet, organic soils retard animal use and minimize soil disturbance problems. Yet, trampling damage occurs readily with any livestock use.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = semipermanently flooded to seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = wet meadow range site.

OTHER STUDIES

Mattson identified a similar *Eleocharis pauciflora* (few-flowered spike-rush)-*Carex aquatilis* (water sedge) type in central Yellowstone National Park. Kovalchik (1987) described an *Eleocharis pauciflora* (few-flowered spike-rush) association for the central Oregon. Ratliff (1982) identified a similar community for meadows of the Sierra Nevada, California. Finally, Padgett and others (1989) described a similar community for Utah and southeastern Idaho.

Equisetum fluviatile Habitat Type
(Water Horsetail Habitat Type)

EQUFLU (EQFL)
Number Of Stands Sampled = 16

LOCATION AND ASSOCIATED LANDFORMS

The *Equisetum fluviatile* (water horsetail) habitat type is an incidental type at low to mid elevations in the mountains of central and southwestern Montana, and a minor type in the mountains and valleys of northwest Montana. It ranges from 793 to 1,841 m (2,600 to 6,040 ft). This habitat type occupies shallow water or wet ground along the margins of lakes and ponds, and backwater areas of rivers and streams in standing water up to 0.5 m (20 in) deep.

FLORISTIC CHARACTERISTICS

The *Equisetum fluviatile* (water horsetail) habitat type usually forms monotypic stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Graminoids			
Carex rostrata (beaked sedge)	1	0-1	17
Glyceria grandis (American mannagrass)	1	0-1	17
Ferns and Allies			
Equisetum fluviatile (water horsetail)	81	70-98	100

SUCCESSIONAL INFORMATION

Equisetum fluviatile (water horsetail) is an early colonizer of shallowly submerged sediments. Most sites are so wet throughout the growing season as to preclude most types of disturbances.

SOILS

Soils vary widely including Histosols, Mollisols, and Entisols. Mineral soils (Mollisols and Entisols) commonly have layers of organic accumulation. Soils are poorly to very poorly drained. Standing water is usually present throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by *Nuphar* species (lily), *Typha* species (cattails), *Scirpus* species (bulrush), or open water. Adjacent drier communities may be dominated by a wide variety of species including *Phalaris arundinacea* (reed canarygrass), *Phragmites australis* (common reed), *Carex* species (sedge), and *Salix* species (willow).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is moderate. However, *Equisetum fluviatile* (water horsetail) is seldom grazed by livestock due to its low palatability. Johnson and Nichols (1982) note species of *Equisetum* (horsetail) are not generally regarded as an important forage. In wild hay, if in excessive quantities, *Equisetum* species (horsetail) is known to cause scours, paralysis, and occasionally death. Hay containing around 20 percent or more *Equisetum* species (horsetail) can produce poisoning symptoms in horses. Symptoms appear in 2-5 weeks, beginning with weight loss, loss of muscular control, and followed by falling, exhaustion, and possibly death. Cattle, sheep, and goats are rarely affected.

Wildlife

Equisetum fluviatile (water horsetail) is seldom grazed by wildlife due to its low palatability. Waterfowl and muskrats use this habitat type for nesting and hiding cover.

Fisheries

The *Equisetum fluviatile* (water horsetail) habitat type may provide valuable spawning areas for many species of fish. It may also provide hiding cover.

Soil Management and Rehabilitation Opportunities
These sites are generally so wet as to preclude most development.

Recreational Uses and Considerations
The sites are generally so wet as to preclude most types of recreational uses except fishing.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = permanently flooded to semipermanently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
The range site classification does not classify sites with this degree of wetness.

OTHER STUDIES

A similar community was described by Dirschl and others (1974) in northern Alberta, Canada.

Glyceria borealis Habitat Type
(Northern Mannagrass Habitat Type)

GLYBOR (GLBO)
Number Of Stands Sampled = 9

LOCATION AND ASSOCIATED LANDFORMS

The *Glyceria borealis* (northern mannagrass) habitat type is an incidental type at low to mid elevations in Montana. Stand elevations ranged from 670 to 1,812 m (2,200 to 5,940 ft) with slopes ranging from 0 to 1 percent. This habitat type occupies pond and lake margins, and low-gradient streams where it often occurs in shallow water. In some instances, it may be associated with wet meadows.

FLORISTIC CHARACTERISTICS

Sites are generally monotypic in nature and are dominated by the tall *Glyceria borealis* (northern mannagrass). In addition, *Eleocharis palustris* (common spikesedge), *Eleocharis acicularis* (needle spike-rush), and *Glyceria elata* (tall mannagrass) may also be present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Graminoids			
Alopecurus geniculatus (water foxtail)	1	0-1	20

Carex rostrata (beaked sedge)	1	0-1	20
Eleocharis acicularis (needle spike-rush)	30	0-30	20
Eleocharis palustris (common spikesedge)	25	0-40	40
Glyceria borealis (northern mannagrass)	66	30-90	100
Glyceria elata (tall mannagrass)	20	0-20	20
Glyceria grandis (American mannagrass)	3	0-3	20
Forbs			
Nasturtium officinale (water-cress)	10	0-10	20
Nuphar luteum (yellow water-lily)	3	0-3	20
Ranunculus aquatilis (white water-buttercup)	20	0-20	20
Sparganium emersum (small bur-reed)	20	0-20	20

SUCCESSIONAL INFORMATION

The sites are generally so wet as to preclude most types of disturbances.

SOILS

Soils vary widely, including Histosols, Mollisols (Aquolls) and Entisols (Aquents). Mineral soils typically have some organic matter accumulation. Soils are poorly to very poorly drained. Water tables often remain above the soil surface throughout the summer. Soil reaction varies little from slightly acid to neutral (pH 6.0 to 7.0).

ADJACENT COMMUNITIES

Adjacent wetter communities are typically the open water, while adjacent drier communities are often dominated by the *Carex rostrata* (beaked sedge) habitat type. Adjacent upland are dominated by a variety of communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is usually high with *Glyceria borealis* (northern mannagrass) rated as highly palatable for livestock (USDA Forest Service 1937). Cattle and horses will consume both flowering stalks and leaves. Sheep tend to use only the leaves. Wet conditions tend to delay grazing until late in the season at which time the soils are normally drier and the forage is less succulent.

Wildlife

The zones of *Glyceria borealis* (northern mannagrass) along lakes and ponds offer valuable habitat for waterfowl. The seeds provide good forage for ducks. Elk, moose, and deer may make moderate use of this habitat type.

Fire

Wildfire is rare in this habitat type.

Soil Management and Rehabilitation Opportunities

These sites are generally so wet as to preclude most development activities.

Recreational Uses and Considerations

The sites are generally so wet as to preclude most types of recreational uses except for fishing.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below

along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = wet meadow range site.

OTHER STUDIES

Similar communities have been described by Jeglum and others (1974) for Ontario, Canada.

Glycyrrhiza lepidota Community Type
(American Licorice Community Type)

GLYLEP (GLLE)
Number Of Stands Sampled = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Glycyrrhiza lepidota* (American licorice) community type is a minor type of low elevation riparian or wetland environments throughout central and eastern Montana. This type occurs on sloping banks, low terraces, and recent alluvial deposits adjacent to streams and rivers.

FLORISTIC CHARACTERISTICS

Glycyrrhiza lepidota (American licorice) dominates the aspect of this type. Common associates of this grazing disclimax include *Bromus inermis* (smooth brome), *Agropyron smithii* (western wheatgrass), and *Xanthium strumarium* (common cocklebur) (Appendix 00).

SUCCESSIONAL INFORMATION

The *Glycyrrhiza lepidota* (American licorice) community type is a grazing induced disclimax; replacing sites formally held by the *Salix exigua* (sandbar willow), *Populus trichocarpa* (black cottonwood), and *Populus deltoides* (Great Plains cottonwood) community types or the *Acer negundo* (box-elder) habitat type. This community type occurs over a wide range of environmental conditions and is considered an increaser due to its high tolerance to grazing.

SOILS

Soils are Entisols or rarely Mollisols (Aquolls and Borolls). Soil texture varies little from clay loam to sandy loam. Water tables are often at or near the soil surface in spring, but typically drop to 1 m (39 in) below the soil surface by late August.

ADJACENT COMMUNITIES

A variety of types occupy adjacent wetter sites, including the *Typha latifolia* (common cattail), *Scirpus acutus* (hardstem bulrush), *Scirpus pungens* (sharp bulrush), and *Carex rostrata* (beaked sedge) habitat types. The *Populus*

deltoides/Herbaceous (Great Plains cottonwood/Herbaceous) community type and *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat types are common on adjacent sites with similar or slightly drier moisture regimes.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of this community type are productive and the forage value is relatively high. *Glycyrrhiza lepidota* (American licorice) has been reported to be both excluded in heavily grazed areas, and to withstand heavy grazing. Our observations indicate it increases with moderate grazing and decreases with heavy grazing.

Wildlife

Glycyrrhiza lepidota (American licorice) is rated as fair forage for deer.

Fisheries

Glycyrrhiza lepidota (American licorice) produces a mass of coarse and creeping rhizomes, and one established, rapidly spreads. These soil holding characteristics may make it valuable for stabilizing streambanks.

Soil Management and Rehabilitation Opportunities

Moist soils are readily compacted by livestock and vehicular traffic. Sites with fine textured soils are more susceptible to compaction damage. Compaction of these soils can lower productivity and cause vegetative compositional changes that favor *Glycyrrhiza lepidota* (American licorice).

The strong rhizomes of *Glycyrrhiza lepidota* (American licorice) are effective stabilizers of streambanks, especially where soils are coarse and otherwise unstable. The associated graminoids, such as *Poa glaucifolia* (pale-leaf bluegrass), *Scirpus pungens* (hardstem bulrush), and *Agropyron smithii* (western wheatgrass), of this type also provide some streambank protection.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

No other studies have described this type.

Hordeum jubatum Community Type

(Foxtail Barley Community Type)

HORJUB (HOJU)
Number Of Stands Sampled = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Hordeum jubatum* (foxtail barley) community type is a minor type at low to mid elevations in central and eastern Montana. This community type occurs most frequently in the drawdown zone of pond or temporary ponds with moderately saline or alkali water. This drawdown zone is flooded during the early part of the growing season but the water table falls to below the soil surface by late spring or early summer. The drawdown zone takes on the appearance of narrow bands encircling the open water. The soil surface is may be covered with white salt crusts. Sites range in elevation from 747 to 1,250 m (2,450 to 4,100 ft).

FLORISTIC CHARACTERISTICS

Vegetative diversity is very low with *Hordeum jubatum* (foxtail barley) generally the only species present.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Graminoids			
Hordeum jubatum (foxtail barley)	65	20-98	100

SUCCESSIONAL INFORMATION

In many situations, the *Hordeum jubatum* (foxtail barley) community type represents an early seral (pioneer) stage that will be eventually taken over by a variety of later successional species. Close observation of similar sites may give insight to the climax community for the site.

In other situations, the *Hordeum jubatum* (foxtail barley) community type may represent an early/mid seral grazing disclimax of many habitat types including the *Distichlis spicata* (inland saltgrass) habitat type, and the *Agropyron smithii* (western wheatgrass) habitat type.

SOILS

Soils are typically fine textured and poorly to very poorly drained. Water tables remain at or slightly below the soil surface. On the Blackfeet Indian Reservation, Lesica and Shelly (1988) found conductivities to range from 2,150 to 41,000 uhmos/cm (a median of 16,350 uhmos/cm).

ADJACENT COMMUNITIES

Adjacent wetter communities are usually occupied by open water. Adjacent drier communities may be dominated by a variety of upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production from the *Hordeum jubatum* (foxtail barley) community type is low. Palatability of *Hordeum jubatum* (foxtail barley) when young is fair for livestock, but little use occurs after seed heads develop (USDA Forest Service 1937, Johnson and Nichols 1982). Consuming the awned seed heads can cause severe mouth sores and occasionally death. Injuries to wildlife such as elk, deer, and pronghorn have also been documented (USDA Forest Service 1937).

Hordeum jubatum (foxtail barley) acts as an increaser under excessive grazing pressure and also quickly invades suitable sites (USDA Forest Service 1937). Moderate grazing may allow desired forage plants to regain dominance.

Wildlife

Low herbage production and palatability makes this community type of limited value for wildlife. Consuming the mature awned seed heads can cause severe mouth sores and occasionally death. Injuries to wildlife such as elk, deer, and pronghorn have also been documented (USDA Forest Service 1937).

Soil Management and Rehabilitation Opportunities

Most management concerns associated with this type are centered around the increasing saline seep problems. The presence or expansion of seep areas may indicate that upland vegetation, small grains, fallow fields, or excess irrigation are not allowing the water table to drop to levels these sites have routinely experienced in the past. Excess water then flows through the soil, gathering soluble salts before evaporating in depressions. The salts remain, increasing in concentration with time, thereby restricting the types of plants able to tolerate this environment. The state of Montana is working with landowners to solve or reduce saline related problems. However, it is important to note that saline areas occur naturally due to the arid climate, parent material, and local topography.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = emergent wetland; Subclass = persistent; Water Regime (nontidal) = saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site, silty saline range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains; 5-9 inch Precipitation Zone = saline lowland range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = saline lowland range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

A similar community was described by Lesica and Shelly (1988) for the Blackfeet Indian Reservation.

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, thin clayey range site, thin sandy range site, thin silty range site, subirrigated range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, saline lowland range site.

OTHER STUDIES

The *Elaeagnus angustifolia* (Russian olive) community type has not been described elsewhere.

Fraxinus pennsylvanica/Prunus virginiana Habitat Type
(Green Ash/Common Chokecherry Habitat Type)

FRAPEN/PRUVIR (FRPE/PRVI)
Number Of Stands Sampled = 104

LOCATION AND ASSOCIATED LANDFORMS

The *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type is a major type in the Great Plains region of central and eastern Montana. It occurs along streams, rivers, lakes, springs, and ponds throughout the region, occupying either terraces, fans, or floodplain positions. In addition, it occupies V-shaped ravines (locally called woody draws) where sites may be occasionally flooded by overland flows. Sites range in elevation from 595 to 1,219 m (1,950 to 4,000 ft).

In the northern Great Plains where the soil orders of Mollisols and Aridisols usually support grassland or shrubland vegetation, woodland vegetation is confined to stream courses or to other positions on the landscape where combinations of soil and topography permit greater than average accumulation of moisture (Hansen and Hoffman 1988). Sites can be found on higher (older) terraces of the Missouri and middle to lower segments of the Yellowstone River, Powder River, Tongue River, Milk River, and the Little Missouri River.

FLORISTIC CHARACTERISTICS

The tree layer of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type may include *Acer negundo* (box-elder) and *Ulmus americana* (American elm). However, Dutch elm disease has had a detrimental impact on *Ulmus americana* (American elm) and the future of *Ulmus americana* (American elm) in Montana is questionable. *Populus deltoides* (Great Plains cottonwood) may dominate seral stands of this type. In sharply cut, V-shaped ravines, the largest trees are near the center or bottom of the ravines where there is greater soil moisture.

In relatively undisturbed stands, the undergrowth is comprised of two layers. The taller and more conspicuous shrub layer (2-3 m [6.5-9.8 ft] in height) is dominated by *Prunus virginiana* (common chokecherry). Associated shrubs may include *Prunus americana* (wild plum) and *Amelanchier alnifolia* (western serviceberry). The second layer is dominated by

herbaceous species such as *Carex sprengelii* (Sprengel's sedge), *Elymus virginicus* (Virginia wildrye), and *Thalictrum dasycarpum* (purple meadowrue).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Acer negundo (box-elder)	34	0-60	50
Fraxinus pennsylvanica (green ash)	63	20-80	100
Juniperus scopulorum (Rocky Mountain juniper)	3	0-3	14
Ulmus americana (American elm)	22	0-40	14
Shrubs			
Amelanchier alnifolia (western serviceberry)	13	0-20	36
Amelanchier humilis (low serviceberry)	2	0-3	14
Berberis repens (creeping Oregongrape)	25	0-40	29
Clematis ligusticifolia (western virgins-bower)	2	0-3	14
Cornus stolonifera (red-osier dogwood)	2	0-3	14
Crataegus succulenta (succulent hawthorn)	6	0-20	29
Juniperus communis (common juniper)	3	0-3	7
Parthenocissus vitacea (woodbine)	1	0-1	14
Prunus americana (wild plum)	15	0-20	50
Prunus virginiana (common chokecherry)	60	20-80	100
Rhus aromatica (fragrant sumac)	1	0-1	7
Ribes americanum (black currant)	3	0-3	7
Ribes missouriense (Missouri gooseberry)	1	0-3	21
Ribes odoratum (buffalo currant)	5	0-20	36
Ribes setosum (Missouri gooseberry)	7	0-20	29
Ribes spp. (currant)	3	0-3	14
Rosa woodsii (woods rose)	7	0-20	50
Rubus idaeus (red raspberry)	1	0-1	7
Symphoricarpos albus (common snowberry)	20	0-20	14
Symphoricarpos occidentalis (western snowberry)	10	0-20	71
Toxicodendron rydbergii (poison ivy)	5	0-20	36
Graminoids			
Agropyron caninum (bearded wheatgrass)	2	0-3	36
Bromus inermis (smooth brome)	30	0-40	14
Bromus tectorum (cheatgrass)	42	0-80	14
Carex sprengelii (Sprengel's sedge)	38	0-60	71
Elymus canadensis (Canada wildrye)	20	0-20	14
Elymus virginicus (Virginia wildrye)	29	0-80	57
Oryzopsis micrantha (little-seed ricegrass)	2	0-3	14
Poa compressa (Canada bluegrass)	3	0-3	7
Poa palustris (fowl bluegrass)	3	0-3	7
Poa pratensis (Kentucky bluegrass)	14	0-20	57
Forbs			
Achillea millefolium (common yarrow)	1	0-1	14

Arctium minus (common burdock)	3	0-3	14
Campanula rotundifolia (lady's-thimble)	1	0-1	7
Convolvulus arvensis (field morning glory)	1	0-1	14
Disporum trachycarpum (wartberry fairy-bell)	2	0-3	14
Fragaria virginiana (Virginia strawberry)	2	0-3	14
Frasera spp. (frasera)	3	0-3	7
Galium aparine (goose-grass)	5	0-20	50
Galium boreale (northern bedstraw)	5	0-20	36
Hackelia deflexa (nodding stickseed)	2	0-3	14
Hackelia floribunda (showy stickseed)	3	0-3	7
Heuchera richardsonii (Richardson's alumroot)	2	0-3	14
Lysimachia ciliata (fringed loosestrife)	3	0-3	7
Monarda fistulosa (horsemint)	2	0-3	29
Osmorhiza chilensis (mountain sweet-cicely)	3	0-3	7
Osmorhiza claytonii (Clayton sweet-cicely)	1	0-1	7
Osmorhiza longistylis (anise root)	2	0-3	21
Parietaria pensylvanica (Pennsylvania pellitory)	2	0-3	14
Polygonatum biflorum (Solomon's seal)	1	0-1	7
Sanicula marilandica (black snake-root)	11	0-20	29
Smilacina stellata (starry Solomon-plume)	5	0-20	43
Smilax herbacea (carrion-flower)	3	0-3	14
Solidago missouriensis (Missouri goldenrod)	3	0-3	7
Taraxacum officinale (common dandelion)	2	0-3	21
Thalictrum dasycarpum (purple meadowrue)	4	0-20	64
Thalictrum venulosum (veiny meadowrue)	1	0-1	7
Urtica dioica (stinging nettle)	2	0-3	14
Viola canadensis (Canada violet)	20	0-40	21
Viola spp. (violet)	3	0-3	7
Ferns and Allies			
Cystopteris fragilis (brittle bladder-fern)	20	0-20	7

SUCCESSIONAL INFORMATION

Primary Successional Stages

Primary successional stages of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type may be dominated by a variety of types including cottonwoods, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types.

Early Seral Stage — An early seral stage on a primary successional site, such as a recently deposited alluvial bar, may contain the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type.

Mid-Seral Stage — Through time under limited disturbance, the stand progresses to a mature stand of *Populus deltoides* (Great Plains cottonwood) representing the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Fraxinus pennsylvanica* (green ash). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes more open, and finally, becomes decadent, *Fraxinus pennsylvanica* (green ash) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, primary succession can continue from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type.

Secondary Successional Stages

Late Seral to Climax (PNC) Stage — The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. In relatively undisturbed stands (e.g., climax plant community), the undergrowth of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type is comprised of two layers. *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and *Ribes odoratum* (buffalo currant) dominate the taller and more conspicuous shrub layer (2-3 m [6.5-9.8 ft] in height). Herbaceous species such as *Carex sprengelii* (Sprengel's sedge), *Galium boreale* (northern bedstraw), *Smilacina stellata* (starry Solomon-plume), and *Thalictrum dasycarpum* (purple meadowrue) dominate the second layer. In addition, relatively undisturbed stands will have all age groups of tree species present (seedlings, saplings, pole, and mature).

Mid-Seral Stage — Maintaining moderate levels of grazing sharply reduces reproduction of tree species. In addition, many of the sapling and pole size trees begin to show signs of damage. Reducing the seedling and sapling stages of the overstory tree species will eventually result in a decline of the tree population. If the degree of disturbance continues over an extended period of time, the trees will eventually be eliminated from the site.

In addition to its impact on the tree layer, grazing greatly reduces both the abundance and canopy cover of the understory layer of the desirable shrub and herbaceous species. Less desirable species such as *Symphoricarpos occidentalis* (western snowberry), *Rosa woodsii* (woods rose), *Crataegus succulenta* (succulent hawthorn), and *Poa pratensis* (Kentucky bluegrass) begin to invade the stand.

Under heavy grazing pressures, tree reproduction is either severely restricted or completely eliminated. At this stage, most of the saplings and pole sized trees have either been eliminated by trampling and/or rubbing, or browsed back until they are dead. High levels of grazing cause the stand to open up allowing the more sun tolerant, less desirable species (*Symphoricarpos occidentalis* [western snowberry], *Rosa woodsii* [woods rose], *Crataegus succulenta* [succulent hawthorn], and *Poa pratensis* [Kentucky bluegrass]) to dominate. In fact, many of the sites that support the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type in the northern Great Plains are in this state or in the severe overgrazed state (discussed in the following paragraph).

Early Seral Stage — Prolonged periods of severe overgrazing result in a stand of only older, decadent trees and a very open understory. The understory may be so severely impacted that most of the less desirable species (*Symphoricarpos occidentalis* (western snowberry), *Rosa woodsii* (woods rose), *Crataegus succulenta* (succulent hawthorn), and *Poa pratensis* (Kentucky bluegrass) are also eliminated resulting in large amounts of exposed soil. When a stand is at this stage, the prospect of returning the site to its former state is very difficult if not impossible. (Restoration would be extremely expensive in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand of trees, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

Severely disturbed *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) sites may be dominated by either the *Shepherdia argentea* (thorny buffaloberry), *Crataegus succulenta* (succulent hawthorn), *Rosa woodsii* (woods rose), or the *Symphoricarpos occidentalis* (western snowberry) community types. Close observation of remnant species, such as *Fraxinus pennsylvanica* (green ash) will aid in determination of the site potential.

SOILS

Flooding is infrequent to this habitat type and duration is generally brief. However, *Fraxinus pennsylvanica* (green ash) is very tolerant of prolonged flooding and can withstand up to 8 weeks of total submersion and still survive. Soils are typically Entisols (Torrifluvents) or Mollisols (Haploborolls and Argiborolls). Soil textures range from clay loam to sandy loam. Water tables are generally near the soil surface in spring or after storm events, but commonly fall below 1 m (39 in) during dry periods.

ADJACENT COMMUNITIES

Adjacent drier sites are dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or by a variety of upland species. Wetter sites may be dominated by *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), *Eleocharis* species (spike rushes), or *Phragmites australis* (common reed) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Fraxinus pennsylvanica (green ash) is of low palatability to livestock but is often overbrowsed by livestock. If the long term management objective is the maintenance of the tree stand on the site, then managers needs to key in on the seedling reproduction by *Fraxinus pennsylvanica* (green ash) or the stand will eventually be eliminated.

On relatively undisturbed sites, dense stands of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type limit access by livestock. As the stands open up, livestock use may go up proportionally. This habitat type is valuable to livestock managers because of the following benefits they provide: 1) thermal cover (shade), 2) water source, 3) palatable forage, 4) protection from seasonal storms, and 5) calving grounds. Because the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type covers a small portion of the landscape and because of their high wildlife values (see the Wildlife section), these sites are becoming focal points for livestock and wildlife management conflicts in this region.

Livestock managers should reduce or eliminate hot season of use in this type. This can be accomplished by placing salt blocks on the uplands away from the woody draws, moving water sources out of the draws, and in some instances, by using cross fences (or drift fences) that are placed perpendicular to the linear stand at appropriate intervals. This method is most appropriate for those stands located in V-shaped draws or ravines. These short fences will discourage livestock from trailing down the center of the stand. In disturbed sites, it may be necessary to fence out a portion of the stand for a period of five or more years in order to allow regeneration by the tree and shrub species. After the appropriate time frame, the fence could be moved to a different portion of the stand.

The use of these sites as winter feeding grounds can have a variety of results. In many instances, proper winter use will have minimal impacts on the stand. However, if livestock numbers are high, trampling and rubbing can have a detrimental impact on the woody species. In addition, if livestock use is high when the frost is going out of the ground, a great deal of soil churning and compaction can occur.

Over the years there has been some debate whether *Prunus virginiana* (common chokecherry) leaves are poisonous to livestock. The leaves and seeds do have sugars that contain cyanide. These cyanide sugars are not poisonous themselves, but when plant material is crushed, eaten or decomposed, enzymes cause hydrogen cyanide to be released (Ode 1987). In high concentrations hydrogen cyanide is a metabolic poison to most animals, including humans. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide if they consume small amounts of it over an extended period of time. Therefore, *Prunus virginiana* (common chokecherry) will poison livestock only if it is consumed in large amounts without prior exposure.

The high values associated with the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type should elicit special consideration by livestock operators.

Timber

In a study in eastern Montana, Hansen and Hoffman (1988) found basal areas range from 67.5 to 195.2 square feet per acre (15.5 to 44.8 m ^{2}/ha). The average age of *Fraxinus pennsylvanica* (green ash) was 70 to 80 years old. Many stands have been cut for firewood. Due to the high value associated with this type, firewood cutting should be closely monitored.

Most of the important tree and shrub species in the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type are capable of producing sprouts from the root crown when the main trunk in damaged. Some researchers have proposed cutting of the mature or decadent trees as a method of encouraging the production of new seedlings. Limited success has been shown by this approach. However, unless the management on the site is not changed, livestock and/or wildlife may browse all new sprouts with the end result being the accelerated demise of the stand.

Wildlife

In the northern Great Plains, the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type are very important to wildlife even though they represent a very small fraction of the total area (around 1-2 percent of the total landscape). Located in areas of greater than normal moisture, they are more productive than the surrounding upland vegetation (Thomas and others 1979). This habitat type attracts wildlife for thermal cover, nesting habitat, water source, late summer and winter forage, travel corridors, and hiding cover (Ames 1977; Hansen and others 1984; Hansen and Hoffman 1988; Severson and Boldt 1978). The *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type is an important year round habitat for mule deer, provides critical winter habitat for whitetail deer (Severson and Carter 1978; Swenson 1981), and is an important fawning area for both whitetail and mule deer. During fall and winter, this habitat type provides critical habitat for sharptailed grouse.

In addition, the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type provides essential habitat for a large number of nongame species. Grosz and others (1981) found that this habitat type is the center of activity for most species and are critical importance to many species during the stressful winter months. They also found that these sites support a greater diversity and density of birds when compared to adjacent uplands. In northwestern North Dakota, Hopkins (1984) censused species of birds nesting in this habitat type and found that although it had lower species diversity than cottonwood forests, the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type supported a much higher density of breeding pairs. Finally, this habitat type provides important habitat for such nongame mammals as coyote, weasel, bobcat, and red fox (Swenson 1981; Sieg and others 1984).

If the long term management objective is the maintenance of the tree stand on the site, then managers needs to key in on the seedling reproduction by *Fraxinus pennsylvanica* (green ash) or the stand will eventually be eliminated.

Fisheries

The woody species associated with the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type provide valuable streambank stability and thermal cover.

Fire

Fraxinus pennsylvanica (green ash) has a good tolerance of fire when burned in the dormant state (Wasser 1982). Most of the important tree and shrub species in the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type produce sprouts from the root crown when the main trunk is damaged. The ability of the woody species to sprout prolifically suggests that this habitat type is adapted to fire and perhaps to periodic stand regeneration by fire. However, the historic role of fire in this habitat type is not well known.

Soil Management and Rehabilitation Opportunities

Sites adjacent to streams are extremely vulnerable to streambank sloughing, particularly when soils are moist. Excessive livestock use will increase levels of soil compaction and decrease stability. Management should emphasize the importance of the understory shrub communities for streambank stabilization.

Where revegetation with woody species is desired, *Fraxinus pennsylvanica* (green ash), *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and *Ribes odoratum* (buffalo currant), are well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are moderate to rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits.

Recreational Uses and Considerations

Because of its proximity to streams, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

The fruit of *Prunus virginiana* (common chokecherry) is highly regarded for making wine and tasty jelly, but one must harvest ahead of the birds (Johnson and Nichols 1982). Indians ate the fruit fresh or preserved it by drying. In addition they combined it with venison and buffalo meat to make mincemeat. They also used the berries for medicinal purposes.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, thin clayey range site, thin sandy range site, thin silty range site, subirrigated range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

The *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type was first described by Hansen and others (1984), and Hansen and Hoffman (1988) for the region. Girard (1985) described the same habitat type for southwestern North Dakota. A somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Populus angustifolia/Cornus stolonifera Community Type
(Narrowleaf Cottonwood/Red-Osier Dogwood Community Type)

POPANG/CORSTO (POAN3/COST4)

Number Of Stands Sampled = 13

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type is a major type at low to mid elevations throughout the mountains and foothills east of the Continental Divide in Montana. *Populus angustifolia* (narrowleaf cottonwood) tends to occur at intermediate elevations, occupying sites that are between the elevational limits of *Populus trichocarpa* (black cottonwood) and *Populus deltoides* (Great Plains cottonwood). Sites range from 945 to 2,044 m (3,100 to 6,700 ft). The type occurs on recently deposited alluvial bars of major streams and rivers, and around lakes and ponds. In general, these sites are recent sediment deposits, such as point bars, side bars, mid channel bars, delta bars, and islands.

FLORISTIC CHARACTERISTICS

This type is characterized by an overstory of cottonwoods over a potentially dense and diverse group of undergrowth shrubs and herbaceous plants. *Populus deltoides* (Great Plains cottonwood) and *Populus trichocarpa* (black cottonwood) may be present, as in the Red Lodge and Great Falls area, but are subordinate to *Populus angustifolia* (narrowleaf cottonwood).

Cornus stolonifera (red-osier dogwood) is the diagnostic shrub for this type. Other shrub species may include *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose). Common herbaceous species are *Agrostis stolonifera* (redtop), *Poa pratensis* (Kentucky bluegrass), and *Cirsium arvense* (Canada thistle).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus angustifolia (narrowleaf cottonwood)	50	40-60	100
Populus trichocarpa (black cottonwood)	3	0-3	25
Salix amygdaloides (peach-leaf willow)	3	0-3	25
Shrubs			
Cornus stolonifera (red-osier dogwood)	45	40-60	100
Ribes spp. (currant)	1	0-1	25
Rosa acicularis (prickly rose)	20	0-20	25
Rosa spp. (rose)	20	0-20	25
Rosa woodsii (woods rose)	12	0-20	50
Rubus idaeus (red raspberry)	3	0-3	25
Salexi exigua (sandbar willow)	22	0-40	50
Salix lasiandra (Pacific willow)	3	0-3	25
Symphoricarpos occidentalis (western snowberry)	7	1-20	100
Graminoids			
Agrostis spp. (bentgrass)	20	0-20	25
Agrostis stolonifera (redtop)	36	3-60	100
Carex lanuginosa (woolly sedge)	3	0-3	25
Elymus virginicus (Virginia wildrye)	3	0-3	25
Phalaris arundinacea (reed canarygrass)	12	0-20	50
Phleum pratense (common timothy)	3	0-3	25
Poa pratensis (Kentucky bluegrass)	14	0-20	75

Forbs			
Achillea millefolium (common yarrow)	1	0-1	25
Apocynum cannabinum (hemp dogbane)	3	0-3	25
Cirsium arvense (Canada thistle)	14	0-20	75
Geum macrophyllum (large-leaved avens)	1	0-1	25
Glycyrrhiza lepidota (American licorice)	20	0-20	25
Heracleum lanatum (cow-parsnip)	20	0-20	25
Humulus lupulus (common hop)	1	0-1	25
Lysimachia ciliata (fringed loosestrife)	3	0-3	25
Mentha arvensis (field mint)	3	0-3	50
Rumex crispus (curly dock)	3	0-3	25
Smilacina stellata (starry Solomon-plume)	3	0-3	25
Solidago canadensis (Canada goldenrod)	12	0-20	50
Solidago spp. (goldenrod)	3	0-3	25
Taraxacum officinale (common dandelion)	1	0-1	25
Urtica dioica (stinging nettle)	3	0-3	25
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	25

SUCCESSIONAL INFORMATION

The *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type represents a mid-seral stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying

influences of floods (Hansen 1989).

Early Seral Stage — The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus angustifolia* (narrowleaf cottonwood) stand is dominated by conifers such as *Picea* (spruce), *Pseudotsuga menziesii* (Douglas fir), *Pinus ponderosa* (ponderosa pine), or *Juniperus scopulorum* (Rocky Mountain juniper). Near the foothills, the understory may be dominated by *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder). As the *Populus angustifolia* (narrowleaf cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers, *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder) are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type to the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type, the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. At higher elevations, succession may progress to the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type. In the foothills, succession continues to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry), the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus angustifolia* (narrowleaf cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This represents the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus angustifolia*/Herbaceous [narrowleaf cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The

presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaf willow) and *Salix lasiandra* (Pacific willow) may also border this type. The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type or the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type may be adjacent on disturbed sites. Nearby uplands are dominated by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Poa pratensis* (Kentucky bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the amount of available forage. However, most sites are presently subjected to heavy grazing pressures because of their topographic location and ease of access. With moderate to heavy prolonged grazing pressures, most shrubs will be eliminated leaving the shrubs *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) as the dominate understory. At this point, the stand has been converted to the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) disturbance-caused community type. If disturbance is severe, the shrubs will also be eliminated and the stand has converted to the *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

Ungulates, especially whitetail deer, are common residents of these communities. Songbirds, raptors, and small mammals are

also common, due to the high structural diversity and abundant food sources. *Populus angustifolia* (narrowleaf cottonwood) and *Cornus stolonifera* (red-osier dogwood) are often eaten by moose (Costain 1989) and used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of this *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Cornus stolonifera* (red-osier dogwood) and associated shrub species are excellent in controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus angustifolia* (narrowleaf cottonwood) and other shrubs of this type are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus angustifolia* (narrowleaf cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established

seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

A similar community type was described by Youngblood and others (1985b) for eastern Idaho and western Wyoming, and by Padgett and others (1989) for Utah and southeastern Idaho. Major undergrowth shrubs were *Cornus stolonifera* (red-osier dogwood), *Betula occidentalis* (water birch), and *Salix bebbiana* (Bebb willow). A somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Populus angustifolia/Herbaceous Community Type

POPANG (POAN3)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type is a major type at low to mid elevations throughout the mountains and foothills east of the Continental Divide in Montana. *Populus angustifolia* (narrowleaf cottonwood) tends to occur at intermediate elevations, occupying sites that are between the elevational limits of *Populus trichocarpa* (black cottonwood) and *Populus deltoides* (Great Plains cottonwood). Sites range from 945 to 2,044 m (3,100 to 6,700 ft). The type occurs on recently deposited alluvial bars of major streams and rivers, and around lakes and ponds. In general, these sites are recent sediment deposits, such as point bars, side bars, mid channel bars, delta bars, and islands.

The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type is more common than the small sample size suggests, and occurs on alluvial terraces along larger streams and rivers. It is a widespread type on private lands at low elevations where woody species have been removed mechanically or by grazing.

FLORISTIC CHARACTERISTICS

The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type is a grazing disclimax characterized by a two layer structure of mature, widely spaced *Populus angustifolia* (narrowleaf cottonwood) over grasses such as *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy). Shrub species are absent or present as remnant, scattered individuals. *Taraxacum officinale* (common dandelion) and *Achillea millefolium* (common yarrow) are the most common forbs.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus angustifolia (narrowleaf cottonwood)	44	10-90	100
Shrubs			
Cornus stolonifera (red-osier dogwood)	1	0-1	40
Rosa woodsii (woods rose)	14	0-20	60
Graminoids			
Agropyron spp. (wheatgrass)	3	0-3	40
Agrostis stolonifera (redtop)	1	0-1	40
Phleum pratense (common timothy)	22	0-40	40
Poa pratensis (Kentucky bluegrass)	21	3-40	100
Forbs			
Achillea millefolium (common yarrow)	1	0-3	60
Cirsium arvense (Canada thistle)	2	0-3	40
Melilotus officinalis (yellow sweet-clover)	2	0-3	40
Smilacina stellata (starry Solomon-plume)	3	0-3	40
Taraxacum officinale (common dandelion)	8	0-20	60

SUCCESSIONAL INFORMATION

The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type.

Primary Successional Stages
Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus angustifolia* (narrowleaf cottonwood) stand is dominated by conifers such as *Picea* (spruce), *Pseudotsuga menziesii* (Douglas fir), *Pinus ponderosa* (ponderosa pine), or *Juniperus scopulorum* (Rocky Mountain juniper). Near the foothills, the understory may be dominated by *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder). As the *Populus angustifolia* (narrowleaf cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers, *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder) are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will

occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type to the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type, the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. At higher elevations, succession may progress to the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type. In the foothills, succession continues to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry), the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus angustifolia* (narrowleaf cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This represents the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus angustifolia*/Herbaceous [narrowleaf cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that

produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaf willow) and *Salix lasiandra* (Pacific willow) may also border this type. The *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type may be adjacent on relatively undisturbed sites. The *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type may be adjacent on disturbed sites. Nearby uplands are often dominated by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Poa pratensis* (Kentucky bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open structure of this community type and continued dominance of the undergrowth by *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), *Agropyron repens* (quackgrass), *Phleum pratense* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This community type is commonly used as a winter feed ground by ranchers. *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), *Agropyron repens* (quackgrass), *Phleum pratense* (common timothy), and *Bromus inermis* (smooth brome) are palatable and moderately productive grasses, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a graminoid dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the typically open, two layered structure. Birds are common, and larger cottonwoods provide nest sites. Large accipiters and cavity nesters may inhabit this type (Youngblood and others 1985b). Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries

The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of

cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus angustifolia* (narrowleaf cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds

begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

A similar community type was identified by Youngblood and others (1985) for eastern Idaho and western Wyoming, by Padgett and others (1989) for Utah and southeastern Idaho, and by Chadde and others (1988) for northern Yellowstone National Park. A somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Populus angustifolia/Recent Alluvial Bar Community Type
(Narrowleaf Cottonwood/Recent Alluvial Bar Community Type)

POPANG (POAN3)

Number Of Stands Sampled = 8

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is a major type at low to mid elevations throughout the mountains and foothills east of the Continental Divide in Montana. *Populus angustifolia* (narrowleaf cottonwood) tends to occur at intermediate elevations, occupying sites that are between the elevational limits of *Populus trichocarpa* (black cottonwood) and *Populus deltoides* (Great Plains cottonwood). Sites range from 945 to 2,044 m (3,100 to 6,700 ft). The type occurs on recently deposited alluvial bars of major streams and rivers, and around lakes and ponds. In general, these sites are recent sediment deposits, such as point bars, side bars, mid channel bars, delta bars, and islands.

FLORISTIC CHARACTERISTICS

This type is characterized by a stand dominated by seedlings or saplings of *Populus angustifolia* (narrowleaf cottonwood), or a stand codominated by cottonwoods and *Salix exigua* (sandbar willow). *Populus deltoides* (Great Plains cottonwood) and

Populus trichocarpa (black cottonwood) may be present, but are subordinate to *Populus angustifolia* (narrowleaf cottonwood). The understory is dominated by an assortment of grasses such as *Agrostis stolonifera* (redtop) and *Phleum pratense* (common timothy).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Juniperus scopulorum (Rocky Mountain juniper)	1	0-1	13
Pinus contorta (lodgepole pine)	1	0-1	13
Pinus flexilis (limber pine)	1	0-1	13
Populus angustifolia (narrowleaf cottonwood)	30	20-60	100
Pseudotsuga menziesii (Douglas fir)	2	0-3	25
Shrubs			
Arctostaphylos uva-ursi (kinnikinnick)	1	0-1	13
Artemisia tridentata (big sagebrush)	1	0-1	25
Betula occidentalis (water birch)	3	0-3	13
Clematis ligusticifolia (western virgins-bower)	60	0-60	13
Dryas drummondii (yellow mountain-avens)	30	0-40	25
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	13
Rhus aromatica (fragrant sumac)	20	0-20	13
Rosa woodsii (woods rose)	20	0-20	13
Salix exigua (sandbar willow)	34	0-80	38
Salix lutea (yellow willow)	1	0-1	25
Graminoids			
Agropyron caninum (bearded wheatgrass)	1	0-3	50
Agropyron spp. (wheatgrass)	1	0-1	13
Agrostis stolonifera (redtop)	8	0-20	63
Bromus ciliatus (fringed brome)	1	0-1	13
Carex spp. (sedge species)	1	0-1	13
Koeleria cristata (prairie junegrass)	1	0-1	13
Phleum pratense (common timothy)	2	0-3	63
Poa palustris (fowl bluegrass)	1	0-1	13
Poa pratensis (Kentucky bluegrass)	1	0-1	13
Poa spp. (bluegrass)	3	0-3	13
Sitanion hystrix (bottlebrush squirreltail)	1	0-1	13
Trisetum wolfii (Wolf's trisetum)	1	0-1	25
Forbs			
Achillea millefolium (common yarrow)	1	0-1	25
Antennaria anaphaloides (tall pussy-toes)	1	0-1	13
Antennaria spp. (pussy-toes)	1	0-1	13
Arabis spp. (rockcress)	1	0-1	25
Artemisia dracunculus (tarragon)	3	0-3	25
Aster chilensis (long-leaved aster)	2	0-3	25
Aster occidentalis (western aster)	1	0-1	25

Aster spp. (aster)	1	0-1	13
Astragalus spp. (milk-vetch)	1	0-1	25
Chrysopsis villosa (hairy golden-aster)	1	0-1	13
Comandra umbellata (bastard toad-flax)	1	0-1	13
Epilobium angustifolium (fireweed)	1	0-1	13
Epilobium suffruticosum (shrubby willow-herb)	20	0-20	13
Eriogonum umbellatum (sulfur buckwheat)	3	0-3	13
Fragaria virginiana (Virginia strawberry)	3	0-3	13
Gentianella detonsa (smaller fringed gentian)	1	0-1	13
Lupinus argenteus (silvery lupine)	20	0-20	13
Lupinus spp. (lupine)	3	0-3	13
Melilotus alba (white sweet-clover)	1	0-1	13
Melilotus officinalis (yellow sweet-clover)	1	0-1	13
Oxytropis spp. (crazyweed)	3	0-3	13
Sedum lanceolatum (lance-leaved stonecrop)	1	0-1	25
Solidago canadensis (Canada goldenrod)	1	0-1	38
Solidago missouriensis (Missouri goldenrod)	3	0-3	25
Sonchus arvensis (field milk-thistle)	3	0-3	13
Taraxacum officinale (common dandelion)	1	0-1	13
Trifolium repens (white clover)	7	0-20	38
Ferns and Allies			
Equisetum arvense (field horsetail)	20	0-20	13
Equisetum laevigatum (smooth scouring-rush)	1	0-1	13

SUCCESSIONAL INFORMATION

The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type represents an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of

inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus angustifolia* (narrowleaf cottonwood) stand is dominated by conifers such as *Picea* (spruce), *Pseudotsuga menziesii* (Douglas fir), *Pinus ponderosa* (ponderosa pine), or *Juniperus scopulorum* (Rocky Mountain juniper). Near the foothills, the understory may be dominated by *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder). As the *Populus angustifolia* (narrowleaf cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers, *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder) are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type to the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type, the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. At higher elevations, succession may progress to the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type. In the foothills, succession continues to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry), the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressures. Moderate, prolonged grazing and browsing pressures will cause a stand to progress to the disturbance-caused *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type. Severe, prolonged grazing and browsing pressures may eliminate all conifer and/or deciduous seedlings and may eliminate the undergrowth of shrub species as well. This severely disturbed stage of secondary succession is called the *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/herbaceous) community type. In this situation, the overstory of *Populus angustifolia* (narrowleaf cottonwood) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types.

Stands of the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type are very susceptible to the natural dynamics of a river system and may be flooded and eliminated after just a year or two

of growth. Ice can also have a dramatic impact on these recently deposited alluvial bars. Ice can influence the floodplain landscape by either one of two ways: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage generally involves the following: a) the laying down or bending over of the younger cottonwoods, b) the physical shearing off of the stems, c) the actual pulling out of the ground by the ice that surrounds the main stems, and d) the tilting or pushing over of mature trees. In addition, young cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If livestock pressures are too great, the stand can be either partially or totally eliminated. In many situations, excessive livestock pressure has completely eliminated the establishment of new cottonwood stands. Beaver and big game species can also have a dramatic impact on newly established cottonwood stands.

SOILS

Soils are typically Entisols (Fluvents) overlying river gravel or cobbles. Soil texture varies from loam to coarse sand. Water tables are generally at or near the soil surface. In late summer water tables may drop below 50 cm (20 in) of the soil surface but surface horizons remain moist due to capillary action. Soils are well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaf willow) and *Salix lasiandra* (Pacific willow) may also border this type. Adjacent undisturbed sites may have the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. The *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community type or the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type may be adjacent on disturbed sites. Nearby uplands are dominated by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Poa pratensis* (Kentucky bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to moderate. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrub species thereby limiting the amount of available forage. These stands are very susceptible to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations it may be advisable to eliminate livestock use until the cottonwoods are of sufficient height to preclude defoliation by livestock.

Wildlife

The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. *Populus angustifolia* (narrowleaf cottonwood) is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of the *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is valuable for fisheries by providing for streambank stability.

Fire

The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings do not have an extensive root system or

thick bark and may be severely damaged (or eliminated) by fire.

Soil Management and Rehabilitation Opportunities

The coarse textured substrates are not susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. Managers should maintain a buffer strip of the *Populus angustifolia* (narrowleaf cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species. However, the dense nature of many of these stands may preclude various types of recreational activities such as fly fishing.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type has not been described elsewhere.

Populus angustifolia/Symphoricarpos occidentalis Community Type
(Narrowleaf Cottonwood/Western Snowberry Community Type)

POPANG/SYMOCC (POAN3/SYOC)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type is a major type at low to mid elevations throughout the mountains and foothills east of the Continental Divide in Montana. *Populus angustifolia* (narrowleaf cottonwood) tends to occur at intermediate elevations, occupying sites that are between the elevational limits of *Populus trichocarpa* (black cottonwood) and *Populus deltoides* (Great Plains cottonwood). Sites range from 945 to 2,044 m (3,100 to 6,700 ft). The type occurs on recently deposited alluvial bars of major streams and rivers, and around lakes and ponds. In general, these sites are recent sediment deposits, such as point bars, side bars, mid channel bars, delta bars, and islands.

FLORISTIC CHARACTERISTICS

The *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type is a grazing disclimax. Moderate grazing pressures favors the increase of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose). Common herbaceous species are *Poa pratensis* (Kentucky bluegrass), *Bromus inermis* (smooth brome), *Glycyrrhiza lepidota* (American licorice), *Agrostis stolonifera* (redtop), and *Cirsium arvense* (Canada thistle).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus angustifolia (narrowleaf cottonwood)	56	40-80	100
Shrubs			
Cornus stolonifera (red-osier dogwood)	1	0-1	11
Ribes spp. (currant)	1	0-1	40
Rosa woodsii (woods rose)	20	0-20	40
Salix exigua (sandbar willow)	12	0-20	40
Symphoricarpos occidentalis (western snowberry)	12	0-20	80
Graminoids			
Agropyron caninum (bearded wheatgrass)	2	0-3	40
Agrostis stolonifera (redtop)	12	0-20	40
Bromus inermis (smooth brome)	28	0-60	60
Poa pratensis (Kentucky bluegrass)	31	0-60	80
Forbs			
Aster spp. (aster)	2	0-3	40
Cirsium arvense (Canada thistle)	10	0-20	40
Glycyrrhiza lepidota (American licorice)	21	0-60	60

SUCCESSIONAL INFORMATION

The *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type represents a moderately disturbed secondary successional stage of the mid-seral *Populus angustifolia/Cornus stolonifera*

(narrowleaf cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus angustifolia* (narrowleaf cottonwood) stand is dominated by conifers such as *Picea* (spruce), *Pseudotsuga menziesii* (Douglas fir), *Pinus ponderosa* (ponderosa pine), or *Juniperus scopulorum* (Rocky Mountain juniper). Near the foothills, the understory may be dominated by *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder). As the *Populus angustifolia* (narrowleaf cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers, *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box-elder) are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at lower elevations succession continues from the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type to the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type, the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. At higher elevations, succession may progress to the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type. In the foothills, succession continues

to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry), the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type. In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus angustifolia* (narrowleaf cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This represents the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus angustifolia*/Herbaceous [narrowleaf cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are often the *Salix exigua* (sandbar willow) community type. Stands of *Salix amygdaloides* (peach-leaf willow) and *Salix lasiandra* (Pacific willow) may also border this type. The *Populus angustifolia*/Herbaceous

(narrowleaf cottonwood/Herbaceous) community type may be adjacent on disturbed sites. Nearby uplands are dominated by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Poa pratensis* (Kentucky bluegrass).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense shrub understory within the stands. Forage production from dense thickets of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) is low. Stands may be so dense that they exclude most livestock use. As the shrub understory is eliminated by continual prolonged heavy grazing or browsing, stands open and forage production increases accordingly due to the presence and amount of *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), or *Bromus inermis* (smooth brome). The palatability of *Symphoricarpos occidentalis* (western snowberry) ranges from low to fair for cattle and sheep (Wasser 1982; Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (woods rose) are considered fair to fairly good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

Ungulates, especially whitetail deer, are common residents of these communities. Songbirds, raptors, and small mammals are also common, due to the high structural diversity and abundant food sources. *Populus angustifolia* (narrowleaf cottonwood) and *Rosa woodsii* (woods rose) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural understory diversity of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (western snowberry) is rated as good for deer and elk (Wasser 1982; Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (woods rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (woods rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Fisheries

The stream side location of this *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) are excellent in controlling erosion along streams due to their rhizomatous nature. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) community type is susceptible to fire during the late summer and fall. *Populus angustifolia* (narrowleaf cottonwood) and other shrubs of this type are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular

species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Symphoricarpos occidentalis (western snowberry) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (woods rose) is strongly fire tolerant, except for smoldering fires with heavy volumes of surface fuel. The species has a shallow and much branched rhizomatous root system that will readily sprout and sucker. This sprouting capability of *Rosa woodsii* (woods rose) make it a good soil stabilizer.

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus angustifolia* (narrowleaf cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth.

Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Symphoricarpos occidentalis (western snowberry) is well adapted for revegetating sites. Commonly growing in dense colony stands makes it suitable for disturbed land stabilization. It does best on moist, well drained soils which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erosive sites may need complete exclusion from grazing during establishment, and animal populations and stacking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (woods rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanted materials.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (western snowberry) is an important food source for upland birds due to fruits that persist into the winter. Native Americans made extensive use of *Rosa woodsii* (woods rose) roots, stems, leaves, flowers, and rose hips for food and therapeutic materials (US Forest Service 1975). The persistent rose hips are edible, and are one of the best natural sources of vitamin C. They can be dried for use in flavoring teas, jellies, fruitcakes, and puddings.

Nature trails should be routed around dense stands of *Rosa woodsii* (woods rose) community type. However, *Rosa woodsii* (woods rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

A similar community type was described by Youngblood and others (1985b) for eastern Idaho and western Wyoming, and by Padgett and others (1989) for Utah and southeastern Idaho. Major undergrowth shrubs were *Cornus stolonifera* (red-osier dogwood), *Betula occidentalis* (water birch), and *Salix bebbiana* (Bebb willow). A somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Populus deltoides/Cornus stolonifera Community Type
(Great Plains Cottonwood/Red-Osier Dogwood Community Type)

POPDEL/CORSTO (PODE3/COST4)
Number Of Stands Sampled = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type is a major type at low elevations in central and eastern Montana. The type occurs on older alluvial bars of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus deltoides* (Great Plains cottonwood) is the lowest (elevationally) occurring cottonwood with *Populus angustifolia* (narrowleaf) occurring at intermediate elevations, and *Populus trichocarpa* (black cottonwood) occurring at higher elevations. Sampled sites ranged in elevation from 579 to 1,097 m (1,900 to 3,600 ft). Stands may be broad and extensive, as along the lower stretches of the Missouri and Yellowstone Rivers, or may be relatively narrow as along the Milk, Little Missouri, Tongue, and Powder Rivers.

FLORISTIC CHARACTERISTICS

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type is characterized by an overstory of *Populus deltoides* (Great Plains cottonwood) over a dense and diverse understory of shrubs and herbs. In relatively undisturbed stands the shrub layer includes *Cornus stolonifera* (red-osier dogwood), *Salix lutea* (yellow willow), and *Prunus virginiana* (common chokecherry). The herbaceous layer may be dominated by *Solidago canadensis* (Canada goldenrod).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Fraxinus pennsylvanica (green ash)	1	0-1	33
Populus angustifolia (narrowleaf cottonwood)	20	0-20	33
Populus deltoides (Great Plains cottonwood)	70	40-90	100
Populus trichocarpa (black cottonwood)	40	0-40	33
Shrubs			
Clematis ligusticifolia (western virgins-bower)	3	0-3	33
Cornus stolonifera (red-osier dogwood)	63	20-90	100
Prunus virginiana (common chokecherry)	40	0-40	33
Ribes odoratum (buffalo currant)	3	0-3	33
Rosa woodsii (woods rose)	14	1-20	100
Salix lutea (yellow willow)	35	0-60	67
Symphoricarpos occidentalis (western snowberry)	1	0-1	33
Graminoids			
Agropyron repens (quackgrass)	20	0-20	33
Bromus inermis (smooth brome)	20	0-20	33

Forbs			
Apocynum spp. (dogbane)	3	0-3	33
Euphorbia esula (leafy spurge)	20	0-20	33
Glycyrrhiza lepidota (American licorice)	1	0-1	33
Melilotus alba (white sweet-clover)	3	0-3	33
Smilacina stellata (starry Solomon-plume)	40	0-40	33
Solidago canadensis (Canada goldenrod)	30	0-40	67

SUCCESSIONAL INFORMATION

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type represents a mid-seral stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Fraxinus pennsylvanica* (green ash), or in some instances, *Acer negundo* (box-elder). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes open, and finally, becomes decadent, the *Fraxinus*

pennsylvanica (green ash), or *Acer negundo* (box-elder) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, succession continues from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of a *Populus deltoides* (Great Plains cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus deltoides*/Herbaceous [Great Plains cottonwood/Herbaceous] community type). In this situation, the overstory of *Populus deltoides* (Great Plains cottonwood) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential has been changed to one capable of supporting the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, or the *Agropyron smithii* (western wheatgrass) habitat type.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of fine textured mineral soil overlying sand or gravel. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from silt loam to silty clay. Water tables drop below 1 m (39 in) of the soil surface in summer, but surface soils often remain moist due to fine textured soils, associated low permeability and dense shading by woody species. As evidence of periodic saturation, redox concentrations (mottles) are common in the surface horizon and decrease with depth. Soils are generally poorly drained with high available water.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow)

community type and the *Salix lutea* (yellow willow) dominated habitat types, or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) dominated habitat types. In some situations, wetter sites may be open water. Adjacent drier communities may be dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, the *Agropyron smithii* (western wheatgrass) habitat type, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the amount of available forage. However, most sites are presently subjected to heavy grazing pressures because of their topographic location and ease of access. With moderate to heavy prolonged grazing pressures, most shrubs will be eliminated leaving the shrubs *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) as the dominate understory. At this point, the stand has been converted to the *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) disturbance-caused community type. If disturbance is severe, the shrubs will also be eliminated and the stand has converted to the *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods is moderate to high. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type provides valuable cover, shade, and food for a variety of species. Big game use, such as whitetail deer and mule deer, may be high, depending upon the time of year. The spreading crown of *Populus deltoides* (Great Plains cottonwood) provides sites for huge platform like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus deltoides* (Great Plains cottonwood) and *Cornus stolonifera* (red-osier dogwood) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type is very important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Cornus stolonifera* (red-osier dogwood) and associated shrub species are excellent in controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus deltoides* (Great Plains cottonwood) and associated shrubs are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great

Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus deltoides* (Great Plains cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody shrub species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody shrub species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, sandy range site, subirrigated range site, thin sandy range site, thin silty range site, thin clayey range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984) for the northern Great Plains.

Populus deltoides/Herbaceous Community Type
(Great Plains Cottonwood/Herbaceous Community Type)

POPDEL (PODE3)
Number Of Stands Sampled = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) community type is a major type at low elevations in central and eastern Montana. The type occurs on older alluvial bars of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus deltoides* (Great Plains cottonwood) is the lowest (elevationally) occurring cottonwood with *Populus angustifolia* (narrowleaf) occurring at intermediate elevations, and *Populus trichocarpa* (black cottonwood) occurring at higher elevations. Sampled sites ranged in elevation from 579 to 1,097 m (1,900 to 3,600 ft). Stands may be broad and extensive, as along the lower stretches of the Missouri and Yellowstone Rivers, or may be relatively narrow as along the Milk, Little Missouri, Tongue, and Powder Rivers.

FLORISTIC CHARACTERISTICS

The *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) community type is a grazing or browsing

disclimax community type characterized by a two layer structure of mature, widely spaced *Populus deltoides* (Great Plains cottonwood) over an understory of herbaceous vegetation dominated by *Agropyron repens* (quackgrass), *Elymus canadensis* (Canada wildrye), and *Glycyrrhiza lepidota* (American licorice). Shrub species are absent or present as remnant, scattered individuals.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Elaeagnus angustifolia (Russian olive)	12	0-60	50
Populus deltoides (Great Plains cottonwood)	58	40-70	100
Salix amygdaloides (peach-leaf willow)	1	0-1	60
Shrubs			
Rosa woodsii (woods rose)	1	0-3	40
Symphoricarpos occidentalis (western snowberry)	5	0-20	40
Graminoids			
Agropyron repens (quackgrass)	27	0-60	70
Elymus canadensis (Canada wildrye)	15	0-20	50
Muhlenbergia racemosa (satin-grass)	16	0-20	40
Forbs			
Glycyrrhiza lepidota (American licorice)	3	0-10	80
Melilotus alba (white sweet-clover)	15	0-20	40

SUCCESSIONAL INFORMATION

The *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically,

rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Fraxinus pennsylvanica* (green ash), or in some instances, *Acer negundo* (box-elder). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes open, and finally, becomes decadent, the *Fraxinus pennsylvanica* (green ash), or *Acer negundo* (box-elder) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, succession continues from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of a *Populus deltoides* (Great Plains cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus deltoides*/Herbaceous [Great Plains cottonwood/Herbaceous] community type). In this situation, the overstory of *Populus deltoides* (Great Plains cottonwood) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site

now has become so open and dry that the site's potential has been changed to one capable of supporting the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, or the *Agropyron smithii* (western wheatgrass) habitat type.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from silt loam to silty clay. Water tables usually drop below 1 m (39 in) of the soil surface in summer. Redox concentrations (mottles) are rare in these soils. Soils are generally poorly drained with high available water, but usually dry out quickly due to the lack of shading by shrub species.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type and the *Salix lutea* (yellow willow) dominated habitat types, or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) dominated habitat types. In some situations, wetter sites may be open water. Adjacent drier communities may be dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, the *Agropyron smithii* (western wheatgrass) habitat type, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open (park-like) structure of this community type and continued dominance of the undergrowth by *Poa pratensis* (Kentucky bluegrass) *Phleum pratense* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This community type has been and in many instances, still is used by the ranching community as a winter feeding ground. *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Bromus inermis* (smooth brome) are palatable and moderately productive, especially when soil moisture levels are high, and tolerate a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Timber

Due to the favorable moisture relationship of this type, timber productivity in cottonwood stands is moderate. Complete stand removal may result in a graminoid dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the typically open, two layered

structure. All kinds of birds are common since food and cover is available both on the ground and in the trees. Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible. Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries
The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire
This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can be used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities
Fine textured soils are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. However, management should emphasize the greater stability of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus deltoides* (Great Plains cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody shrub species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody shrub species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire

as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, sandy range site, subirrigated range site, thin sandy range site, thin silty range site, thin clayey range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984) for the northern Great Plains.

Populus deltoides/Recent Alluvial Bar Community Type
(Great Plains Cottonwood/Recent Alluvial Bar Community Type)

POPDEL (PODE3)

Number Of Stands Sampled = 42

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is a major type at low elevations in central and eastern Montana. The type occurs on recently deposited alluvial bars of major streams and rivers, and around lakes and ponds. In general, these sites are recent sediment deposits, such as point bars, side bars, mid channel bars, delta bars, and islands. In central and eastern Montana *Populus deltoides* (Great Plains cottonwood) is the lowest (elevationally) occurring cottonwood with *Populus angustifolia* (narrowleaf) occurring at intermediate elevations, and *Populus trichocarpa* (black cottonwood) occurring at higher elevations. Sampled sites ranged in elevation from 579 to 1,097 m (1,900 to 3,600 ft). Stands may be broad and extensive, as along the lower stretches of the Missouri and Yellowstone Rivers, or may be relatively narrow as along the Milk, Little Missouri, Tongue, and Powder Rivers.

FLORISTIC CHARACTERISTICS

This type is characterized by a stand dominated by seedlings or saplings of *Populus deltoides* (Great Plains cottonwood), or a stand codominated by cottonwoods and *Salix exigua* (sandbar willow). *Populus trichocarpa* (black cottonwood) and *Populus angustifolia* (narrowleaf cottonwood) may be present but are subordinate to *Populus deltoides* (Great Plains cottonwood). The herbaceous understory contains a diverse group of plants.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Elaeagnus angustifolia (Russian olive)	1	0-1	6
Fraxinus pennsylvanica (green ash)	1	0-1	3
Juniperus scopulorum (Rocky Mountain juniper)	1	0-1	3
Populus angustifolia (narrowleaf cottonwood)	20	0-20	3
Populus deltoides (Great Plains cottonwood)	34	3-80	100
Populus trichocarpa (black cottonwood)	20	0-20	3
Salix amygdaloides (peach-leaf willow)	3	0-40	56
Shrubs			
Amelanchier alnifolia (western serviceberry)	1	0-1	3
Cornus stolonifera (red-osier dogwood)	1	0-3	9
Gutierrezia sarothrae (broom snakeweed)	1	0-1	3
Parthenocissus quinquefolia (Virginia creeper)	1	0-1	9
Ribes odoratum (buffalo currant)	1	0-1	9
Rosa woodsii (woods rose)	1	0-3	16
Salix exigua (sandbar willow)	34	0-80	81
Salix lasiandra (Pacific willow)	10	0-10	3
Salix lutea (yellow willow)	27	0-60	19
Shepherdia argentea (thorny buffaloberry)	1	0-1	3
Symphoricarpos occidentalis (western snowberry)	1	0-1	6
Tamarix chinensis (salt cedar)	1	0-1	3
Toxicodendron rydbergii (poison ivy)	1	0-1	9
Vitis riparia (river-bank grape)	3	0-3	3

Graminoids			
Agropyron repens (quackgrass)	8	0-20	28
Agropyron smithii (western wheatgrass)	5	0-3	19
Agrostis stolonifera (redtop)	25	0-40	13
Bromus inermis (smooth brome)	3	0-3	3
Calamovilfa longifolia (prairie sandgrass)	2	0-3	13
Carex brevior (short-beaked sedge)	6	0-20	13
Carex lanuginosa (woolly sedge)	10	0-20	6
Distichlis spicata (inland saltgrass)	1	0-1	6
Echinochloa crusgalli (large barnyard-grass)	3	0-20	28
Echinochloa spp. (barnyard grass)	1	0-1	3
Eleocharis palustris (common spikesedge)	7	0-20	13
Elymus canadensis (Canada wildrye)	7	0-20	47
Eragrostis hypnoides (creeping lovegrass)	1	0-1	6
Hordeum jubatum (foxtail barley)	6	0-20	22
Juncus spp. (rush)	1	0-1	3
Juncus torreyi (Torrey's rush)	12	0-20	6
Muhlenbergia racemosa (satin grass)	7	0-20	28
Panicum capillare (common witchgrass)	1	0-1	3
Phalaris arundinacea (reed canarygrass)	1	0-1	3
Poa palustris (fowl bluegrass)	3	0-3	3
Poa pratensis (Kentucky bluegrass)	1	0-1	3
Poa spp. (bluegrass)	3	0-3	6
Polypogon monspeliensis (rabbitfoot polypogon)	15	0-40	9
Scirpus maritimus (alkali bulrush)	1	0-1	3
Scirpus pungens (sharp bulrush)	28	0-60	9
Scirpus validus (softstem bulrush)	3	0-3	3
Setaria viridis (green bristlegrass)	1	0-1	6
Spartina pectinata (prairie cordgrass)	2	0-3	6
Sporobolus cryptandrus (sand dropseed)	12	0-20	6
Forbs			
Ambrosia psilostachya (western ragweed)	1	0-3	9
Artemisia biennis (biennial wormwood)	3	0-3	3
Artemisia ludoviciana (prairie sagewort)	1	0-3	16
Asclepias verticillata (whorled milkweed)	1	0-3	13
Aster brachyactis (rayless alkali aster)	32	0-60	6
Aster oblongifolius (aromatic aster)	3	0-3	3
Aster pansus (tuffed white prairie aster)	2	0-3	6
Chenopodium album (lambsquarter)	1	0-3	13
Cirsium arvense (Canada thistle)	8	0-40	28
Conyza canadensis (horseweed)	2	0-3	9
Cycloloma atriplicifolium (tumble ringwing)	1	0-1	6
Epilobium ciliatum (common willow-herb)	20	0-40	6
Euphorbia esula (leafy spurge)	20	0-40	6
Euphorbia glyptosperma (corrugate-seeded spurge)	2	0-3	9
Glycyrrhiza lepidota (American licorice)	5	0-20	28
Gnaphalium palustre (lowl cudweed)	10	0-20	6
Grindelia squarrosa (curlycup gumweed)	5	0-20	13

Helenium autumnale (sneezeweed)	1	0-1	3
Helianthus petiolaris (prairie sunflower)	3	0-3	6
Kochia scoparia (summer cypress)	20	0-20	3
Medicago lupulina (black medic)	1	0-1	3
Melilotus alba (white sweet-clover)	10	0-40	28
Melilotus officinalis (yellow sweet-clover)	7	0-20	25
Mentha arvensis (field mint)	15	0-40	9
Oenothera biennis (common evening-primrose)	2	0-3	6
Plantago major (common plantain)	12	0-20	6
Plantago patagonica (Indian-wheat)	1	0-1	3
Polygonum amphibium (water smartweed)	2	0-3	13
Polygonum aviculare (prostrate knotweed)	5	0-20	13
Polygonum lapathifolium (willow weed)	1	0-1	6
Polygonum minimum (leafy dwarf knotweed)	20	0-20	3
Polygonum spp. (smartweed)	3	0-3	3
Potentilla anserina (common silverweed)	2	0-3	6
Potentilla paradoxa (bushy cinquefoil)	2	0-3	22
Ranunculus spp. (buttercup)	1	0-1	3
Rorippa sinuata (spreading yellowcress)	1	0-1	3
Rumex crispus (curly dock)	2	0-3	6
Rumex maritimus (golden dock)	2	0-3	22
Salsola iberica (Russian thistle)	1	0-1	3
Sisymbrium loeselii (Loeselii tumblemustard)	1	0-1	3
Solidago canadensis (Canada goldenrod)	33	0-60	9
Solidago gigantea (late goldenrod)	3	0-3	3
Solidago occidentalis (western goldenrod)	7	0-20	9
Sonchus arvensis (field milk-thistle)	29	0-80	9
Sonchus asper (prickly sowthistle)	1	0-1	9
Tanacetum vulgare (common tansy)	1	0-1	3
Taraxacum laevigatum (red-seeded dandelion)	1	0-1	3
Verbena bracteata (bracted verbena)	20	0-20	3
Veronica americana (American speedwell)	3	0-3	3
Veronica catenata (chain speedwell)	1	0-1	3
Viola canadensis (Canada violet)	1	0-1	3
Xanthium strumarium (common cocklebur)	30	0-50	9
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-3	16
Equisetum laevigatum (smooth scouring-rush)	1	0-1	6

SUCCESSIONAL INFORMATION

The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type represents an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable

seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Fraxinus pennsylvanica* (green ash), or in some instances, *Acer negundo* (box-elder). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes open, and finally, becomes decadent, the *Fraxinus pennsylvanica* (green ash), or *Acer negundo* (box-elder) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, succession continues from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type.

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressures. Moderate, prolonged grazing and browsing pressures will cause a stand to change to the disturbance-caused *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type. Severe, prolonged grazing and browsing pressures may eliminate all seedlings of *Fraxinus pennsylvanica* (green ash) and/or *Acer negundo* (box-elder) and may eliminate the undergrowth of shrub species as well. This severely disturbed stage of secondary succession is called the *Populus deltoides*/Herbaceous (Great Plains cottonwood/Herbaceous) community type. In this situation, the overstory of *Populus deltoides* (Great Plains cottonwood) still matures and becomes open with an understory

dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential has been changed to one capable of supporting the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, or the *Agropyron smithii* (western wheatgrass) habitat type.

Stands of the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type are very susceptible to the natural dynamics of a river system and may be flooded and eliminated after just a year or two of growth. Ice can also have a dramatic impact on these recently deposited alluvial bars. Ice can influence the floodplain landscape by either one of two ways: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage generally involves the following: a) the laying down or bending over of the younger cottonwoods, b) the physical shearing off of the stems, c) the actual pulling out of the ground by the ice that surrounds the main stems, and d) the tilting or pushing over of mature trees. In addition, young cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If livestock pressures are too great, the stand can be either partially or totally eliminated. In many situations, excessive livestock pressure has completely eliminated the establishment of new cottonwood stands. Beaver and big game species can also have a dramatic impact on newly established cottonwood stands.

SOILS

Soils are typically Entisols (Fluvents), are deep and formed in recent alluvium. Surface horizons are typically fine textured (silty clay to clay), overlying a stratified, coarse textured substratum of some sand or gravels. Water tables are generally at or near the soil surface. In late summer water tables may drop below 50 cm (20 in) of the soil surface but surface horizons remain moist due to capillary action. Soils are poorly drained, permeability is slow and available water is low.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type and the *Salix lutea* (yellow willow) dominated habitat types, or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) dominated habitat types. In some situations, wetter sites may be open water. Adjacent drier communities may be dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, *Agropyron smithii* (western wheatgrass) habitat type, or by a variety of upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to moderate. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrub species thereby limiting the amount of available forage. These stands are very susceptible to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations it may be advisable to eliminate livestock use until the cottonwoods are of sufficient height to preclude defoliation by livestock.

Wildlife

The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. *Populus deltoides* (Great Plains cottonwood) is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar)

community type is valuable for fisheries by providing for streambank stability.

Fire

The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings do not have an extensive root system or thick bark and may be severely damaged (or eliminated) by fire.

Soil Management and Rehabilitation Opportunities

Fine textured substrates are susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. Managers should maintain a buffer strip of the *Populus deltoides* (Great Plains cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize stream banks, and slow flood waters.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites where substrates are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species. However, the dense nature of many of these stands may preclude various types of recreational activities such as fishing.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, sandy range site, subirrigated range site, thin sandy range site, thin silty range site, thin clayey range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type has not been described elsewhere.

Populus deltoides/Symphoricarpos occidentalis Community Type (Great Plains Cottonwood/Western Snowberry Community Type)

POPDEL/SYMOCC (PODE3/SYOC)
Number Of Stands Sampled = 19

LOCATION AND ASSOCIATED LANDFORMS

The *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type is a major type at low elevations in central and eastern Montana. The type occurs on older alluvial bars of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus deltoides* (Great Plains cottonwood) is the lowest (elevationally) occurring cottonwood with *Populus angustifolia* (narrowleaf) occurring at intermediate elevations, and *Populus trichocarpa* (black cottonwood) occurring at higher elevations. Sites range in elevation from 579 to 1,097 m (1,900 to 3,600 ft). Stands may be broad and extensive, as along the lower stretches of the Missouri and Yellowstone Rivers, or may be relatively narrow as along the Milk, Little Missouri, Tongue, and Powder Rivers.

FLORISTIC CHARACTERISTICS

The *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type represents a grazing disclimax. It is characterized by an overstory of *Populus deltoides* (Great Plains cottonwood) over an understory dominated by *Symphoricarpos occidentalis* (western snowberry) or *Rosa woodsii* (woods rose).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus deltoides (Great Plains cottonwood)	53	30-90	100
Shrubs			
Cornus stolonifera (red-osier dogwood)	1	0-1	11
Rosa woodsii (woods rose)	26	0-98	89
Symphoricarpos occidentalis (western snowberry)	30	0-80	84
Toxicodendron rydbergii (poison ivy)	16	0-20	42
Graminoids			
Bromus inermis (smooth brome)	14	0-40	47

SUCCESSIONAL INFORMATION

The *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type represents a moderately disturbed secondary successional stage of the mid-seral *Populus deltoides/Cornus stolonifera* (Great

Plains cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Fraxinus pennsylvanica* (green ash), or in some instances, *Acer negundo* (box-elder). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes open, and finally, becomes decadent, the *Fraxinus pennsylvanica* (green ash), or *Acer negundo* (box-elder) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, succession continues from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present

and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of a *Populus deltoides* (Great Plains cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused secondary succession is called the *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus deltoides*/Herbaceous [Great Plains cottonwood/Herbaceous] community type). In this situation, the overstory of *Populus deltoides* (Great Plains cottonwood) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential has been changed to one capable of supporting the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, or the *Agropyron smithii* (western wheatgrass) habitat type.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from silt loam to silty clay. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action and dense shading. As evidence of a fluctuating water table, redox concentrations (mottles) are common in these soils. Soils are generally poorly drained with high available water.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) community type and the *Salix lutea* (yellow willow) dominated habitat types, or the *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), and *Eleocharis* (spikesedge) dominated habitat types. In some situations, wetter sites may be open water. Adjacent drier communities may be dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type, the *Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) habitat type, the *Agropyron smithii* (western wheatgrass) habitat type, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense shrub understory within the stands. Forage production from dense thickets of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) is low. Stands may be

so dense that they exclude most livestock use. As the shrub understory is eliminated by continual prolonged heavy grazing or browsing, stands open and forage production increases accordingly due to the presence and amount of *Agropyron smithii* (western wheatgrass), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), or *Bromus inermis* (smooth brome). The palatability of *Symphoricarpos occidentalis* (western snowberry) ranges from low to fair for cattle and sheep (Wasser 1982; Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (woods rose) are considered fair to fairly good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

The *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type provides valuable cover, shade, and food for a variety of species. Big game use, such as whitetail deer and mule deer, may be high, depending upon the time of year. The spreading crown of *Populus deltoides* (Great Plains cottonwood) provides sites for huge platform like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus deltoides* (Great Plains cottonwood) and *Rosa woodsii* (woods rose) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural understory diversity of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (western snowberry) is rated as good for deer and elk (Wasser 1982; Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (woods rose), while the persistent fruit (rose hips) provides fall and winter food for birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (woods rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Fisheries

The stream side location of the *Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry) community type is very important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) are excellent in controlling erosion along streams due to their rhizomatous nature. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus deltoides* (Great Plains cottonwood) and associated shrubs are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be

excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Symphoricarpos occidentalis (western snowberry) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (woods rose) is strongly fire tolerant, except for smoldering fires with heavy volumes of surface fuel. The species has a shallow and much branched rhizomatous root system that will readily sprout and sucker. This sprouting capability of *Rosa woodsii* (woods rose) make it a good soil stabilizer.

Soil Management and Rehabilitation Opportunities

Fine textured soils are susceptible to compaction problems. This community type can be subject to some recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus deltoides* (Great Plains cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody shrub species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody shrub species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Symphoricarpos occidentalis (western snowberry) is well adapted for revegetating sites. Commonly growing in dense colony stands makes it suitable for disturbed land stabilization. It does best on moist, well drained soils which have not been

excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erosive sites may need complete exclusion from grazing during establishment, and animal populations and stacking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (woods rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanted materials.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (western snowberry) is an important food source for upland birds due to fruits that persist into the winter. Native Americans made extensive use of *Rosa woodsii* (woods rose) roots, stems, leaves, flowers, and rose hips for food and therapeutic materials (US Forest Service 1975). The persistent rose hips are edible, and are one of the best natural sources of vitamin C. They can be dried for use in flavoring teas, jellies, fruitcakes, and puddings.

Nature trails should be routed around dense stands of *Rosa woodsii* (woods rose) community type. However, *Rosa woodsii* (woods rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, sandy range site, subirrigated range site, thin sandy range site, thin silty range site, thin clayey range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

Similar communities were described by Nelson (1961), Jorgensen (1979), Boggs (1984), and Hansen and others (1984) for the northern Great Plains.

Populus tremuloides/Berberis repens Habitat Type
(Quaking Aspen/Creeping Oregongrape Habitat Type)

POPTRE/BERREP (POTR10/BERE)
Number Of Stands Sampled = 3

CAUTION — Not all sites currently dominated by *Populus tremuloides* (quaking aspen) are considered riparian or wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Berberis repens* (quaking aspen/creeping Oregongrape) habitat type is an incidental type in the southeastern portion of Montana. The distribution of this type throughout Montana is unknown at this time. It occurs in V-shaped ravines, along small permanent or ephemeral streams, and near springs or seeps in the region. In many instances, sites are located in areas of high beaver activities where the water tables have been raised. Sites range in elevation from 920 to 1,200 m (3,019 to 3,937 ft). The sites were sampled in the Sioux District of the Custer National Forest.

FLORISTIC CHARACTERISTICS

The *Populus tremuloides/Berberis repens* (quaking aspen/creeping Oregongrape) habitat type habitat type is recognized by the consistent presence and reproductive success of *Populus tremuloides* (quaking aspen) and the dominance of *Berberis repens* (creeping Oregongrape) in the undergrowth. Other understory plants present include *Symphoricarpos albus* (common snowberry), *Prunus virginiana* (common chokecherry), *Poa pratensis* (Kentucky bluegrass), *Carex sprengelii* (Sprengel's sedge), *Elymus virginicus* (Virginia wildrye), *Galium boreale* (northern bedstraw), and *Smilacina stellata* (starry Solomon-plume) (Appendix 00).

SUCCESSIONAL INFORMATION

Livestock grazing tends to increase the amount and abundance of *Poa pratensis* (Kentucky bluegrass), *Monarda fistulosa* (horsemint), *Fragaria virginiana* (Virginia strawberry), and *Taraxacum officinale* (western meadowrue). If grazing pressures are severe, the stand will eventually take on the appearance of the grazing disclimax *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type.

SOILS

Soils of this type are commonly Mollisols. Soil texture varies from loam to sandy loam. Water tables are usually within 1 m (39 in) of the soil surface throughout the growing season. Soils are generally well drained and have low water holding capacity. Litter layers average 5 cm (2 in) in depth. Soil reaction ranges from slightly acid to moderately alkaline (pH 6.0 to 8.0).

ADJACENT COMMUNITIES

Adjacent wetter sites may be dominated by various willow types. In other situations, adjacent wetter sites are sedge meadows or the *Typha latifolia* (common cattail) habitat type. Adjacent drier sites are typically dominated by upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Livestock show a high preference for the *Populus tremuloides/Berberis repens* (quaking aspen/creeping Oregongrape) habitat type due to the availability of forage, thermal cover, and water source. Forage production is rated as moderate, depending on the density of the tree and shrub layer. Palatability of the various herbaceous species associated with this type are often high, and cattle use may be heavy as upland vegetation cures and animals spend much of their time in the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. They also browse

young suckers and, combined with trampling and soil compaction, can alter both the age structure and herbaceous layer of this type.

Wildlife

Beaver show a high preference for those sites adjacent to a stream or spring. In some sites, beaver have had a tremendous impact on *Populus tremuloides* (quaking aspen). Deer make use of these sites for thermal and hiding cover, forage, and water.

Fire

Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (quaking aspen) (Jones and DeByle 1985). Brown (1984) provides information for using prescribed fire in stands of *Populus tremuloides* (quaking aspen). Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful reproduction.

Berberis repens (creeping Oregongrape) is moderately resistant and survives all but severe fires that both remove the duff and heat the upper soil for extended periods.

Soil Management and Rehabilitation Opportunities

Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984). *Populus tremuloides* (quaking aspen) can be useful in revegetation of disturbed sites having moist, well drained soils. Best results are obtained using rooted cuttings or nursery grown stock. Once established, growth rates are rapid with spreading roots quickly stabilizing the soil.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

This discussion is an expanded description of the *Populus tremuloides/Berberis repens* (quaking aspen/creeping Oregongrape) habitat type habitat type as defined by Hansen and Hoffman (1988). *Populus tremuloides* (quaking aspen) forests with somewhat similar undergrowth vegetation occur in the Black Hills National Forest (Hoffman and Alexander 1987), western North Dakota (Hansen and others 1984), and western Wyoming (Youngblood and Mueggler 1981).

Populus tremuloides/Calamagrostis canadensis Habitat Type
(Quaking Aspen/Bluejoint Reedgrass Habitat Type)

POPTRE/CALCAN (POTR10/CACA4)

Number Of Stands Sampled = 6

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Calamagrostis canadensis* (quaking aspen/bluejoint reedgrass) habitat type is an incidental type at mid to high elevations throughout the mountains of Montana. Elevations of sampled sites range from 854 to 1,966 m (2,800 to 6,450 ft). It typically occurs adjacent to streams and rivers on alluvial terraces.

FLORISTIC CHARACTERISTICS

Populus tremuloides (quaking aspen) dominates the overstory. *Rosa woodsii* (woods rose), *Symphoricarpos albus* (common snowberry), and *Alnus incana* (mountain alder) occur often in substantial amounts in the understory. *Calamagrostis canadensis* (bluejoint reedgrass) is the dominant herbaceous species. Other herbaceous species include *Fragaria virginiana* (Virginia strawberry), *Phleum pratense* (common timothy), *Aster occidentalis* (western aster), *Geranium* spp. (geranium), and *Equisetum arvense* (field horsetail).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus tremuloides (quaking aspen)	63	40-90	100
Shrubs			
Alnus incana (mountain alder)	20	0-20	33
Amelanchier alnifolia (western serviceberry)	1	0-1	33
Arctostaphylos uva-ursi (kinnikinnick)	3	0-3	33
Potentilla fruticosa (shrubby cinquefoil)	3	0-3	33
Ribes spp. (currant)	3	0-3	33
Rosa acicularis (prickly rose)	10	0-10	33
Rosa woodsii (woods rose)	20	0-20	67
Salix bebbiana (Bebb willow)	1	0-1	33
Symphoricarpos albus (common snowberry)	30	0-30	33
Graminoids			
Agropyron caninum (bearded wheatgrass)	3	0-3	33
Agropyron spp. (wheatgrass)	3	0-3	33
Bromus ciliatus (fringed brome)	3	0-3	67
Calamagrostis canadensis (bluejoint reedgrass)	60	40-80	100
Carex spp. (sedge)	3	0-3	33
Elymus canadensis (Canada wildrye)	3	0-3	33
Elymus glaucus (blue wildrye)	3	0-3	33
Juncus balticus (Baltic rush)	3	0-3	33
Phleum pratense (common timothy)	10	0-20	67
Poa palustris (fowl bluegrass)	3	0-3	33
Poa pratensis (Kentucky bluegrass)	3	0-3	33
Stipa viridula (green needlegrass)	1	0-1	33
Forbs			
Achillea millefolium (common yarrow)	3	0-3	33
Actaea rubra (baneberry)	20	0-20	33
Allium spp. (onion)	1	0-1	33
Angelica arguta (sharptooth angelica)	10	0-10	33

Antennaria spp. (pussy-toes)	3	0-3	33
Aster occidentalis (western aster)	7	0-10	67
Aster spp. (aster)	3	0-3	33
Cirsium scariosum (elk thistle)	2	0-3	67
Epilobium angustifolium (fireweed)	2	0-3	67
Fragaria virginiana (Virginia strawberry)	3	3-3	100
Galium asperrimum (rough bedstraw)	3	0-3	33
Galium triflorum (sweetscented bedstraw)	1	0-1	33
Geranium spp. (geranium)	3	0-3	67
Geum macrophyllum (large-leaved avens)	3	0-3	33
Heracleum lanatum (cow-parsnip)	20	0-20	33
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	33
Pedicularis bracteosa (bracted lousewort)	1	0-1	33
Pyrola asarifolia (pink wintergreen)	1	0-1	33
Rubus pubescens (dwarf red blackberry)	3	0-3	33
Senecio pseudaureus (streambank groundsel)	3	0-3	33
Senecio serra (tall butterweed)	1	0-1	33
Senecio triangularis (arrowleaf groundsel)	3	0-3	33
Smilacina stellata (starry Solomon-plume)	1	0-1	33
Solidago canadensis (Canada goldenrod)	1	0-1	33
Taraxacum officinale (common dandelion)	3	0-3	33
Thalictrum occidentale (western meadowrue)	3	0-3	33
Trifolium repens (white clover)	3	0-3	33
Urtica dioica (stinging nettle)	1	0-1	33
Veratrum viride (green false hellebore)	1	0-1	33
Viola canadensis (Canada violet)	1	0-1	33
Viola spp. (violet)	3	0-3	33
Ferns and Allies			
Equisetum arvense (field horsetail)	15	0-20	67

SUCCESSIONAL INFORMATION

High levels of grazing and browsing by livestock and wildlife will reduce the coverages and successful reproduction of *Populus tremuloides* (quaking aspen) and the various shrubs associated with this habitat type, while increasing the coverages of disturbance-caused herbaceous species. In extreme cases, a loss of the understory may occur, and the stand will take on the appearance of the grazing disclimax *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type.

SOILS

Soils are commonly Entisols (Fluvents) or Mollisols (Borolls) derived from alluvium. Water tables approach the soil surface in spring, but are usually greater than 1 m (39 in) below the surface in mid summer. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are dominated by *Alnus incana* (mountain alder), *Salix drummondiana* (Drummond willow), *Carex rostrata* (beaked sedge) or occasionally by *Populus trichocarpa* (black cottonwood). Adjacent uplands are dominated by conifers such as *Abies lasiocarpa* (subalpine fir), *Picea engelmannii* (Engelmann spruce), and *Pseudotsuga*

menziesii (Douglas fir).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is usually high. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Continued close utilization results in decreased *Calamagrostis canadensis* (bluejoint reedgrass) production.

This type is generally moist until mid summer and is preferred as mid to late season pasture by livestock following forage depletion on adjacent uplands. Therefore, the season of use often coincides with the maturity of *Calamagrostis canadensis* (bluejoint reedgrass). Grazing by livestock can have a limited impact when done with moderation. However, grazing should be restricted when soils are moist, especially along streams where bank sloughing can occur.

In order to develop an upward trend in ecological status on moderately disturbed sites, time the season of use by livestock to both the drying of the soil surface and to the maturation of the seedheads. Livestock should be removed when 40 percent or less utilization of herbaceous forage is obtained.

In severely disturbed sites, more intensive rehabilitation strategies will be required due to the abundance of *Poa pratensis* (Kentucky bluegrass) and *Poa palustris* (fowl bluegrass).

Timber

Most timber harvest is salvage for fuelwood. Overstory removal will result in sprouting of young aspen that are susceptible to grazing pressure.

Wildlife

The *Populus tremuloides/Calamagrostis canadensis* (quaking aspen/bluejoint reedgrass) habitat type, although often covering only small areas, has high value as wildlife cover and feeding areas. Beaver, if present, may make heavy use of *Populus tremuloides* (quaking aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). In addition, *Populus tremuloides* (quaking aspen) and is highly preferred by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common. Elk may make moderate summer use of *Calamagrostis canadensis* (bluejoint reedgrass) (Kufeld 1987).

Fisheries

Where adjacent to streams, stands of this type enhance fisheries by stabilizing banks and providing overhanging cover. The rhizomatous nature of *Calamagrostis canadensis* (bluejoint reedgrass) will help provide bank stability for those sites adjacent to streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (quaking aspen) (Jones and DeByle 1985). Brown (1984) provides information for using prescribed fire in stands of *Populus tremuloides* (quaking aspen). Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful reproduction.

Fires reduce the abundance of other associated species and tends to result in increases in *Calamagrostis canadensis* (bluejoint reedgrass) and other rhizomatous species (Haeussler and Coates 1986). *Calamagrostis canadensis* (bluejoint reedgrass) is an aggressive invader of burned sites. Repeated burning tends to favor rhizomatous species such as *Poa pratensis* (Kentucky bluegrass) and *Agropyron caninum* (bearded wheatgrass).

Soil Management and Rehabilitation Opportunities

Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984).

Populus tremuloides (quaking aspen) may be useful in revegetating disturbed sites having moist, well drained soils. Best results are obtained using rooted cuttings or nursery grown stock. Once established, growth rates are rapid. The quickly spreading roots of *Populus tremuloides* (quaking aspen) effectively stabilize soils.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streambanks.

Recreational Uses and Considerations

Fishing and birding opportunities are often good. Campsites should be located away from stands of this type because of wet soils and large mosquito populations.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

This type has not been described by other regional studies.

Populus tremuloides/Cornus stolonifera Habitat Type
(Quaking Aspen/Red-Osier Dogwood Habitat Type)

POPTRE/CORSTO (POTR10/COST4)

Number Of Stands Sampled = 75

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type is a minor type at low to mid elevations throughout the mountains and foothills of Montana. Sites range in elevation from 732 to 2,104 m (2,400 to 6,900 ft). It typically occurs on alluvial terraces adjacent to streams and rivers, or near springs and seeps.

FLORISTIC CHARACTERISTICS

This type is characterized by an overstory of *Populus tremuloides* (quaking aspen) dominating an undergrowth of dense willows and other shrubs. *Populus trichocarpa* (black cottonwood) and scattered conifers are sometimes present. Associated shrubs include *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), *Rosa woodsii* (woods rose), and *Rubus idaeus* (red raspberry).

Herbaceous vegetation present include *Equisetum arvense* (field horsetail), *Galium triflorum* (sweetscented bedstraw), *Smilacina stellata* (starry Solomon-plume), *Actaea rubra* (baneberry), and *Geum macrophyllum* (large-leaved avens).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Betula papyrifera (paper birch)	70	0-70	11
Juniperus scopulorum (Rocky Mountain juniper)	2	0-3	22
Populus tremuloides (quaking aspen)	54	10-90	100
Populus trichocarpa (black cottonwood)	20	0-20	11
Shrubs			
Acer glabrum (Rocky Mountain maple)	3	0-3	11
Alnus incana (mountain alder)	28	0-40	44
Amelanchier alnifolia (western serviceberry)	5	0-10	22
Berberis repens (creeping Oregongrape)	1	0-1	11
Betula glandulosa (bog birch)	10	0-10	11
Betula occidentalis (water birch)	20	0-20	11
Betula spp. (birch)	10	0-10	11
Clematis ligusticifolia (western virgins-bower)	3	0-3	11
Cornus canadensis (bunchberry)	1	0-1	11
Cornus stolonifera (red-osier dogwood)	42	20-80	100
Linnaea borealis (twinflower)	30	0-30	11
Lonicera involucrata (twin-berry)	10	0-10	11
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	11
Prunus virginiana (common chokecherry)	12	0-20	22
Ribes lacustre (swamp currant)	10	0-10	11
Ribes setosum (Missouri gooseberry)	1	0-1	11
Ribes spp. (currant)	1	0-1	22
Rosa acicularis (prickly rose)	2	0-3	22
Rosa spp. (rose)	1	0-1	11
Rosa woodsii (woods rose)	3	0-3	56
Rubus idaeus (red raspberry)	4	0-10	44
Rubus parviflorus (thimbleberry)	12	0-20	22
Salix bebbiana (Bebb willow)	16	0-30	44
Salix boothii (Booth willow)	3	0-3	11
Salix candida (hoary willow)	1	0-1	11
Salix drummondiana (Drummond willow)	23	0-60	13
Salix geyeriana (Geyer willow)	7	0-10	3
Salix lasiandra (Pacific willow)	3	0-3	1

Salix lutea (yellow willow)	3	0-3	11
Salix planifolia (planeleaf willow)	3	0-3	11
Salix pseudomonticola (mountain willow)	1	0-1	11
Salix scouleriana (Scouler willow)	10	0-30	9
Salix serissima (autumn willow)	1	0-1	11
Shepherdia canadensis (Canada buffaloberry)	1	0-1	11
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	11
Symphoricarpos albus (common snowberry)	7	0-10	22
Symphoricarpos occidentalis (western snowberry)	8	0-20	33
Graminoids			
Agropyron repens (quackgrass)	2	0-3	33
Agrostis stolonifera (redtop)	2	0-3	33
Bromus ciliatus (fringed brome)	1	0-1	11
Bromus inermis (smooth brome)	10	0-10	11
Calamagrostis canadensis (bluejoint reedgrass)	7	0-20	33
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	11
Carex aurea (golden sedge)	1	0-1	11
Carex lenticularis (lentil-fruit sedge)	1	0-1	11
Carex rostrata (beaked sedge)	1	0-1	11
Carex spp. (sedge species)	1	0-1	11
Cinna latifolia (drooping woodreed)	1	0-1	11
Eleocharis palustris (common spikesedge)	10	0-10	11
Elymus glaucus (blue wildrye)	27	0-60	33
Glyceria grandis (American mannagrass)	1	0-1	11
Glyceria striata (fowl mannagrass)	1	0-1	11
Juncus balticus (Baltic rush)	1	0-1	11
Phleum pratense (common timothy)	1	0-1	22
Poa palustris (fowl bluegrass)	3	0-3	11
Poa pratensis (Kentucky bluegrass)	11	0-20	44
Trisetum wolfii (Wolf's trisetum)	1	0-1	11
Forbs			
Achillea millefolium (common yarrow)	1	0-1	11
Actaea rubra (baneberry)	5	0-20	56
Adenocaulon bicolor (trail-plant)	1	0-1	11
Agrimonia striata (striate agrimony)	1	0-1	11
Angelica arguta (sharptooth angelica)	1	0-1	11
Antennaria anaphaloides (tall pussy-toes)	1	0-1	11
Arctium minus (common burdock)	3	0-3	11
Arctium spp. (burdock)	1	0-1	11
Aster ciliolatus (Lindley aster)	1	0-1	11
Aster conspicuus (showy aster)	1	0-1	11
Aster foliaceus (leafy aster)	1	0-1	11
Aster occidentalis (western aster)	1	0-1	11
Aster spp. (aster)	1	0-1	11
Cirsium arvense (Canada thistle)	5	0-10	22
Cirsium spp. (thistle)	1	0-1	11
Clintonia uniflora (queen's cup)	1	0-1	11
Cynoglossum officinale (common hound's tongue)	1	0-1	11

Disporum trachycarpum (wartberry fairy-bell)	2	0-3	22
Dodecatheon jeffreyi (tall mountain shooting star)	1	0-1	11
Epilobium angustifolium (fireweed)	1	0-1	11
Fragaria virginiana (Virginia strawberry)	1	0-3	44
Galium aparine (goose-grass)	15	0-20	22
Galium boreale (northern bedstraw)	1	0-1	22
Galium trifidum (small bedstraw)	1	0-1	11
Galium triflorum (sweetscented bedstraw)	10	0-40	56
Geranium richardsonii (white geranium)	1	0-1	22
Geum macrophyllum (large-leaved avens)	2	0-10	56
Habenaria hyperborea (northern green bog-orchid)	1	0-1	22
Heracleum lanatum (cow-parsnip)	2	0-3	22
Mentha arvensis (field mint)	10	0-10	11
Mitella spp. (mitrewort)	10	0-10	11
Osmorhiza chilensis (mountain sweet-cicely)	2	0-3	22
Parnassia fimbriata (fringed grass-of-parnassus)	1	0-1	11
Pyrola asarifolia (pink wintergreen)	1	0-3	44
Pyrola secunda (one-sided wintergreen)	1	0-1	11
Rumex crispus (curly dock)	3	0-3	11
Sanicula marilandica (black snake-root)	1	0-1	11
Scutellaria galericulata (marsh skullcap)	1	0-1	11
Senecio pseudaureus (streambank groundsel)	2	0-3	22
Senecio serra (tall butterweed)	1	0-1	11
Smilacina racemosa (false spikenard)	1	0-1	11
Smilacina stellata (starry Solomon-plume)	8	0-20	56
Solidago canadensis (Canada goldenrod)	1	0-1	11
Solidago missouriensis (Missouri goldenrod)	3	0-3	11
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	11
Taraxacum ceratophorum (horned dandelion)	1	0-1	11
Taraxacum officinale (common dandelion)	3	0-10	44
Thalictrum occidentale (western meadowrue)	1	0-3	44
Tiarella trifoliata (trefoil foamflower)	10	0-10	11
Trifolium hybridum (alsike clover)	1	0-1	11
Trifolium repens (white clover)	1	0-1	11
Urtica dioica (stinging nettle)	1	0-1	11
Valeriana spp. (valerian)	1	0-1	11
Vicia americana (American vetch)	1	0-1	33
Viola adunca (hook violet)	1	0-1	11
Viola canadensis (Canada violet)	10	0-10	11
Viola palustris (marsh violet)	1	0-1	11
Viola spp. (violet)	1	0-1	11
Zizia aurea (golden Alexanders)	1	0-1	11
Ferns and Allies			
Botrychium multifidum (leathery grape-fern)	1	0-1	11
Equisetum arvense (field horsetail)	23	0-60	56
Equisetum fluviatile (water horsetail)	30	0-30	11
Gymnocarpium dryopteris (oak-fern)	3	0-3	11

SUCCESSIONAL INFORMATION

High levels of grazing and browsing by livestock and wildlife will reduce the coverages and successful reproduction of *Populus tremuloides* (quaking aspen) and the various shrubs associated with this type, while increasing the coverages of disturbance-caused herbaceous species. In extreme cases, a loss of the woody understory may occur, and the stand will take on the appearance of the grazing disclimax *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type.

SOILS

Soils are typically Mollisols (Aquolls and Borolls). Sites adjacent to streams are often shallow Fluvents overlying river cobbles. Soil textures vary from silt loam to sand. Water tables average 30 cm (12 in) below the surface in mid-summer but water depths of several stands were greater than one meter. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities are dominated by *Carex rostrata* (beaked sedge), *Salix exigua* (sandbar willow), or occasionally *Populus trichocarpa* (black cottonwood). Drier sites are uplands dominated by conifers such as *Picea engelmannii* (Engelmann spruce), *Pseudotsuga menziesii* (Douglas fir), and *Pinus contorta* (lodgepole pine), or by steppe vegetation such as *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Festuca scabrella* (rough fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production varies from low to moderate, depending on the density of the tree and shrub layer. Palatability of the various herbaceous species associated with this type are often high, and cattle use may be heavy as upland vegetation cures and animals spend much of their time in the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. They also browse young suckers and, combined with trampling and soil compaction, can alter both the age structure and herbaceous layer of this type.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Timber

Most timber harvest is salvage for fuelwood. Overstory removal will result in sprouting of young aspen that are susceptible to grazing pressure.

Wildlife

The *Populus tremuloides/Cornus stolonifera* (quaking aspen/red-osier dogwood) habitat type, although often covering only small areas, has high value as wildlife cover and feeding areas. Beaver, if present, may make heavy use of *Populus tremuloides* (quaking aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). In addition, *Populus tremuloides* (quaking aspen) and *Cornus stolonifera* (red-osier dogwood) are highly preferred by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common.

Numerous bird species frequent communities dominated by *Populus tremuloides* (quaking aspen). Common species nesting

and feeding in this type include flickers, chickadees, sap suckers, and woodpeckers (Flack 1976).

Fisheries

Where adjacent to streams, stands of this type enhance fisheries by stabilizing banks and providing overhanging cover. *Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (quaking aspen) (Jones and DeByle 1985). Brown (1984) provides information for using prescribed fire in stands of *Populus tremuloides* (quaking aspen). Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful reproduction.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984).

Populus tremuloides (quaking aspen) may be useful in revegetating disturbed sites having moist, well drained soils. Best results are obtained using rooted cuttings or nursery grown stock. Once established, growth rates are rapid. The quickly spreading roots of *Populus tremuloides* (quaking aspen) effectively stabilize soils.

Where revegetation with woody shrub species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits.

Recreational Uses and Considerations

Fishing and birding opportunities are often good. Campsites should be located away from stands of this type because of wet soils and large mosquito populations.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

This type has not been described by other regional studies.

Populus tremuloides/Osmorhiza occidentalis Habitat Type
(Quaking Aspen/Western Sweet-cicely Habitat Type)

POPTRE/OSMOCC (POTR10/OSCC)
Number Of Stands Sampled = 15

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Osmorhiza occidentalis* (quaking aspen/western sweet-cicely) habitat type is a major type occurring in V-shaped, narrow mountain valleys, glacial moraine depressions underlain by clay lenses, springs or seeps on hillslopes, and along the fringe of glacial kettle lakes (Cooper 1981). Sites range in elevation from 1,548 to 1,753 m (5,080 to 5,750 ft). Extensive areas are located along the East Front of the Rocky Mountains, especially on the Blackfeet Indian Reservation and the Lewis and Clark National Forest.

FLORISTIC CHARACTERISTICS

The overstory is dominated by *Populus tremuloides* (quaking aspen) with scattered *Populus trichocarpa* (black cottonwood) also present. The shrub layer consists of *Amelanchier alnifolia* (western serviceberry) and *Rubus parviflorus* (thimbleberry). The rich and diverse forb layer includes *Thalictrum occidentale* (western meadowrue), *Actaea rubra* (baneberry), *Osmorhiza occidentalis* (western sweet-cicely), and *Heracleum lanatum* (cow-parsnip).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Picea spp. (spruce)	1	0-1	20
Populus tremuloides (quaking aspen)	78	60-98	100
Populus trichocarpa (black cottonwood)	50	0-60	40
Shrubs			
Amelanchier alnifolia (western serviceberry)	2	0-3	60
Berberis repens (creeping Oregongrape)	1	0-1	20
Ribes spp. (currant)	4	0-10	60
Rosa acicularis (prickly rose)	1	0-1	20
Rosa spp. (rose)	1	0-1	20
Rubus parviflorus (thimbleberry)	40	0-40	40
Salix spp. (willow)	1	0-1	20
Symphoricarpos albus (common snowberry)	5	0-10	60
Symphoricarpos occidentalis (western snowberry)	3	0-3	40
Graminoids			
Agropyron caninum (bearded wheatgrass)	20	0-20	20
Agrostis scabra (tickle-grass)	1	0-1	20
Bromus anomalus (nodding brome)	10	0-10	20
Bromus ciliatus (fringed brome)	20	0-20	20
Bromus inermis (smooth brome)	10	0-10	20

Bromus vulgaris (Columbia brome)	2	0-3	40
Calamagrostis canadensis (bluejoint reedgrass)	3	0-3	20
Calamagrostis rubescens (pinegrass)	20	0-40	40
Elymus glaucus (blue wildrye)	7	0-10	40
Melica spectabilis (showy oniongrass)	10	0-10	20
Melica subulata (Alaska oniongrass)	1	0-1	20
Phleum alpinum (alpine timothy)	3	0-3	20
Phleum pratense (common timothy)	2	0-3	40
Poa pratensis (Kentucky bluegrass)	1	0-1	20
Trisetum cernuum (nodding trisetum)	2	0-3	40
Forbs			
Achillea millefolium (common yarrow)	1	0-1	40
Actaea rubra (baneberry)	12	0-40	80
Agoseris glauca (pale agoseris)	1	0-1	20
Angelica arguta (sharptooth angelica)	15	0-20	40
Arenaria macrophylla (bigleaf sandwort)	1	0-1	20
Aster engelmannii (Engelmann's aster)	1	0-1	20
Aster laevis (smooth aster)	1	0-1	20
Aster occidentalis (western aster)	12	0-20	40
Camassia quamash (common camas)	1	0-1	20
Castilleja miniata (scarlet paintbrush)	1	0-1	20
Cerastium arvense (field chickweed)	1	0-1	20
Collinsia parviflora (small-flowered blue-eyed Mary)	1	0-1	20
Corallorhiza striata (striped coral-root)	1	0-1	20
Delphinium glaucum (pale larkspur)	1	0-1	20
Dodecatheon jeffreyi (tall mountain shooting star)	1	0-1	20
Epilobium angustifolium (fireweed)	2	0-3	60
Erythronium grandiflorum (glacier-lily)	10	0-10	20
Fragaria virginiana (Virginia strawberry)	6	0-20	80
Galium boreale (northern bedstraw)	1	0-3	60
Galium triflorum (sweetscented bedstraw)	1	0-1	27
Geranium richardsonii (white geranium)	1	0-1	40
Geranium spp. (geranium)	1	0-1	20
Geranium viscosissimum (sticky geranium)	1	0-1	40
Geum macrophyllum (large-leaved avens)	1	0-1	20
Hackelia floribunda (showy stickseed)	1	0-1	40
Heracleum lanatum (cow-parsnip)	10	0-20	80
Heuchera cylindrica (roundleaf alumroot)	1	0-1	20
Lathyrus ochroleucus (cream-flowered peavine)	2	0-3	40
Nemophila breviflora (Great Basin nemophila)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	12	0-20	40
Osmorhiza occidentalis (western sweet-cicely)	11	0-20	80
Pedicularis bracteosa (bracted lousewort)	1	0-1	60
Potentilla arguta (tall cinquefoil)	1	0-1	40
Pyrola minor (snowline pyrola)	1	0-1	20
Ranunculus spp. (buttercup)	1	0-1	20
Ranunculus uncinatus (little buttercup)	1	0-1	20
Sanicula marilandica (black snake-root)	1	0-1	20

Senecio integerrimus (western groundsel)	12	0-20	40
Senecio pseudaureus (streambank groundsel)	2	0-3	40
Smilacina stellata (starry Solomon-plume)	1	0-3	60
Taraxacum officinale (common dandelion)	2	0-3	40
Thalictrum occidentale (western meadowrue)	14	1-40	100
Valeriana dioica (northern valerian)	1	0-1	20
Veratrum viride (green false hellebore)	12	0-20	40
Vicia americana (American vetch)	1	0-1	60
Viola canadensis (Canada violet)	30	0-40	40
Viola spp. (violet)	1	0-1	20
Ferns and Allies			
Equisetum arvense (field horsetail)	3	0-3	20
Equisetum hyemale (common scouring-rush)	1	0-1	60

SUCCESSIONAL INFORMATION

Most sites show varying degrees of livestock impacts. With disturbance, grasses such as *Phleum pratense* (common timothy) and *Poa pratensis* (Kentucky bluegrass) increase dramatically. In addition, a variety of disturbance-caused forbs such as *Fragaria virginiana* (Virginia strawberry), *Urtica dioica* (stinging nettle), *Cerastium arvense* (field chickweed), and *Cirsium* species (thistles) begin to dominate the site. With continued disturbance, the stand begins to take on the appearance of the grazing disclimax *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type.

SOILS

Soils are typically Mollisols. Parent material varies and include; alluvium, colluvium, or aeolian deposits of sedimentary rock types layered over morainal drift (Cooper 1981). Litter accumulations vary between 1 to 10 cm (0.3 to 4 in). Soil reaction is commonly neutral (pH 7.0) and base saturation is usually high.

ADJACENT COMMUNITIES

Adjacent wetter sites are dominated by *Carex* (sedge) dominated habitat types, the *Calamagrostis canadensis* (bluejoint reedgrass) habitat type, or *Salix* (willow) dominated habitat types. Adjacent drier sites are generally upland sites.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Palatability of the various herbaceous species associated with this type are often high, and cattle use may be heavy as upland vegetation cures and animals spend much of their time in the shade provided by these communities. Livestock will use this type for forage, shade, and as bedding ground. They also browse young suckers and, combined with trampling and soil compaction, can alter both the age structure and herbaceous layer of this type.

The *Populus tremuloides/Osmorhiza occidentalis* (quaking aspen/western sweet-cicely) habitat type rates high for forage production. In a similar type in western Wyoming, Youngblood and Mueggler (1981) found forage production to be approximately 1,200 lbs/acre.

Wildlife

The *Populus tremuloides/Osmorhiza occidentalis* (quaking aspen/western sweet-cicely) habitat type has high value as wildlife cover and feeding areas. These sites are important winter and summer grounds for big game. Beaver, if present, may make heavy use of *Populus tremuloides* (quaking aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often

moderate to heavy (Kufeld 1973). In addition, *Populus tremuloides* (quaking aspen) is a highly preferred species by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common.

Numerous bird species frequent communities dominated by *Populus tremuloides* (quaking aspen). Common species nesting and feeding in this type include flickers, chickadees, sap suckers, and woodpeckers (Flack 1976).

Fisheries
Where adjacent to streams, stands of this type enhance fisheries by stabilizing banks and providing overhanging cover.

Fire
Wet conditions in the spring and summer tend to limit successful burning to the drier fall period. Fire, sometimes in combination with cutting, is becoming an increasingly important tool in regenerating decadent stands of *Populus tremuloides* (quaking aspen) (Jones and DeByle 1985). Brown (1984) provides information for using prescribed fire in stands of *Populus tremuloides* (quaking aspen). Protection of newly burned or cleared sites from beaver and grazing animals may be necessary for successful reproduction.

Soil Management and Rehabilitation Opportunities
Soils compaction is likely when repeated animal use occurs on moist soils. Grazing should be deferred to periods when soils and streambanks are drier (Marlow 1984). *Populus tremuloides* (quaking aspen) can be useful in revegetating disturbed sites having moist, well drained soils. Best results are obtained using rooted cuttings or nursery grown stock. Once established, growth rates are rapid with spreading roots quickly stabilizing the soil.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Comparable range site(s) could not be determined.

OTHER STUDIES

This type represents the *Populus tremuloides-Populus trichocarpa/Osmorhiza occidentalis* (quaking aspen-black cottonwood/western sweet-cicely) community type described by Cooper (1981) for the Blackfeet Indian Reservation. A similar type was described by Lynch (1955) for Glacier County, Montana, and by Youngblood and Mueggler (1981) for western Wyoming.

Populus tremuloides/Poa pratensis Community Type
(Quaking Aspen/Kentucky Bluegrass Community Type)

POPTRE/POAPRA (POTR10/POPR)
Number Of Stands Sampled = 26

CAUTION — Not all sites currently dominated by *Populus tremuloides* (quaking aspen) are considered riparian or

wetland sites. In some instances, they are considered upland sites. The topographic position of the site must match the description as presented in the Location and Associated Landform section.

LOCATION AND ASSOCIATED LANDFORMS

The *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type is a major type at mid elevations throughout the mountains and foothills of Montana. Sites range from 732 to 2,306 m (2,400 to 7,560 ft). It typically occurs adjacent to streams and rivers on alluvial terraces, or near springs and seeps.

FLORISTIC CHARACTERISTICS

The *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type represents a grazing disclimax. *Populus tremuloides* (quaking aspen) dominates the overstory. Shrubs such as *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), *Prunus virginiana* (common chokecherry), and *Salix* species (willows) are absent or present in small amounts only, due to high grazing and browsing pressures. *Rosa woodsii* (woods rose) may be present, often in substantial amounts. Grasses include *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy). *Taraxacum officinale* (common dandelion) and *Fragaria virginiana* (Virginia strawberry) are common forbs.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus tremuloides (quaking aspen)	50	10-80	100
Shrubs			
Rosa woodsii (woods rose)	15	0-80	50
Graminoids			
Agrostis stolonifera (redtop)	16	0-60	23
Phleum pratense (common timothy)	17	0-60	73
Poa pratensis (Kentucky bluegrass)	22	0-98	85
Forbs			
Actaea rubra (baneberry)	2	0-3	8
Aster occidentalis (western aster)	4	0-10	42
Fragaria virginiana (Virginia strawberry)	8	0-40	46
Galium boreale (northern bedstraw)	1	0-3	50
Galium triflorum (sweetscented bedstraw)	1	0-1	12
Heracleum lanatum (cow-parsnip)	10	0-20	8
Smilacina stellata (starry Solomon-plume)	1	0-10	54
Taraxacum officinale (common dandelion)	4	0-20	58
Viola canadensis (Canada violet)	1	0-1	4

SUCCESSIONAL INFORMATION

This community type reflects past periods of prolonged animal use. The *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community type represents a grazing disclimax of the *Populus tremuloides* (quaking aspen) dominated habitat types. Loss of the original undergrowth dominants has occurred, and successful reproduction of *Populus tremuloides* (quaking aspen) has been severely limited. Conifers may also have been present as potential late successional species but have been removed by prolonged grazing disturbance. Carefully observation of site and vegetative characteristics

may aid in determining the site's potential.

SOILS

Soils are commonly Entisols (Fluvents) or Mollisols (Borolls) derived from alluvium. Water tables approach the soil surface in spring, but are usually greater than one meter below the soil surface in mid summer.

ADJACENT COMMUNITIES

Adjacent wetter communities vary. Nearby uplands are often dominated by *Pseudotsuga menziesii* (Douglas fir), *Artemisia tridentata* (big sagebrush), *Festuca scabrella* (rough fescue), and *Festuca idahoensis*(Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

This type is a valuable source of browse and forage for livestock and wildlife. In addition, livestock use this type for shade and as bedding ground. However, persistent grazing and trampling have resulted in compositional and structural changes, including the loss of native herbaceous species. Conversion back to the original vegetation is unlikely to occur simply by altering the grazing regime.

Poa pratensis (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater. Streambanks associated with low vigor *Poa pratensis* (Kentucky bluegrass) are susceptible to sloughing.

Timber

Most timber harvest is salvage for fuelwood. Overwood removal will result in sprouting of young aspen from suckers. Stand development necessitates protection of young aspen from grazing.

Wildlife

Deer may use this type for early season forage. Cover value for big game is limited because of the typically open, two layered structure. Beaver, if present, may make heavy use of *Populus tremuloides* (quaking aspen) stands (Allen 1983). Wild ungulates such as deer and elk browse young suckers and occasionally feed on the bark of older trees. Use by elk during spring, fall, and winter periods is often moderate to heavy (Kufeld 1973). In addition, *Populus tremuloides* (quaking aspen) is highly preferred by moose (Costain 1989). Use of this type as bedding grounds by wildlife is also common. Birds such as redshafted flickers are common, and often nest in cavities of larger aspen. Understory species such as *Agropyron repens* (quackgrass), *Rosa* species (rose), and *Symphoricarpos* species (snowberry) provide food and cover for small mammals and birds, upland game and waterfowl (Dittberner and Olson 1983).

Fire

Populus tremuloides (quaking aspen) responds to fire by producing large numbers of vigorous root suckers. However, livestock and large ungulates should be kept out of newly burned stands if successful regeneration is desired. *Poa pratensis* (Kentucky bluegrass) is little harmed by fires, especially when moisture levels are adequate to dampen soil temperatures during the burn. However, it is intolerant of burning during the active growth stages and can be successfully controlled by late spring burning. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but

spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can severely damage stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Moist, fine textured soils are easily compacted and disturbed by livestock in spring and after rain events. Soil compaction is minimal on dry coarse textured soils.

Populus tremuloides (quaking aspen) may be useful in revegetating disturbed sites having moist, well drained soils. Best results are obtained using rooted cuttings or nursery grown stock. Once established, growth rates are rapid. The quickly spreading roots of *Populus tremuloides* (quaking aspen) effectively stabilize soils.

On the other hand, *Poa pratensis* (Kentucky bluegrass) is not very effective in stabilizing streambanks (Youngblood and others 1985b). Bank undercutting and sloughing may occur, especially when soils are wet or stands weakened by excessive grazing.

Recreational Uses and Considerations

If stands are extensive, this community type may provide good campground locations. Overstory aspen provide shade in an often otherwise treeless environment. However, successful aspen reproduction is likely to be reduced or eliminated by trampling. Fencing of selected areas to allow suckers to grow is recommended.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

Similar grazing influenced *Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) community types have been described for southeastern Idaho and western Wyoming by Youngblood and Mueggler (1981), Mueggler and Campbell (1982), and Chadde and others (1988).

Populus trichocarpa/Cornus stolonifera Community Type
(Black Cottonwood/Red-Osier Dogwood Community Type)

POPTRI/CORSTO (POTR6/COST4)

Number Of Stands Sampled = 23

LOCATION AND ASSOCIATED LANDFORMS

The *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type is a major type at low to mid elevations throughout the mountains and foothills of Montana. *Populus trichocarpa* (black cottonwood) is the dominant cottonwood species that occurs west of the Continental Divide. *Populus angustifolia* (narrowleaf cottonwood) and

Populus deltoides (Great Plains cottonwood) are restricted to areas east of the Continental Divide. Sites range from 610 to 2,013 m (2,000 to 6,600 ft). The type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus trichocarpa* (black cottonwood) tends to occur at higher elevations than *Populus angustifolia* (narrowleaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (Great Plains cottonwood). Stands may be broad and extensive, or they may be relatively narrow (stringers).

FLORISTIC CHARACTERISTICS

This type is characterized by an overstory of cottonwoods over a potentially dense and diverse group of undergrowth shrubs and herbaceous plants. *Populus deltoides* (Great Plains cottonwood) and *Populus angustifolia* (narrowleaf cottonwood) may be present but are subordinate to *Populus trichocarpa* (black cottonwood).

Cornus stolonifera (red-osier dogwood) is the diagnostic shrub for this type. Other shrub species present include *Rosa* species (rose). A wide variety of herbaceous species are present including *Smilacina stellata* (starry Solomon-plume).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Picea spp. (spruce)	2	0-3	40
Populus tremuloides (quaking aspen)	3	0-3	20
Populus trichocarpa (black cottonwood)	50	40-60	100
Shrubs			
Alnus incana (mountain alder)	10	0-10	20
Amelanchier alnifolia (western serviceberry)	3	0-3	20
Betula occidentalis (water birch)	20	0-20	20
Clematis ligusticifolia (western virgins-bower)	1	0-1	20
Cornus stolonifera (red-osier dogwood)	46	20-60	100
Crataegus columbiana (Columbia hawthorn)	10	0-10	20
Crataegus douglasii (black hawthorn)	3	0-3	20
Prunus virginiana (common chokecherry)	40	0-40	20
Rhamnus alnifolia (alder buckthorn)	10	0-10	20
Ribes americanum (black currant)	20	0-20	20
Ribes spp. (currant)	3	0-3	20
Rosa spp. (rose)	10	0-10	20
Rosa woodsii (woods rose)	5	0-10	80
Salix boothii (Booth willow)	20	0-20	20
Salix lutea (yellow willow)	1	0-1	20
Salix planifolia (planeleaf willow)	3	0-3	20
Symphoricarpos albus (common snowberry)	3	0-3	20
Graminoids			
Agrostis stolonifera (redtop)	3	0-3	40
Carex bebbii (Bebb's sedge)	3	0-3	20
Deschampsia cespitosa (tufted hairgrass)	1	0-1	20
Eleocharis compressa (flatstem spike-rush)	1	0-1	20
Elymus glaucus (blue wildrye)	1	0-1	20

Phleum pratense (common timothy)	3	0-3	20
Poa compressa (Canada bluegrass)	10	0-10	20
Poa palustris (fowl bluegrass)	3	0-3	20
Poa pratensis (Kentucky bluegrass)	5	0-10	60
Forbs			
Achillea millefolium (common yarrow)	1	0-1	20
Actaea rubra (baneberry)	20	0-20	20
Allium cernuum (nodding onion)	1	0-1	20
Arctium lappa (great burdock)	1	0-1	20
Arnica chamissonis (meadow arnica)	3	0-3	20
Aster occidentalis (western aster)	10	0-10	20
Chenopodium glaucum (oakleaf goosefoot)	1	0-1	20
Cirsium arvense (Canada thistle)	2	0-3	40
Cirsium vulgare (bull thistle)	1	0-1	20
Fragaria virginiana (Virginia strawberry)	3	0-3	20
Galium triflorum (sweetscented bedstraw)	2	0-3	40
Geum macrophyllum (large-leaved avens)	1	0-1	20
Heracleum lanatum (cow-parsnip)	1	0-1	20
Lysimachia ciliata (fringed loosestrife)	1	0-1	20
Medicago lupulina (black medic)	1	0-1	20
Medicago sativa (alfalfa)	3	0-3	20
Mentha arvensis (field mint)	10	0-10	20
Myosotis laxa (small-flowered forget-me-not)	1	0-1	20
Psoralea esculenta (Indian bread-root)	1	0-1	20
Scutellaria galericulata (marsh skullcap)	1	0-1	20
Senecio foetidus (sweet-marsh butterweed)	1	0-1	20
Smilacina stellata (starry Solomon-plume)	3	0-3	80
Solidago canadensis (Canada goldenrod)	1	0-1	20
Taraxacum ceratophorum (horned dandelion)	1	0-1	20
Taraxacum officinale (common dandelion)	1	0-1	20
Urtica dioica (stinging nettle)	1	0-1	20
Vicia spp. (vetch)	1	0-1	20
Viola spp. (violet)	3	0-3	20
Ferns and Allies			
Equisetum laevigatum (smooth scouring-rush)	1	0-1	60
Equisetum sylvaticum (wood horsetail)	40	0-40	20

SUCCESSIONAL INFORMATION

The *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type represents a mid-seral stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may

appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus trichocarpa* (black cottonwood) stand is dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). As the *Populus trichocarpa* (black cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at low to mid elevations succession continues from the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type to wetland habitat types dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus trichocarpa* (black cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus trichocarpa/Cornus*

stolonifera (black cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused succession is called the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus trichocarpa*/Herbaceous [black cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in)of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) and the *Salix lasiandra* (Pacific willow) community types, or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Adjacent drier communities may be dominated by a variety of *Populus trichocarpa* (black cottonwood) types, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense nature of the stands. Stands in good to excellent health (condition) often support dense thickets of shrubs, limiting the amount of available forage. However, most sites are presently subjected to heavy grazing pressures because of their topographic location and ease of access. With moderate to heavy prolonged grazing pressures, most shrubs will be eliminated leaving the shrubs *Symphoricarpos occidentalis* (western

snowberry) and *Rosa woodsii* (woods rose) as the dominate understory. At this point, the stand has been converted to the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) disturbance-caused community type. If disturbance is severe, the shrubs will also be eliminated and the stand has converted to the *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) disturbance-caused community type (see the discussion under the Seral Stages section).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

The *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. The spreading crown of *Populus trichocarpa* (black cottonwood) provides sites for huge platform like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus trichocarpa* (black cottonwood) and *Cornus stolonifera* (red-osier dogwood) are often eaten by moose (Costain 1989) and used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type is very important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Cornus stolonifera* (red-osier dogwood) and associated shrub species are excellent in controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type is susceptible to fire during the late summer and fall. *Populus trichocarpa* (black cottonwood) and associated shrubs are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated

species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus trichocarpa* (black cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982).

Populus trichocarpa/Herbaceous Community Type (Black Cottonwood/Herbaceous Community Type)

POPTRI (POTR6)
Number Of Stands Sampled = 12

LOCATION AND ASSOCIATED LANDFORMS

The *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type is a major type at low to mid elevations throughout the mountains and foothills of Montana. *Populus trichocarpa* (black cottonwood) is the dominant cottonwood species that occurs west of the Continental Divide. *Populus angustifolia* (narrowleaf cottonwood) and *Populus deltoides* (Great Plains cottonwood) are restricted to areas east of the Continental Divide. Sites range from 610 to 2,013 m (2,000 to 6,600 ft). The type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus trichocarpa* (black cottonwood) tends to occur at higher elevations than *Populus angustifolia* (narrowleaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (Great Plains cottonwood). Stands may be broad and extensive, or they may be relatively narrow (stringers).

FLORISTIC CHARACTERISTICS

The *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type is a grazing or browsing disclimax community type characterized by a two layer structure of mature, widely spaced *Populus trichocarpa* (black cottonwood) over an understory of grasses dominated by *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (common timothy). Shrub species are absent or present as remnant, scattered individuals. *Tanacetum vulgare* (common tansy) and *Centaurea maculosa* (spotted knapweed) are common forbs.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus trichocarpa (black cottonwood)	43	30-60	100
Shrubs			
Rosa woodsii (woods rose)	2	0-3	50

Graminoids			
Agropyron repens (quackgrass)	18	0-70	42
Phleum pratense (common timothy)	19	0-60	58
Poa pratensis (Kentucky bluegrass)	17	0-50	67
Forbs			
Centaurea maculosa (spotted knapweed)	5	0-20	42
Tanacetum vulgare (common tansy)	9	0-30	42

SUCCESSIONAL INFORMATION

The *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type represents a severely disturbed secondary successional stage of the mid-seral *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type represents an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus trichocarpa* (black cottonwood) stand is dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir),

Picea (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). As the *Populus trichocarpa* (black cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at low to mid elevations succession continues from the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type to wetland habitat types dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus trichocarpa* (black cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused succession is called the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus trichocarpa*/Herbaceous [black cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil

surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) and the *Salix lasiandra* (Pacific willow) community types, or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. The *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type or the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type may occupy adjacent sites. Adjacent drier communities may include a variety of upland communities.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type provides moderate levels of spring and summer forage. Heavy grazing and trampling tend to maintain the open (park-like) structure of this community type and continued dominance of the undergrowth by *Poa pratensis* (Kentucky bluegrass) *Phleum pratense* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs. This community type has been and in many instances, still is used by the ranching community as a winter feeding ground. *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), and *Bromus inermis* (smooth brome) are palatable and moderately productive, especially when soil moisture levels are high, and tolerate a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a graminoid dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

This type is a source of early spring forage for deer and elk. Cover value is limited because of the typically open, two layered structure. All kinds of birds are common since food and cover is available both on the ground and in the trees. Great blue herons nest in large cottonwood stands if isolation during the nesting period is possible. Colonial nest sites are used for many years if left undisturbed (Parker 1980). Osprey will also use this type for nesting (Zarn 1974).

Fisheries

The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section).

Fire

This type will burn when conditions are dry, such as fall or in late winter if snow accumulations are minimal. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability

than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Poa pratensis (Kentucky bluegrass) is damaged only by a hot, intense fire. Cool burns will have little effect on *Poa pratensis* (Kentucky bluegrass) (Volland and Dell 1981), but spring burns may lower tiller densities (Dix and Smeins 1967). Intense burns during active growing periods can used to control stands of *Poa pratensis* (Kentucky bluegrass) (Wasser 1982).

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus trichocarpa* (black cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds

begin to swell along the cuttings, wipe them off the lower two thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982).

Populus trichocarpa/Recent Alluvial Bar Community Type (Black Cottonwood/Recent Alluvial Bar Community Type)

POPTRI (POTR6)

Number Of Stands Sampled = 21

LOCATION AND ASSOCIATED LANDFORMS

The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is a major type at low to mid elevations throughout the mountains and foothills of Montana. *Populus trichocarpa* (black cottonwood) is the dominant cottonwood species that occurs west of the Continental Divide. *Populus angustifolia* (narrowleaf cottonwood) and *Populus deltoides* (Great Plains cottonwood) are restricted to areas east of the Continental Divide. Sites range from 610 to 2,013 m (2,000 to 6,600 ft). The type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus trichocarpa* (black cottonwood) tends to occur at higher elevations than *Populus angustifolia* (narrowleaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (Great Plains cottonwood). Stands may be broad and extensive, or they may be relatively narrow (stringers).

FLORISTIC CHARACTERISTICS

This type is characterized by a stand dominated by seedlings or saplings of *Populus trichocarpa* (black cottonwood), or a stand codominated by cottonwoods and *Salix exigua* (sandbar willow). *Populus deltoides* (Great Plains cottonwood) and

Populus angustifolia (narrowleaf cottonwood) may be present but are subordinate to *Populus trichocarpa* (black cottonwood). A wide variety of herbaceous species occupy the understory.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	10
Betula papyrifera (paper birch)	1	0-1	10
Juniperus scopulorum (Rocky Mountain juniper)	1	0-1	20
Picea spp. (spruce)	3	0-3	10
Pinus ponderosa (ponderosa pine)	2	0-3	20
Populus trichocarpa (black cottonwood)	48	10-98	100
Shrubs			
Alnus incana (mountain alder)	20	0-20	10
Alnus sinuata (Sitka alder)	1	0-1	10
Amelanchier alnifolia (western serviceberry)	1	0-1	30
Betula occidentalis (water birch)	3	0-3	10
Clematis ligusticifolia (western virgins-bower)	1	0-1	10
Cornus canadensis (bunchberry)	40	0-40	10
Cornus stolonifera (red-osier dogwood)	2	0-3	20
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	10
Prunus virginiana (common chokecherry)	1	0-1	10
Rosa woodsii (woods rose)	2	0-3	20
Salix drummondiana (Drummond willow)	15	0-30	20
Salix exigua (sandbar willow)	11	0-20	40
Salix lutea (yellow willow)	1	0-1	10
Salix planifolia (planeleaf willow)	1	0-1	10
Salix scouleriana (Scouler willow)	3	0-3	10
Symphoricarpos occidentalis (western snowberry)	1	0-1	20
Toxicodendron rydbergii (poison ivy)	1	0-1	20
Graminoids			
Agropyron repens (quackgrass)	1	0-1	30
Agropyron smithii (western wheatgrass)	1	0-1	10
Agropyron spicatum (bluebunch wheatgrass)	1	0-1	10
Agrostis stolonifera (redtop)	10	0-20	40
Calamagrostis canadensis (bluejoint reedgrass)	20	0-40	20
Carex prionophylla (saw-leaved sedge)	3	0-3	10
Dichanthelium acuminatum (western witchgrass)	2	0-3	20
Elymus glaucus (blue wildrye)	1	0-1	10
Phleum pratense (common timothy)	2	0-3	20
Poa compressa (Canada bluegrass)	6	0-10	40
Poa palustris (fowl bluegrass)	20	0-20	10
Poa pratensis (Kentucky bluegrass)	1	0-1	10

Forbs			
Achillea millefolium (common yarrow)	1	0-1	10
Allium cernuum (nodding onion)	1	0-1	10
Allium schoenoprasum (chives)	1	0-1	10
Anaphalis margaritacea (common pearly-everlasting)	1	0-1	10
Arnica lonchophylla (point-leaf arnica)	1	0-1	10
Artemisia lindleyana (riverbank wormwood)	1	0-1	20
Artemisia ludoviciana (prairie sagewort)	1	0-1	10
Asclepias speciosa (showy milkweed)	1	0-1	10
Aster foliaceus (leafy aster)	3	0-3	20
Aster laevis (smooth aster)	1	0-1	10
Aster modestus (few-flowered aster)	3	0-3	10
Astragalus spp. (milk-vetch)	1	0-1	10
Castilleja spp. (paintbrush)	1	0-1	10
Centaurea maculosa (spotted knapweed)	1	0-1	10
Chenopodium spp. (goosefoot)	1	0-1	10
Chrysanthemum leucanthemum (oxeye-daisy)	3	0-3	10
Epilobium angustifolium (fireweed)	3	0-3	10
Epilobium palustre (swamp willow-herb)	3	0-3	10
Euphorbia esula (leafy spurge)	1	0-1	20
Fragaria vesca (woods strawberry)	3	0-3	10
Gaillardia aristata (blanket-flower)	1	0-1	10
Galium triflorum (sweetscented bedstraw)	1	0-1	10
Heracleum lanatum (cow-parsnip)	20	0-20	10
Hypericum perforatum (common St. John's-wort)	1	0-1	20
Lathyrus ochroleucus (cream-flowered peavine)	1	0-1	10
Lysimachia ciliata (fringed loosestrife)	10	0-10	10
Medicago lupulina (black medic)	1	0-1	10
Medicago sativa (alfalfa)	10	0-10	10
Melilotus alba (white sweet-clover)	1	0-1	20
Melilotus officinalis (yellow sweet-clover)	1	0-1	10
Monarda fistulosa (horsemint)	1	0-1	10
Oxytropis spp. (crazyweed)	1	0-1	10
Physostegia parviflora (purple dragonhead)	1	0-1	10
Smilacina stellata (starry Solomon-plume)	3	0-3	30
Solidago canadensis (Canada goldenrod)	5	0-10	30
Streptopus amplexifolius (clasping-leaved twisted stalk)	3	0-3	10
Tanacetum vulgare (common tansy)	1	0-1	20
Taraxacum officinale (common dandelion)	1	0-1	30
Thalictrum occidentale (western meadowrue)	40	0-40	10
Verbascum thapsus (common mullein)	1	0-1	10
Vicia americana (American vetch)	1	0-1	20
Viola spp. (violet)	1	0-1	10
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	10
Equisetum hyemale (common scouring-rush)	1	0-1	10
Equisetum laevigatum (smooth scouring-rush)	1	0-1	10

SUCCESSIONAL INFORMATION

The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type represents an early seral (pioneer) stage of primary succession.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus trichocarpa* (black cottonwood) stand is dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). As the *Populus trichocarpa* (black cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at low to mid elevations succession continues from the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type to wetland habitat types dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga*

heterophylla (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The normal primary successional sequence (described above) may be altered due to varying degrees of grazing and browsing pressures. Moderate, prolonged grazing and browsing pressures will cause a stand to progress to the disturbance-caused *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type. Severe, prolonged grazing and browsing pressures may eliminate all conifer and/or deciduous seedlings and may eliminate the undergrowth of shrub species as well. This severely disturbed stage of secondary succession is called the *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type. In this situation, the overstory of *Populus trichocarpa* (black cottonwood) still matures and becomes open with an understory dominated by herbaceous species. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types.

Stands of the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type are very susceptible to the natural dynamics of a river system and may be flooded and eliminated after just a year or two of growth. Ice can also have a dramatic impact on these recently deposited alluvial bars. Ice can influence the floodplain landscape by either one of two ways: 1) mechanical damage, or 2) flooding (inundation). Mechanical damage generally involves the following: a) the laying down or bending over of the younger cottonwoods, b) the physical shearing off of the stems, c) the actual pulling out of the ground by the ice that surrounds the main stems, and d) the tilting or pushing over of mature trees. In addition, young cottonwood seedlings and saplings are very susceptible to defoliation by livestock. If livestock pressures are too great, the stand can be either partially or totally eliminated. In many situations, excessive livestock pressure has completely eliminated the establishment of new cottonwood stands. Beaver and big game species can also have a dramatic impact on newly established cottonwood stands.

SOILS

Soils are typically Entisols (Fluvents) overlying river gravel or cobbles. Soil texture varies from loam to coarse sand. Water tables are generally at or near the soil surface. In late summer water tables may drop below 50 cm (20 in) of the soil surface but surface horizons remain moist due to capillary action. Soils are well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) and the *Salix lasiandra* (Pacific willow) community types, or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Adjacent drier communities may be dominated by a variety of *Populus trichocarpa* (black cottonwood) types, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to moderate. Stands in good to excellent health (condition) often support dense thickets of cottonwoods and associated shrub species thereby limiting the amount of available forage. These stands are very susceptible

to defoliation by livestock. If establishment of new cottonwood stands is a management objective, livestock impacts should be closely monitored. In some situations it may be advisable to eliminate livestock use until the cottonwoods are of sufficient height to preclude defoliation by livestock.

Wildlife

The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. *Populus trichocarpa* (black cottonwood) is used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

Fisheries

The stream side location of the *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is valuable for fisheries by providing for streambank stability.

Fire

The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is susceptible to fire. In general, cottonwood seedlings, and to a lesser degree, cottonwood saplings do not have an extensive root system or thick bark and may be severely damaged (or eliminated) by fire.

Soil Management and Rehabilitation Opportunities

The coarse textured substrates are not susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. Managers should maintain a buffer strip of the *Populus trichocarpa* (black cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize stream banks, and slow flood waters.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Recreational Uses and Considerations

Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species. However, the dense nature of many of these stands may preclude various types of recreational activities such as fly fishing.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type has not been described elsewhere.

Populus trichocarpa/Symphoricarpos occidentalis Community Type (Black Cottonwood/Western Snowberry Community Type)

POPTRI/SYMOCC (POTR6/SYOC)
Number Of Stands Sampled = 21

LOCATION AND ASSOCIATED LANDFORMS

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type is a major type at low to mid elevations throughout the mountains and foothills of Montana. *Populus trichocarpa* (black cottonwood) is the dominant cottonwood species that occurs west of the Continental Divide. *Populus angustifolia* (narrowleaf cottonwood) and *Populus deltoides* (Great Plains cottonwood) are restricted to areas east of the Continental Divide. Sites range from 610 to 2,013 m (2,000 to 6,600 ft). The type occurs on alluvial terraces of major streams and rivers, and around lakes and ponds. In central and eastern Montana *Populus trichocarpa* (black cottonwood) tends to occur at higher elevations than *Populus angustifolia* (narrowleaf cottonwood), which in turn occurs at higher elevations than *Populus deltoides* (Great Plains cottonwood). Stands may be broad and extensive, or they may be relatively narrow (stringers).

FLORISTIC CHARACTERISTICS

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type represents a grazing disclimax. This type is characterized by an overstory of cottonwoods over a potentially dense and diverse group of undergrowth shrubs and herbaceous plants. *Populus deltoides* (Great Plains cottonwood) and *Populus angustifolia* (narrowleaf cottonwood) may be present but are subordinate to *Populus trichocarpa* (black cottonwood).

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type is characterized by an overstory of *Populus trichocarpa* (black cottonwood) over an understory dominated by *Symphoricarpos occidentalis* (western snowberry) or *Rosa woodsii* (woods rose).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus trichocarpa (black cottonwood)	60	20-90	100
Shrubs			
Amelanchier alnifolia (western serviceberry)	10	0-60	43

Cornus stolonifera (red-osier dogwood)	1	0-1	24
Rosa acicularis (prickly rose)	20	0-20	5
Rosa woodsii (woods rose)	22	0-60	71
Symphoricarpos albus (common snowberry)	8	0-20	19
Symphoricarpos occidentalis (western snowberry)	18	0-80	52
Graminoids			
Phleum pratense (common timothy)	17	0-80	48
Poa pratensis (Kentucky bluegrass)	12	0-50	67
Forbs			
Smilacina stellata (starry Solomon-plume)	4	0-20	67
Taraxacum officinale (common dandelion)	1	0-3	43

SUCCESSIONAL INFORMATION

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type represents a moderately disturbed secondary successional stage of the mid-seral *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type.

Primary Successional Stages

Cottonwoods are a pioneering species that requires moist, barren, newly deposited alluvium that is exposed to full sunlight. In general, these sites represent point bars, side bars, mid channel bars, delta bars, and islands. Since cottonwoods do not regenerate in their own shade and require moist, barren, fully exposed, newly deposited alluvial material as a suitable seedbed, they are considered a seral species and do not represent the climax community (PNC) for the site. Many stands may appear to have limited regeneration, especially in the open areas. However, it is important to understand that these young seedlings and saplings represent sprouts (asexual reproduction) and not establishment by seeds (sexual reproduction). These sprouts may help prolong the life span of the stand, but will not perpetuate or maintain the stand. In time the cottonwood stand will be replaced by a later successional stage.

The erosional and depositional pattern of a river helps maintain the diversity of plant communities on the floodplain. The distribution of various communities depends on the way the river meanders. In turn, the rate of meandering determines the proportion of floodplain communities considered to be in the pioneer or early seral, mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. Typically, rivers meander like a whip or snake across their floodplain. Lateral movement of the river initiates a dynamic series of vegetation events. As water moves downstream, it erodes established banks, typically covered with riparian or wetland vegetation in different stages of development, on outside curves and deposits fresh alluvial materials on the point bars of inside curves. Each new deposit of alluvium forms a distinct band or terrace with each band being even aged and with gaps in ages between the bands. The ages of the bands are progressively older on older terraces. As the river moves away from sites of previous deposition and continues to downcut, the amount of soil water recharge from channel seepages decreases, making these sites (terraces) drier. If certain portions of the floodplain remain undisturbed for a long enough period of time, their relief with respect to the river may increase to a point where they are only rarely flooded, if at all. These terraces are considered old or mature alluvial terraces and can continue development toward climax (PNC) without the modifying influences of floods (Hansen 1989).

Early Seral Stage — The *Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type is an early seral stage.

Mid-Seral Stage — If disturbance (either human-caused or natural) does not eliminate the stand, the *Populus*

trichocarpa/Recent Alluvial Bar (black cottonwood/Recent Alluvial Bar) community type will progress to the relatively undisturbed mid-seral stage called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus trichocarpa* (black cottonwood) stand is dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). As the *Populus trichocarpa* (black cottonwood) overstory matures, becomes open, and finally, becomes decadent, the conifers are ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, at low to mid elevations succession continues from the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type to wetland habitat types dominated by conifers such as *Pinus ponderosa* (ponderosa pine), *Pseudotsuga menziesii* (Douglas fir), *Abies grandis* (grand fir), *Picea* (spruce), *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), *Abies lasiocarpa* (subalpine fir), and *Juniperus scopulorum* (Rocky Mountain juniper). In other instances, this community type may be successional to the *Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) habitat type or the *Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) habitat type, depending upon elevation.

Secondary Successional Stages

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of the *Populus trichocarpa* (black cottonwood) community will contain a diverse, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries). This stage is called the *Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) community type. With moderate levels of grazing or browsing, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Ribes* (currants and gooseberries). If grazing or browsing pressures continue, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa* species (rose) which can form a nearly impenetrable understory. This stage of disturbance-caused succession is called the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type. If the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Bromus inermis* (smooth brome), and a variety of "weedy" forbs (e.g., the *Populus trichocarpa*/Herbaceous [black cottonwood/Herbaceous] community type). During the process of converting from a diverse, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Finally the stand becomes decadent with the stand's appearance becoming one of widely spaced, dying cottonwoods. The site now has become so open and dry that the site's potential may have changed to one capable of supporting a variety of upland types. The presence of conifers and upland shrub species will usually indicate the site's potential. However, conversion may be slow due to heavy grazing pressures and the sod forming characteristic of herbaceous species. Remnant shrubs and grasses, if present will help indicate the potential undergrowth composition.

Once the stand has converted from a shrub-dominated understory to one that is dominated by a variety of introduced herbaceous species, the ability to return the site to its former state (shrub-dominated) is very difficult. (It may be possible, but it will require a drastic change in management and may be very costly in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand in a shrub-dominated understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

SOILS

Soils are typically Entisols (Fluvents), usually up to 1 m (39 in) of mineral soil overlying river gravel and/or cobbles. Inceptisols and Mollisols can also be found on older sites of relatively longer stability where time has allowed more development to occur. Soil texture varies from loam to coarse sand. Water tables usually drop below 1 m (39 in) of the soil surface in summer, but soils can remain moist due to capillary action. Redox concentrations (mottles) are common in these soils as evidence of a fluctuating water table. Soils are generally well drained with low available water. Coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including the *Salix exigua* (sandbar willow) and the *Salix lasiandra* (Pacific willow) community types, or the *Typha latifolia* (common cattail) and *Eleocharis* (spikesedge) dominated habitat types. Adjacent drier communities may be dominated by the *Populus trichocarpa*/Herbaceous (black cottonwood/Herbaceous) community type, or by a variety of upland species.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low to moderate due to the dense shrub understory within the stands. Forage production from dense thickets of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) is low. Stands may be so dense that they exclude most livestock use. As the shrub understory is eliminated by continual prolonged heavy grazing or browsing, stands open and forage production increases accordingly due to the presence and amount of *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), or *Bromus inermis* (smooth brome). The palatability of *Symphoricarpos occidentalis* (western snowberry) ranges from low to fair for cattle and sheep (Wasser 1982; Johnson and Nichols 1982), and the leaves of *Rosa woodsii* (woods rose) are considered fair to fairly good livestock forage, particularly for sheep (Johnson and Nichols 1982).

Timber

Due to the favorable moisture relationship of this type, timber productivity for the associated cottonwoods and conifers ranges from low to moderate. Complete stand removal may result in a shrub-dominated community with extremely limited cottonwood regeneration except for occasional sprouting from stumps.

Wildlife

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type provides valuable cover, shade, and food for a variety of species. Big game use may be high, depending upon the time of year. The spreading crown of *Populus trichocarpa* (black cottonwood) provides sites for huge platform-like stick nests of bald eagles and ospreys (Arno and Hammerly 1984) and for great blue herons (Parker 1980). Canada geese occasionally use the nests previously built by bald eagles and osprey. A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities. *Populus trichocarpa* (black cottonwood) and *Rosa woodsii* (woods rose) are used by beaver for food and building materials (Allen 1983). Understory species provide food and cover for waterfowl, small birds, and mammals (Dittberner and Olson 1983).

The moderate structural understory diversity of *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) provides thermal and hiding cover for big game and upland bird species. The palatability of *Symphoricarpos occidentalis* (western snowberry) is rated as good for deer and elk (Wasser 1982; Johnson and Nichols 1982). Deer and elk may browse heavily on *Rosa woodsii* (woods rose), while the persistent fruit (rose hips) provides fall and winter food for

birds, small mammals, and bears, which disperse the seeds. *Rosa woodsii* (woods rose) is strongly grazing tolerant but can be dwarfed and thinned by intense browsing or defoliation by season long use.

Fisheries

The stream side location of the *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type is very important in providing thermal cover, debris recruitment, and streambank stability. Its importance can not be emphasized enough (see discussion in the Soil Management and Rehabilitation Opportunities section). *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) are excellent in controlling erosion along streams due to their rhizomatous nature. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

The *Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) community type is susceptible to fire during the late summer and fall. *Populus trichocarpa* (black cottonwood) and associated shrubs are adapted to light and in some instances to moderate intensity fires and may produce new sprouts following burns. The ability of cottonwoods to produce new sprouts following fire seems to be dependent upon three criteria: 1) The particular species of cottonwood present in the stand. In general, *Populus angustifolia* (narrowleaf cottonwood) has a greater sprouting capability than *Populus trichocarpa* (black cottonwood) which in turn has a greater sprouting capability than *Populus deltoides* (Great Plains cottonwood). 2) The age of the trees in the stand. As the trees mature, the sprouting potential tends to decrease proportionally. As the trees reach the decadent stage of development, the sprouting potential is severely limited. 3) The location of the water table. In general, the higher the water table throughout the growing season, the greater the ability for sprouts to survive. Therefore, if a manager wants to extend the life span of a stand of cottonwoods, fire ***MAY BE*** used as a tool in the pole to early mature stage of development. If fire is used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

Symphoricarpos occidentalis (western snowberry) is tolerant of fire. It can be injured by fire but usually sprouts, with stands becoming denser afterward. It is such a strong competitor, particularly in dense colonies, that it is not very compatible with most herbaceous vegetation. *Rosa woodsii* (woods rose) is strongly fire tolerant, except for smoldering fires with heavy volumes of surface fuel. The species has a shallow and much branched rhizomatous root system that will readily sprout and sucker. This sprouting capability of *Rosa woodsii* (woods rose) make it a good soil stabilizer.

Soil Management and Rehabilitation Opportunities

Coarse textured soils are not as susceptible to compaction problems. This community type is subject to recurring scouring by floods and alluvium deposition. However, stands are relatively stable because of the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer in streambank stabilization. This is particularly important on higher gradient stream channels where scouring by seasonal flooding occurs.

Managers should maintain a buffer strip of the *Populus trichocarpa* (black cottonwood) dominated community types adjacent to rivers and streams. These buffer strips reduce sedimentation, stabilize streambanks, and slow flood waters.

If the stand still has a fairly high water table, a dramatic change in management (i.e. elimination of livestock grazing and close monitoring of wildlife impacts) ***MAY*** allow the remnant shrub population to sprout and re-invade the stand. However, if the water table has dropped dramatically and the shrubs have been completely eliminated, the opportunity to reestablish a shrub understory dominated by desirable shrubs may be lost.

Where revegetation with woody species is wanted, desirable shrubs such as *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willows) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established

seedlings effectively stabilize recent bare alluvium. Remember: If the canopy cover of the trees in the stand has opened up too much and/or the water table has been lowered dramatically, the success of revegetation with desirable woody species will be low.

For rehabilitation of stands by the use of fire, see the discussion in the Fire Management section about the limitations of fire as a tool for rehabilitation. If fire is to be used to rehabilitate a stand, it is imperative that the stand be excluded from all livestock grazing for at least five years and that browsing by wildlife be closely monitored.

The following guidelines should be followed when attempting to revegetate sites with cuttings from cottonwoods (Swenson 1988): 1) Do not plant cottonwoods in saline or alkaline sites. 2) Select sites with substrates of sand, gravel, or small cobbles. Avoid sites that are classified as clays or have a thick clay layer. 3) Make cuttings from stands of open, young, rapidly growing trees, using only cuttings that are four years old or less. Remove the side branches, leaving only the tip and next two lower side branches. 4) Make the cuttings when the plants are completely dormant. 5) Soak the cuttings in water for 10 to 14 days. 6) Auger holes to a depth of the lowest anticipated growing season water table. 7) Place the cuttings in the augered holes the same day they are removed from the soak. Set the butt at the lowest anticipated growing season groundwater depth. Select cuttings of a length which provides 1 to 2 m (3 to 6 ft) of cutting to remain above the soil surface. 8) Back fill the holes carefully to avoid air pockets. 9) Place tree guards around the cuttings if rodent or rabbit damage is anticipated. 10) As buds begin to swell along the cuttings, wipe them off the lower two-thirds of the cutting. 11) Plantings must be excluded from livestock grazing and big game browsing for two to three growing seasons. Some beaver control may be needed.

Symphoricarpos occidentalis (western snowberry) is well adapted for revegetating sites. Commonly growing in dense colony stands makes it suitable for disturbed land stabilization. It does best on moist, well drained soils which have not been excessively disturbed. Once established, it grows at a moderate rate and spreads rapidly by root sprouts. Nursery grown seedlings, rooted cuttings, or wildlings are the preferred planting materials. Critical, erosive sites may need complete exclusion from grazing during establishment, and animal populations and stacking rates should be balanced with forage supply on noncritical sites after establishment (Wasser 1982).

Rosa woodsii (woods rose) is valuable for revegetating disturbed sites along streambanks and seeps. It is easily established from nursery grown stock, root cuttings, or transplanted materials.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

Symphoricarpos occidentalis (western snowberry) is an important food source for upland birds due to fruits that persist into the winter. Native Americans made extensive use of *Rosa woodsii* (woods rose) roots, stems, leaves, flowers, and rose hips for food and therapeutic materials (US Forest Service 1975). The persistent rose hips are edible, and are one of the best natural sources of vitamin C. They can be dried for use in flavoring teas, jellies, fruitcakes, and puddings.

Nature trails should be routed around dense stands of *Rosa woodsii* (woods rose) community type. However, *Rosa woodsii* (woods rose) is useful for planting in recreation areas as a biological barrier to protect physical structures, young and delicate plants, and to direct traffic.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have been reported for western Montana (Foote 1965), central Oregon (Kovalchik 1987), and central Idaho (Tuhy and Jensen 1982).

Salix amygdaloides Community Type
(Peach-leaf Willow Community Type)

SALAMY (SAAM2)
Number Of Stands Sampled = 21

LOCATION AND ASSOCIATED LANDFORMS

The *Salix amygdaloides* (peach-leaf willow) community type is an incidental type at lower elevations throughout central and eastern Montana; isolated stands are also located in western Montana such as in the Flathead Valley. It occurs as a narrow band or irregularly shaped community in backwater areas, abandoned meander channels, overflow channels, and along pond and lake margins. In other instances, it occurs as small, isolated clumps immediately adjacent to the streams and rivers of the region. Sites range in elevation from 594 to 1,189 m (1,950 to 3,900 ft). Stands of the *Salix amygdaloides* (peach-leaf willow) community type can be found along the Missouri, Yellowstone, Powder, Tongue, Milk, and Little Missouri Rivers.

FLORISTIC CHARACTERISTICS

The *Salix amygdaloides* (peach-leaf willow) community type is comprised of a short, multi-stem tree layer dominated by *Salix amygdaloides* (peach-leaf willow). Generally associated with the overstory is *Salix exigua* (sandbar willow). The understory includes a diverse group of species such as *Poa palustris* (fowl bluegrass), *Phalaris arundinacea* (reed canarygrass), *Glycyrrhiza lepidota* (American licorice), and *Salix lutea* (yellow willow).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus deltoides (Great Plains cottonwood)	3	0-3	33
Salix amygdaloides (peach-leaf willow)	53	40-60	100
Shrubs			

Cornus stolonifera (red-osier dogwood)	3	0-3	33
Rosa woodsii (woods rose)	3	0-3	33
Salix eriocephala (diamond willow)	40	0-40	33
Salix exigua (sandbar willow)	1	0-1	33
Salix lutea (yellow willow)	80	0-80	33
Graminoids			
Agropyron repens (quackgrass)	3	0-3	67
Agrostis stolonifera (redtop)	3	0-3	33
Bromus inermis (smooth brome)	3	0-3	33
Carex lanuginosa (woolly sedge)	3	0-3	33
Phalaris arundinacea (reed canarygrass)	30	0-60	67
Poa palustris (fowl bluegrass)	50	0-60	67
Poa pratensis (Kentucky bluegrass)	3	3-3	100
Spartina pectinata (prairie cordgrass)	1	0-1	33
Forbs			
Apocynum cannabinum (hemp dogbane)	20	0-20	33
Aster spp. (aster)	20	0-20	33
Cicuta maculata (spotted water-hemlock)	20	0-20	33
Cirsium arvense (Canada thistle)	3	0-3	33
Geranium spp. (geranium)	3	0-3	33
Glycyrrhiza lepidota (American licorice)	60	0-60	33
Lactuca serriola (prickly lettuce)	1	0-1	33
Lycopus asper (rough bugleweed)	20	0-20	33
Melilotus alba (white sweet-clover)	40	0-40	33
Melilotus officinalis (yellow sweet-clover)	40	0-40	33
Mentha arvensis (field mint)	10	0-20	67
Parietaria pensylvanica (Pennsylvania pellitory)	3	0-3	33
Potentilla spp. (cinquefoil)	20	0-20	33
Smilacina stellata (starry Solomon-plume)	3	0-3	33
Ferns and Allies			
Equisetum arvense (field horsetail)	40	0-40	33

SUCCESSIONAL INFORMATION

In most situations, the *Salix amygdaloides* (peach-leaf willow) community type represents a successional stages of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type.

Disturbance Stages

Increased levels of disturbance tend to increase those disturbance-caused species already present. If the disturbance includes trampling and/or rubbing by livestock, the weak, multi-stemmed nature of *Salix amygdaloides* (peach-leaf willow) will result in a great deal of downed woody material. When this happens, the stands tend to limit livestock use. In other situations, the stands may be too wet so as to preclude most types of disturbances.

SOILS

Soils are commonly Entisols (Aquents and Fluvents) or Mollisols (Aquolls and Borolls). This community type occurs on a wide range of soil textures except heavy clay. Water tables are usually within 1 m (39 in) of the soil surface throughout the growing season. *Salix amygdaloides* (peach-leaf willow) can tolerate weak saline and alkali soils, poorly drained soils, and

prolonged flooding.

ADJACENT COMMUNITIES

Drier sites may be dominated by the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type, or the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type. In other situations, drier sites may be dominated the *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), or the *Shepherdia argentea* (thorny buffaloberry) community types.

Wetter sites may be dominated by *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), *Eleocharis* species (spike rushes), *Spartina pectinata* (prairie cordgrass), or *Phragmites australis* (common reed) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Wet conditions and the limited size and extent of stands of this type generally limit livestock use. However, livestock use during wet periods can either lead to the churning of soil or soil compaction.

Wildlife

The high structural diversity of stands of the *Salix amygdaloides* (peach-leaf willow) community type provide excellent thermal and hiding cover for all categories of wildlife.

Fisheries

The *Salix amygdaloides* (peach-leaf willow) community type provides limited thermal cover for fish. However, it is an effective stabilizer of streambanks and managers should attempt to protect them whenever possible.

Fire

Limited information is available on the effects of fire on *Salix amygdaloides* (peach-leaf willow). However, based on our understanding of other willow species, we would assume *Salix amygdaloides* (peach-leaf willow) to be a prolific sprouter after all but the hottest fires.

Soil Management and Rehabilitation Opportunities

High water tables and seasonal flooding should limit activities and development in most of these stands. Care must be taken in the placement of roads and other developments in sites that permit these activities.

Recreational Uses and Considerations

Stands of this community type provide excellent opportunities for viewing wildlife species. However, the dense nature of most stands and the high water tables associated with them tend to limit access. In addition, the large mosquito populations help in limiting access.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Salix amygdaloides* (peach-leaf willow) community type has not been described elsewhere.

WILLOW SHRUB TYPES

Salix bebbiana Community Type
(Bebb Willow Community Type)

SALBEB (SABE2)
Number Of Stands Sampled = 27

LOCATION AND ASSOCIATED LANDFORMS

The *Salix bebbiana* (Bebb willow) community type is a minor type at low to mid and moderately high elevations throughout the mountains, foothills, and mountain valleys of Montana. Sites range from 985 to 2,336 m (3,230 to 7,660 ft). It occupies alluvial terraces and moist to wet areas near springs and seeps. It also occurs sporadically along major rivers and their tributaries.

FLORISTIC CHARACTERISTICS

The *Salix bebbiana* (Bebb willow) community type represents a grazing disclimax. *Salix bebbiana* (Bebb willow) dominates this community type. In some sites, *Salix bebbiana* (Bebb willow) may be a tree form. A diverse group of disturbance-caused herbaceous species are present, including *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), *Agrostis stolonifera* (redtop), and *Solidago canadensis* (Canada goldenrod).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Rosa woodsii (woods rose)	7	0-20	44
Salix bebbiana (Bebb willow)	32	1-98	100
Graminoids			
Agrostis stolonifera (redtop)	14	0-20	52
Phleum pratense (common timothy)	10	0-40	56
Poa pratensis (Kentucky bluegrass)	19	0-60	63
Forbs			
Solidago canadensis (Canada goldenrod)	11	0-40	44

SUCCESSIONAL INFORMATION

The *Salix bebbiana* (Bebb willow) community type represents a browsing/grazing disclimax of the *Salix geyeriana* (Geyer willow), *Salix lutea* (yellow willow), or *Salix drummondiana* (Drummond willow) dominated habitat types. *Salix bebbiana* (Bebb willow) seems to be less palatable than *Salix geyeriana* (Geyer willow), *Salix boothii* (Booth willow), *Salix lutea* (yellow willow), and *Salix drummondiana* (Drummond willow), and represents one of the last willow species to leave a site. The dominance of the undergrowth by introduced species indicates past disturbance.

SOILS

Soils are commonly Mollisols (Aquolls and Borolls) but can intergrade to Histosols under conditions favorable for organic matter accumulation. Soil texture varies little from clay loam to sandy loam. Water tables are usually within 1 m (39 in) of

the soil surface throughout summer. Redoximorphic features (mottles or gleyed soil) are also common within 1 m (39 in) of the soil surface. Estimated available water ranges from low to high.

ADJACENT COMMUNITIES

Adjacent wetter types include the *Carex rostrata* (beaked sedge) habitat type and the *Carex nebrascensis* (Nebraska sedge) community type or *Salix* (willow) types such as the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type. Drier sites support the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type and the *Poa pratensis* (Kentucky bluegrass) community type. Uplands are dominated by conifers or by *Artemisia tridentata* (big sagebrush), *Agropyron spicatum* (bluebunch wheatgrass), and *Festuca idahoensis* (Idaho fescue).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands are usually characterized by widely spaced shrubs, allowing for easy livestock access. Forage production is moderate to high, composed primarily of introduced species. As a result, heavy use by livestock is common. In some stands the willows may have a reduced vigor, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Wildlife

Where this community type occurs on winter game ranges, browsing of *Salix bebbiana* (Bebb willow) is often heavy, reducing plant vigor and regeneration. Gaffney (1941) reported that *Salix bebbiana* (Bebb willow) is a highly valuable browse for elk, with heavy utilization common. Continued use may lead to a conversion to herbaceous communities such as the *Poa palustris* (fowl bluegrass) and *Poa pratensis* (Kentucky bluegrass) community types. Moose and beaver heavily utilize most species of willow.

Fisheries

The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks.

Fire

Salix bebbiana (Bebb willow) sprouts rapidly following fire (Haeussler and Coates 1986). Quick, hot fires maximize sprouting, while slower burns cause more damage to plants. Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities dominated by *Salix bebbiana* (Bebb willow).

Soil Management and Rehabilitation Opportunities

The *Salix bebbiana* (Bebb willow) community type is a browse disclimax and has historically received high use by wildlife and cattle. Soils and streambanks are highly susceptible to trampling damage, especially when soils are fine textured or wet. Deferring grazing until sites are drier can reduce trampling and compaction problems (Marlow 1984).

Unless water tables are restored, these sites will for all practical purposes remain with a ground cover dominated by introduced grass species. On those sites adjacent to a first or second order stream, the use of rock checkdams to aid in the rehabilitation of degraded (de-watered) sites is an excellent cost effective approach. The rock dam will help raise the water table thereby allowing the willows and sedges to reclaim a degraded site.

Salix bebbiana (Bebb willow) is valuable for revegetating streambanks. Cuttings are best taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results with the

cuttings rooting freely along the entire length of the stem. Roots and shoots from cuttings can be expected to appear 10-20 days after planting. However, the use of rooted cuttings and nursery grown stock will produce the best results.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site, subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

A similar *Salix bebbiana* (Bebb willow) community type was identified by Padgett and others (1989) in Utah, with an undergrowth dominated by *Poa pratensis* (Kentucky bluegrass) and other mesic grasses. Chadde and others (1988) defined a *Salix bebbiana/Agrostis stolonifera* (Bebb willow/redtop) community type for northern Yellowstone National Park. A somewhat similar community type was described by Szaro (1989) for Arizona and New Mexico.

Salix candida/Carex rostrata Habitat Type
(Hoary Willow/Beaked Sedge Habitat Type)

SALCAN/CARROS (SACA4/CARO6)
Number Of Stands Sampled = 24

LOCATION AND ASSOCIATED LANDFORMS

The *Salix candida/Carex rostrata* (hoary willow/beaked sedge) habitat type is an incidental type at mid elevations in the mountains of central and southwestern Montana. Limited amounts are also found in the *Thuja plicata* (western red cedar) or *Tsuga heterophylla* (western hemlock) series of northwestern Montana. It is restricted to anchored organic mats along pond and lake margins. Sites range in elevation from 1,475 to 2,195 m (4,840 to 7,200 ft).

FLORISTIC CHARACTERISTICS

The *Salix candida/Carex rostrata* (hoary willow/beaked sedge) habitat type is characterized by scattered clumps of *Salix candida* (hoary willow) over a dense stand of rhizomatous *Carex rostrata* (beaked sedge) and/or *Carex aquatilis* (water sedge). Other important species include *Carex simulata* (short-beaked sedge) and *Triglochin maritimum* (seaside arrow-

grass).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Shrubs			
Betula glandulosa (bog birch)	7	0-10	29
Betula occidentalis (water birch)	3	0-3	14
Cornus stolonifera (red-osier dogwood)	1	0-1	14
Potentilla fruticosa (shrubby cinquefoil)	1	0-3	57
Salix boothii (Booth willow)	1	0-1	14
Salix candida (hoary willow)	19	10-40	100
Salix lutea (yellow willow)	1	0-1	14
Salix planifolia (planeleaf willow)	3	0-3	29
Salix serissima (autumn willow)	1	0-1	14
Salix wolfii (Wolf's willow)	3	0-3	29
Graminoids			
Agropyron caninum (bearded wheatgrass)	1	0-1	14
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-3	57
Carex aquatilis (water sedge)	23	0-60	71
Carex aurea (golden sedge)	1	0-1	14
Carex buxbaumii (Buxbaum's sedge)	1	0-1	14
Carex diandra (lesser-panicled sedge)	3	0-3	14
Carex interior (inland sedge)	1	0-1	14
Carex lanuginosa (woolly sedge)	1	0-1	29
Carex limosa (mud sedge)	40	0-40	14
Carex livida (pale sedge)	15	0-20	29
Carex oederi (green sedge)	3	0-3	14
Carex rostrata (beaked sedge)	19	0-60	71
Carex simulata (short-beaked sedge)	28	0-70	57
Deschampsia cespitosa (tufted hairgrass)	2	0-3	29
Juncus balticus (Baltic rush)	1	0-1	14
Juncus nodosus (tuberous rush)	10	0-10	14
Muhlenbergia andina (foxtail muhly)	3	0-3	14
Muhlenbergia filiformis (slender muhly)	20	0-40	29
Muhlenbergia glomerata (marsh muhly)	1	0-1	14
Poa pratensis (Kentucky bluegrass)	3	0-3	14
Scirpus acutus (hardstem bulrush)	80	0-80	14
Forbs			
Allium schoenoprasum (chives)	1	0-1	14
Antennaria anaphaloides (tall pussy-toes)	1	0-1	29
Aster foliaceus (leafy aster)	1	0-1	14
Cicuta maculata (spotted water-hemlock)	3	0-3	14
Dodecatheon spp. (shooting star)	1	0-1	14
Epilobium ciliatum (common willow-herb)	2	0-3	29

Galium trifidum (small bedstraw)	2	0-3	29
Marrubium vulgare (horehound)	1	0-1	14
Menyanthes trifoliata (buckbean)	35	0-70	29
Parnassia palustris (northern grass-of-parnassus)	1	0-1	29
Parnassia spp. (grass-of-parnassus)	1	0-1	14
Pedicularis groenlandica (elephant's head)	1	0-1	14
Polygonum amphibium (water smartweed)	3	0-3	14
Silene menziesii (Menzie's silene)	1	0-1	14
Sisyrinchium spp. (blue-eyed grass)	1	0-1	14
Sparganium minimum (small bur-reed)	1	0-1	14
Spiranthes romanzoffiana (hooded ladies-tresses)	1	0-1	14
Taraxacum officinale (common dandelion)	1	0-1	14
Triglochin maritimum (seaside arrow-grass)	2	0-3	57
Triglochin palustre (marsh arrow-grass)	1	0-1	14
Typha latifolia (common cattail)	1	0-1	14
Urtica dioica (stinging nettle)	3	0-3	14
Viola nephrophylla (northern bog violet)	1	0-1	14
Viola spp. (violet)	1	0-1	14
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	14

SUCCESSIONAL INFORMATION

With persistent heavy browsing, *Salix candida* (hoary willow) is likely to be all but eliminated from stands of this type, leading to dominance by *Carex rostrata* (beaked sedge). Careful observation should show remnant shoots of *Salix candida* (hoary willow) still present on all but the most severely degraded sites.

SOILS

Soils are Histosols (Borofibrists) characterized by organic horizons greater than 1 m (39 in) thick. Water tables normally remain at or near the soil surface throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter communities are dominated by aquatic species, such as *Nuphar* species (lily) and *Potamogeton* species (pondweed), or by *Typha latifolia* (common cattail) and *Scirpus acutus* (hardstem bulrush). Various *Carex* (sedge) habitat types and the *Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) habitat type are located on adjacent sites. The *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type is located on drier basin margins.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Grazing should be carefully monitored due to the highly organic substrates. Excessive grazing can result in severe churning of the soil.

Estimated herbage production is moderate. Short growing seasons and continually wet soils limit livestock use until August and September. Season long grazing, especially when soils are saturated, will damage plants and soils.

Forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season,

previous grazing use, and the extent of the site. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland species are cured, or stock distribution is poor.

Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled.

Wildlife

Cover value for ungulates is low due to the short potential stature of this type *Salix candida* (hoary willow) reaches a maximum height of 1.0-1.5 m (3-5 ft). *Salix candida* (hoary willow) is a poor, low vigor sprouter following browsing. Birds such as the common snipe and various sparrows inhabit these areas.

Fire

Although the response of *Salix candida* (hoary willow) to fire has not been documented, it may be an effective method of rejuvenating decadent clumps. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix candida/Carex rostrata* (hoary willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

Thick organic substrates should preclude all uses of this type. Roads and trails should be located on adjacent uplands.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = wet meadow range site.

OTHER STUDIES

Lesica (1986) described a dwarf carr wetland community along the Rocky Mountain Front of Montana codominated by *Salix candida* (hoary willow), *Betula glandulosa* (bog birch), *Potentilla fruticosa* (shrubby cinquefoil), and *Cornus stolonifera* (red-osier dogwood).

Salix drummondiana/Calamagrostis canadensis Habitat Type
(Drummond Willow/Bluejoint Reedgrass Habitat Type)

SALDRU/CALCAN (SADR/CACA4)
Number Of Stands Sampled = 26

LOCATION AND ASSOCIATED LANDFORMS

The *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type is a minor type in northwestern Montana, and an incidental type at mid to moderately high elevations in the mountainous regions throughout southern Montana. It ranges in elevation from 707 to 2,378 m (2,320 to 7,800 ft). It occurs adjacent to beaver ponds, lakes or marshes, seeps and springs, and on alluvial terraces adjacent to mountain rivers, and streams. In southern Montana, the *Salix drummondiana* (Drummond willow) dominated types occupy the higher elevation sites with the *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated types occurring at intermediate elevations. The lower elevational foothill sites are occupied by the *Salix lutea* (yellow willow) dominated types.

FLORISTIC CHARACTERISTICS

The overstory is dominated by *Salix drummondiana* (Drummond willow). Limited amounts of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow) may also be present. *Calamagrostis canadensis* (bluejoint reedgrass) and/or *Calamagrostis stricta* (narrow-spiked reedgrass) are the dominant undergrowth species. A variety of forbs are present, including *Geum macrophyllum* (large leaved avens), *Equisetum arvense* (field horsetail), *Aster modestus* (few-flowered aster), and *Aster occidentalis* (western aster).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	8
Larix occidentalis (western larch)	1	0-1	8
Picea spp. (spruce)	3	0-3	17
Pinus contorta (lodgepole pine)	10	0-10	8
Populus tremuloides (quaking aspen)	3	0-3	8
Populus trichocarpa (black cottonwood)	1	0-1	8
Pseudotsuga menziesii (Douglas fir)	3	0-3	8
Shrubs			
Alnus incana (mountain alder)	3	0-3	8
Cornus canadensis (bunchberry)	10	0-10	8
Cornus stolonifera (red-osier dogwood)	1	0-1	8
Lonicera involucrata (twin-berry)	1	0-3	25
Ribes hudsonianum (stinking current)	1	0-1	8
Ribes lacustre (swamp current)	3	0-3	8
Ribes setosum (Missouri gooseberry)	4	0-10	25
Ribes spp. (currant)	6	0-20	33
Rosa acicularis (prickly rose)	3	0-3	8
Rosa spp. (rose)	1	0-1	8

Rubus parviflorus (thimbleberry)	10	0-10	8
Salix barclayi (Barclay's willow)	1	0-1	8
Salix boothii (Booth willow)	4	0-10	42
Salix drummondiana (Drummond willow)	55	20-90	100
Salexi exigua (sandbar willow)	3	0-3	8
Salix geyeriana (Geyer willow)	3	0-3	8
Salix planifolia (planeleaf willow)	3	0-3	17
Shepherdia canadensis (Canada buffaloberry)	1	0-1	8
Graminoids			
Agropyron dasystachyum (thick-spiked wheatgrass)	1	0-1	8
Agrostis scabra (tickle-grass)	3	0-3	8
Agrostis stolonifera (redtop)	80	0-80	8
Bromus ciliatus (fringed brome)	1	0-1	33
Bromus inermis (smooth brome)	1	0-1	8
Bromus secalinus (ryebrome)	1	0-1	8
Calamagrostis canadensis (bluejoint reedgrass)	44	0-70	67
Calamagrostis stricta (narrow-spiked reedgrass)	20	0-30	25
Carex aquatilis (water sedge)	1	0-1	8
Carex brunnescens (brownish sedge)	20	0-20	8
Carex canescens (gray sedge)	1	0-1	8
Carex disperma (soft-leaved sedge)	1	0-1	8
Carex microptera (small-winged sedge)	3	0-3	8
Carex pachystachya (thick-headed sedge)	1	0-1	8
Carex rostrata (beaked sedge)	1	0-3	25
Deschampsia cespitosa (tufted hairgrass)	10	0-20	17
Elymus glaucus (blue wildrye)	2	0-3	17
Glyceria striata (fowl mannagrass)	1	0-1	8
Poa palustris (fowl bluegrass)	7	0-20	50
Poa pratensis (Kentucky bluegrass)	1	0-1	8
Puccinellia pauciflora (weak alkaligrass)	1	0-1	8
Trisetum spicatum (spike trisetum)	1	0-1	8
Trisetum wolfii (Wolf's trisetum)	1	0-1	8
Forbs			
Achillea millefolium (common yarrow)	1	0-1	8
Actaea rubra (baneberry)	2	0-3	17
Anaphalis margaritacea (common pearly-everlasting)	1	0-1	17
Angelica arguta (sharptooth angelica)	1	0-3	42
Arabis glabra (towermustard)	1	0-1	8
Arabis microphylla (littleleaf rockcress)	1	0-1	8
Arnica chamissonis (meadow arnica)	3	0-3	8
Arnica cordifolia (heart-leafed arnica)	1	0-1	8
Aster ciliolatus (Lindley aster)	1	0-1	8
Aster foliaceus (leafy aster)	1	0-1	8
Aster modestus (few-flowered aster)	9	0-20	42
Aster occidentalis (western aster)	3	0-20	58
Castilleja spp. (paintbrush)	1	0-1	8
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	8
Epilobium angustifolium (fireweed)	1	0-1	42

Epilobium ciliatum (common willow-herb)	1	0-3	25
Epilobium latifolium (red willow-herb)	20	0-20	8
Epilobium spp. (willow-herb)	1	0-1	8
Fragaria virginiana (Virginia strawberry)	1	0-1	25
Galium aparine (goose-grass)	1	0-1	8
Galium triflorum (sweetscented bedstraw)	1	0-1	25
Geranium richardsonii (white geranium)	2	0-3	17
Geranium viscosissimum (sticky geranium)	1	0-1	8
Geum macrophyllum (large-leaved avens)	2	0-10	75
Gnaphalium spp. (cudweed)	1	0-1	8
Heracleum lanatum (cow-parsnip)	5	0-10	25
Mentha arvensis (field mint)	20	0-40	17
Mertensia ciliata (mountain bluebell)	1	0-3	25
Mitella breweri (Brewer's mitrewort)	1	0-1	8
Pedicularis groenlandica (elephant's head)	1	0-1	17
Plantago major (common plantain)	1	0-1	8
Polygonum spp. (smartweed)	10	0-10	8
Pyrola asarifolia (pink wintergreen)	8	0-20	25
Pyrola minor (snowline pyrola)	1	0-1	8
Ranunculus gmelinii (small yellow water-buttercup)	3	0-3	8
Rorippa palustris (marsh yellowcress)	10	0-10	8
Rumex crispus (curly dock)	1	0-1	8
Senecio pauciflorus (rayless alpine butterweed)	1	0-1	8
Senecio pseudaureus (streambank groundsel)	2	0-3	25
Senecio triangularis (arrowleaf groundsel)	1	0-1	25
Smilacina racemosa (false spikenard)	3	0-3	8
Smilacina stellata (starry Solomon-plume)	1	0-1	25
Solidago canadensis (Canada goldenrod)	3	0-3	8
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	8
Taraxacum laevigatum (red-seeded dandelion)	3	0-3	8
Taraxacum officinale (common dandelion)	1	0-1	17
Thalictrum occidentale (western meadowrue)	4	0-10	25
Urtica dioica (stinging nettle)	1	0-1	33
Veronica americana (American speedwell)	1	0-1	17
Vicia americana (American vetch)	1	0-1	8
Viola canadensis (Canada violet)	3	0-3	8
Viola orbiculata (round-leaved violet)	1	0-1	8
Viola spp. (violet)	5	0-10	17
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-1	8
Equisetum arvense (field horsetail)	2	0-3	50
Equisetum palustre (marsh horsetail)	1	0-1	8

SUCCESSIONAL INFORMATION

Grazing pressure by livestock will cause a decrease in the more desirable grasses such as *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) with a corresponding increase in either introduced or less desirable species such as *Poa pratensis* (Kentucky bluegrass), *Agrostis stolonifera* (redtop), or *Juncus balticus* (Baltic

rush). If grazing pressures are severe enough, the site takes on the appearance of the *Salix drummondiana* (Drummond willow) community type.

SOILS

Soils are widely variable, including Entisols, Histosols, and Mollisols. Soils adjacent to waterways are usually poorly developed and contain high percentages of gravel and cobbles. This habitat type is also located within broad valleys where soils textures range from silt to clay loam. Water tables range from surface levels to greater than 1 m (39 in) below the soil surface during the growing season. Redoximorphic features (mottling or gleyed soil) are common at any depth. For those communities along waterways, the coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support the *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type. In other situations, wetter sites may include the *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge) habitat types or open water. Drier sites may support the *Salix drummondiana* (Drummond willow) community type or a variety of types including the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types, the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type or upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is high, and where extensive, this type may be an important source of summer forage. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Due to the high forage production and highly palatable grasses, many of these sites have heavy summer and fall use, especially after uplands have been grazed. Sustained grazing decreases the vigor, reproductive success, and competitive ability of *Calamagrostis canadensis* (bluejoint reedgrass) and *Deschampsia cespitosa* (tufted hairgrass) (Volland 1985). Under season long grazing, they may be replaced by *Poa pratensis* (Kentucky bluegrass). To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils dry. Proper levels of grazing should range from light to moderate.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

Wildlife

Abundant food, cover, and proximity to water provide habitat for numerous wildlife species such as mammals and songbirds. Summer and winter use by elk may be moderate (Gaffney 1941). Big game use of *Salix drummondiana* (Drummond willow) shoots, especially during the winter, may be heavy. The linear nature of many of these communities along waterways serve as important corridors for wildlife movement. Moose and beaver tend to heavily utilize most species of willows. Elk may make moderate summer use of *Calamagrostis canadensis* (bluejoint reedgrass) (Kufeld 1987).

Fisheries

Where adjacent to streams, this type effectively stabilizes soils and forms overhanging banks, enhancing fisheries quality. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing

access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in this type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Deschampsia cespitosa (tufted hairgrass) is resistant to damage from fire (DeBenedetti and Parsons 1979). Root crowns are rarely damaged, even by hot, intense fires. However, repeated burning favors rhizomatous species such as *Poa pratensis* (Kentucky bluegrass).

After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth.

Soil Management and Rehabilitation Opportunities

Wet, fine textured soils are highly susceptible to trampling damage by cattle. Grazing should be deferred until soils are drier to protect streambanks and minimize damage (Marlow 1984). Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix drummondiana (Drummond willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix drummondiana* (Drummond willow) produce an abundance of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Recreational Uses and Considerations

Fishing opportunities are good in streams associated with this type. Moist soils and streambanks are subject to trampling damage. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky

Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type has not been previously described. However, communities containing high constancies and coverages of *Salix drummondiana* (Drummond willow) have been described. These include the *Salix boothii* (Booth willow) dominated communities described by Padgett and others (1989) for Utah and southeastern Idaho, the *Salix geyeriana* (Geyer willow) dominated communities types described by Hansen and others (1989) for Montana, and the *Salix boothii* (Booth willow) dominated communities described by Youngblood and others (1985) for eastern Idaho and western Wyoming.

Salix drummondiana/Carex rostrata Habitat Type
(Drummond Willow/Beaked Sedge Habitat Type)

SALDRU/CARROS (SADR/CARO6)
Number Of Stands Sampled = 43

LOCATION AND ASSOCIATED LANDFORMS

The *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type is a major type in northwestern Montana, and a minor to incidental type at mid to moderately high elevations in the mountainous regions throughout southern Montana. It ranges in elevation from 707 to 2,378 m (2,320 to 7,800 ft). It occurs adjacent to beaver ponds, lakes or marshes, seeps and springs, and on alluvial terraces adjacent to mountain rivers, and streams. In southern Montana, the *Salix drummondiana* (Drummond willow) dominated types occupy the higher elevation sites with the *Salix geyeriana* - *Salix boothii* (Geyer willow - Booth willow) dominated types occurring at intermediate elevations. The lower elevational foothill sites are occupied by the *Salix lutea* (yellow willow) dominated types.

FLORISTIC CHARACTERISTICS

Salix drummondiana (Drummond willow) is the dominant shrub. Limited amounts of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow) may also be present. The undergrowth is dominated by *Carex rostrata* (beaked sedge) with lesser amounts of *Calamagrostis canadensis* (bluejoint reedgrass),*Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge) also present. *Geum macrophyllum* (large leaved avens) and *Epilobium ciliatum* (common willow-herb) are the most common forb associated with this type.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Abies lasiocarpa (subalpine fir)	1	0-1	6
Picea spp. (spruce)	1	0-1	6
Shrubs			
Alnus incana (mountain alder)	7	0-20	29
Amelanchier alnifolia (western serviceberry)	1	0-1	6
Betula glandulosa (bog birch)	14	0-20	18

Cornus stolonifera (red-osier dogwood)	1	0-1	12
Lonicera involucrata (twin-berry)	3	0-3	12
Menziesia ferruginea (fool's huckleberry)	1	0-1	6
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	6
Rhamnus alnifolia (alder buckthorn)	1	0-1	6
Ribes hudsonianum (stinking current)	1	0-1	6
Ribes odoratum (buffalo current)	1	0-1	6
Ribes spp. (currant)	3	0-10	35
Rubus idaeus (red raspberry)	1	0-1	12
Salix boothii (Booth willow)	14	0-20	47
Salix drummondiana (Drummond willow)	55	30-90	100
Salix geyeriana (Geyer willow)	1	0-1	18
Salix planifolia (planeleaf willow)	10	0-10	6
Salix pseudomonticola (mountain willow)	15	0-30	12
Spiraea douglasii (Douglas's spiraea)	1	0-1	6
Vaccinium scoparium (whortleberry)	1	0-1	6
Graminoids			
Agrostis diegoensis (thin bentgrass)	40	0-40	6
Agrostis exarata (spike bentgrass)	1	0-1	6
Agrostis scabra (tickle-grass)	1	0-1	6
Agrostis tenuis (colonial bentgrass)	20	0-20	6
Agrostis thurberiana (Thurber bentgrass)	20	0-20	6
Alopecurus pratensis (meadow foxtail)	3	0-3	6
Calamagrostis canadensis (bluejoint reedgrass)	16	0-40	29
Calamagrostis stricta (narrow-spiked reedgrass)	1	0-1	6
Carex aquatilis (water sedge)	34	0-60	18
Carex disperma (soft-leaved sedge)	3	0-3	6
Carex flava (yellow sedge)	1	0-1	6
Carex lanuginosa (woolly sedge)	5	0-10	12
Carex lenticularis (lentil-fruited sedge)	10	0-10	6
Carex rostrata (beaked sedge)	36	0-80	82
Carex vesicaria (inflated sedge)	33	0-80	18
Deschampsia cespitosa (tufted hairgrass)	1	0-1	12
Glyceria grandis (American mannagrass)	3	0-3	6
Glyceria striata (fowl mannagrass)	1	0-1	12
Juncus balticus (Baltic rush)	1	0-1	6
Juncus ensifolius (dagger-leaf rush)	5	0-10	12
Phalaris arundinacea (reed canarygrass)	30	0-30	6
Poa palustris (fowl bluegrass)	5	0-10	12
Scirpus microcarpus (small-flowered bulrush)	1	0-1	6
Forbs			
Angelica arguta (sharptooth angelica)	1	0-1	12
Aster eatonii (Eaton's aster)	1	0-1	6
Aster foliaceus (leafy aster)	3	0-3	6
Aster modestus (few-flowered aster)	3	0-20	41
Aster occidentalis (western aster)	5	0-10	18
Epilobium alpinum (alpine willow-herb)	3	0-3	6
Epilobium angustifolium (fireweed)	1	0-1	12

Epilobium ciliatum (common willow-herb)	3	0-10	53
Fragaria virginiana (Virginia strawberry)	1	0-1	12
Galium aparine (goose-grass)	2	0-3	12
Galium trifidum (small bedstraw)	2	0-10	29
Geum macrophyllum (large-leaved avens)	2	0-10	59
Habernaria dilatata (white orchis)	1	0-1	6
Heracleum lanatum (cow-parsnip)	3	0-3	6
Iris pseudacorus (yellow iris)	1	0-1	6
Ligusticum canbyi (Canby's licorice-root)	1	0-1	6
Lycopus uniflorus (northern bugleweed)	1	0-1	6
Mentha arvensis (field mint)	5	0-10	35
Pedicularis groenlandica (elephant's head)	5	0-10	12
Petasites sagittatus (arrowleaf coltsfoot)	4	0-10	18
Polemonium occidentale (western polemonium)	7	0-10	12
Polygonum amphibium (water smartweed)	1	0-1	6
Polygonum austinae (Austin's knotweed)	10	0-10	6
Potentilla palustris (purple cinquefoil)	1	0-1	18
Pyrola asarifolia (pink wintergreen)	1	0-1	12
Rumex crispus (curly dock)	1	0-1	6
Saussurea americana (American sawwort)	1	0-1	6
Saxifraga arguta (brook saxifrage)	20	0-20	6
Scutellaria galericulata (marsh skullcap)	1	0-1	6
Senecio pseudaureus (streambank groundsel)	1	0-1	12
Senecio triangularis (arrowleaf groundsel)	4	0-10	18
Smilacina stellata (starry Solomon-plume)	1	0-1	12
Stellaria longipes (longstalk starwort)	7	0-20	18
Veronica americana (American speedwell)	5	0-10	12
Viola spp. (violet)	1	0-1	6
Ferns and Allies			
Botrychium lanceolatum (lance-leaved grape-fern)	1	0-1	6
Equisetum arvense (field horsetail)	7	0-10	29
Equisetum fluviatile (water horsetail)	10	0-10	6
Equisetum hyemale (common scouring-rush)	1	0-1	6
Equisetum pratense (meadow horsetail)	1	0-1	6

SUCCESSIONAL INFORMATION

With prolonged disturbance, introduced grasses, such as *Poa palustris* (fowl bluegrass), *Agrostis stolonifera* (redtop), and *Poa pratensis* (Kentucky bluegrass), tend to increase. If browsing is heavy, willow coverages will decrease, resulting in more open communities. The site may then become occupied by the *Salix drummondiana* (Drummond willow) community type which represents a grazing disclimax.

Heavy cutting of the willows by beaver may lead to dominance by the graminoids. If beaver leave the area because of the lack of food, or are removed by trapping, major storm events or seasonal runoff can cause the dams to be washed out. With the elimination of beaver, the dams will not be repaired, resulting in downcutting and eventually, a lowering of the water table. The lowering of the water table can result in the changing of the site's potential. If the water table equilibrates at a new but lower (drier) state, the site's potential changes to the *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type. The *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type occupies a slightly drier position on the landscape than that of the *Salix drummondiana/Carex*

rostrata (Drummond willow/beaked sedge) habitat type.

SOILS

Soils are widely variable, including Entisols, Histosols, and Mollisols. Soils adjacent to waterways are usually poorly developed and contain high percentages of gravel and cobbles. This habitat type is also located within broad valleys where soils textures range from silt to clay loam. Water tables range from surface levels to greater than 1 m (39 in) below the soil surface during the growing season. Redoximorphic features (mottling or gleyed soil) are common at any depth. For those communities along waterways, the coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

This habitat type occurs either next to water or in an intermediate topographic positions between wetter herbaceous communities and drier communities dominated by shrubs or trees. Adjacent wetter communities may include the *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge) habitat types. The *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type or the *Salix drummondiana* (Drummond willow) community type may occupy adjacent drier sites. Additional adjacent drier communities may include the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) or *Deschampsia cespitosa* (tufted hairgrass) habitat types. Uplands support habitat types from the *Abies lasiocarpa* (subalpine fir), *Pseudotsuga menziesii* (Douglas fir), and *Pinus ponderosa* (ponderosa pine) series, depending on elevation and aspect.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value of *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) is variable, depending upon season, previous grazing use, and the extent of the site. Understory production depends on the density of overstory shrubs and the water level. Livestock forage value of *Carex rostrata* (beaked sedge) is variable, depending upon season, previous grazing use, and the extent of the site. *Carex vesicaria* (inflated sedge) appears to be more palatable and may be grazed in mid to late summer, especially as upland vegetation dries. On narrow riparian or wetland sites within extensive rangelands, sedge species are heavily utilized, particularly when upland plants are cured, or where livestock distribution and stocking rate problems occur.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

To minimize undesired changes in community composition and structure, pasture or allotment management should be based on the forage available from stands of this and other riparian or wetland communities. This concept of the riparian or wetland pasture has had some success in maintaining or improving the health of riparian or wetland vegetation (Kinch 1987).

Deferred and rest rotation grazing systems generally favor sedge species over willow species since woody species are vulnerable to longer duration treatments and to late summer/fall treatments (Myers 1989). Woody species are vulnerable to pruning damage, while sedges are protected by a root reserve. Late summer and fall grazing should be carefully controlled with duration of treatments limited to less than 30 days and frequency of this treatment to about one year in three or four (Myers 1989).

Wildlife

Big game use of *Salix drummondiana* (Drummond willow) shoots, especially during the winter, may be heavy. The *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type potentially forms structurally diverse thickets of 3-4 m (10-13 ft) tall willow, providing cover and food for many wildlife species. Moose and beaver tend to heavily utilize most species of willows.

Fisheries

The dense network of roots from the various willows and the rhizomatous *Carex rostrata* (beaked sedge) and *Carex aquatilis* (water sedge) are effective in stabilizing streambanks. Immediately adjacent to the stream, the sedge sod may be undercut and sag into the water providing excellent cover for fish. In addition, the various species of willows provide valuable overhanging stream cover and shade. The importance of willows in streambank protection, cover, and thermal protection for fisheries can not be emphasized enough. In addition, the herbaceous understory aids in filtering out sediments during high flows thereby contributing to the overall building of the streambanks. Some stands may be so dense as to hinder most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

Fire

Prescribed burning in the *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type is an effective method of rejuvenating decadent clumps. The various willow species present in this type sprout vigorously following fire, especially in wetter stands. Quick, hot fires result in more sprouts than slower fires, which are potentially more damaging to the willows and tends to result in fewer sprouts.

Burning of this type can temporarily increase productivity of *Carex rostrata* (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge). However, nonuse by livestock during the year prior to burning is essential. Residual cover burns well in the spring, prior to the growing season. After burning, the site should be eliminated from livestock grazing for at least 2 to 3 years to avoid attracting livestock to young, palatable regrowth. Care should be taken when burning stands along streambanks because of the excellent erosion protection provided by the *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type.

Soil Management and Rehabilitation Opportunities

Soils are easily damaged from trampling by livestock if grazed when moist. This disturbance often leads to soil compaction, streambank sloughing, damage to vegetation, and premature drying of the soil surface. Woody species provide the greatest amount of streambank protection. Herbaceous species rarely afford sufficient stream bank protection. Management should emphasize the importance of willows in protecting the streambank.

Salix drummondiana (Drummond willow) is valuable in revegetating disturbed streambanks. Cuttings should be first rooted then grown in a nursery to insure survival. Cut stems of *Salix drummondiana* (Drummond willow) produce an abundance of roots, located along the entire length of the stem. Best results are obtained from cuttings taken in the spring from dormant two to four year old wood. Cuttings 30-50 cm (12-20 in) long and >1 cm (0.5 in) in diameter produce the best results. Roots and shoots from cuttings can be expected to appear 10-15 days after planting.

Carex rostrata (beaked sedge), *Carex aquatilis* (water sedge), and *Carex vesicaria* (inflated sedge) all form a dense, thick sod that is highly resistant to erosion. Along the stream, the sod may be undercut and sag into the water, providing additional protection to streambanks. However, if grazing or trailing impacts are severe, the heavy weight of the sod makes it susceptible to damage, and streambank sloughing can occur.

Recreational Uses and Considerations

Recreational values of this type are primarily connected with the associated high quality fishery. Dense stands limit canoe or raft access, and camping sites are often unsuitable due to moist or wet conditions. Some stands may be so dense as to hinder

most forms of recreational fishing. If fishing access is important, dense stands may be opened by the use of livestock as a management tool.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = scrub-shrub; Subclass = broad-leaved deciduous; Water Regime (nontidal) = seasonally flooded to saturated to temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valley Bottoms, West of the Continental Divide, 10-14 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type has not been previously described. However, communities containing high constancies and coverages of *Salix drummondiana* (Drummond willow) have been described. These include the *Salix boothii* (Booth willow) dominated communities described by Padgett and others (1989) for Utah and southeastern Idaho, the *Salix geyeriana* (Geyer willow) dominated communities types described by Hansen and others (1989) for Montana, and the *Salix boothii* (Booth willow) dominated communities described by Youngblood and others (1985) for eastern Idaho and western Wyoming.

Salix drummondiana Community Type
(Drummond Willow Community Type)

SALDRU (SADR)
Number Of Stands Sampled = 2

LOCATION AND ASSOCIATED LANDFORMS

The *Salix drummondiana* (Drummond willow) community type is a major type in northwestern Montana, and a minor to incidental type at mid to moderately high elevations in the mountainous regions throughout southern Montana. It ranges in elevation from 707 to 2,378 m (2,320 to 7,800 ft). It occurs adjacent to beaver ponds, lakes or marshes, seeps and springs, and on alluvial terraces adjacent to mountain rivers, and streams. In southern Montana, the *Salix drummondiana* (Drummond willow) dominated types occupy the higher elevation sites with the *Salix geyeriana - Salix boothii* (Geyer willow - Booth willow) dominated types occurring at intermediate elevations. The lower elevational foothill sites are occupied by the *Salix lutea* (yellow willow) dominated types.

FLORISTIC CHARACTERISTICS

The overstory of this grazing disclimax is dominated by *Salix drummondiana* (Drummond willow). Major herbaceous species include *Poa pratensis* (Kentucky bluegrass), *Artemisia lindleyana* (riverbank wormwood), and *Equisetum arvense* (field horsetail) (Appendix 00).

SUCCESSIONAL INFORMATION

The *Salix drummondiana* (Drummond willow) represents an early/mid seral grazing disclimax of the *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type or the *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type.

SOILS

Soils are widely variable, including Entisols, Histosols, and Mollisols. Soils adjacent to waterways are usually poorly developed and contain high percentages of gravel and cobbles. This habitat type is also located within broad valleys where soils textures range from silt to clay loam. Water tables range from surface levels to greater than 1 m (39 in) below the soil surface during the growing season. Redoximorphic features (mottling or gleyed soil) are common at any depth. For those communities along waterways, the coarse textured soils, moderate stream gradients, and high coarse fragment contents throughout the soil profile provide an environment that produces a rapid movement of highly aerated groundwater. This type of substrate is important to many floodplain communities.

ADJACENT COMMUNITIES

Adjacent sites that are slightly wetter may support either the *Salix drummondiana/Carex rostrata* (Drummond willow/beaked sedge) habitat type or the *Salix drummondiana/Calamagrostis canadensis* (Drummond willow/bluejoint reedgrass) habitat type. In other situations, wetter sites may include the *Carex rostrata* (beaked sedge) or *Carex aquatilis* (water sedge) habitat types or open water. Drier sites may support a variety of types including the *Poa pratensis* (Kentucky bluegrass) and *Juncus balticus* (Baltic rush) community types, the *Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) habitat type or upland types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Stands of this type are often open, allowing for easy livestock access. Forage productivity is also high, resulting in potentially heavy utilization, especially as upland vegetation dries. *Poa pratensis* (Kentucky bluegrass) is a palatable and moderately productive grass, especially when soil moisture levels are high, and tolerates a high degree of defoliation. Herbage production is moderate. *Poa pratensis* (Kentucky bluegrass) is well adapted to grazing and is considered an increaser or an invader, especially if grazing intensities and durations are severe (Wasser 1982). This species can produce new shoots from both existing tillers or rhizomes. Grazing practices influence the type of growth form present (Volland 1978). A high density of weak, low vigor tillers results under season long grazing. Stem densities are emphasized over aboveground biomass. Grazing practices incorporating early season rest increase the vigor of individual plants. Fewer shoots may be produced, but total aboveground biomass tends to be greater.

Overuse by livestock will result in a reduced vigor by the willows present, as illustrated by uneven stem age distribution, highlining, clubbing, or dead clumps. With continued overuse, willows show a sharp decline in vigor and may be eventually eliminated from the site.

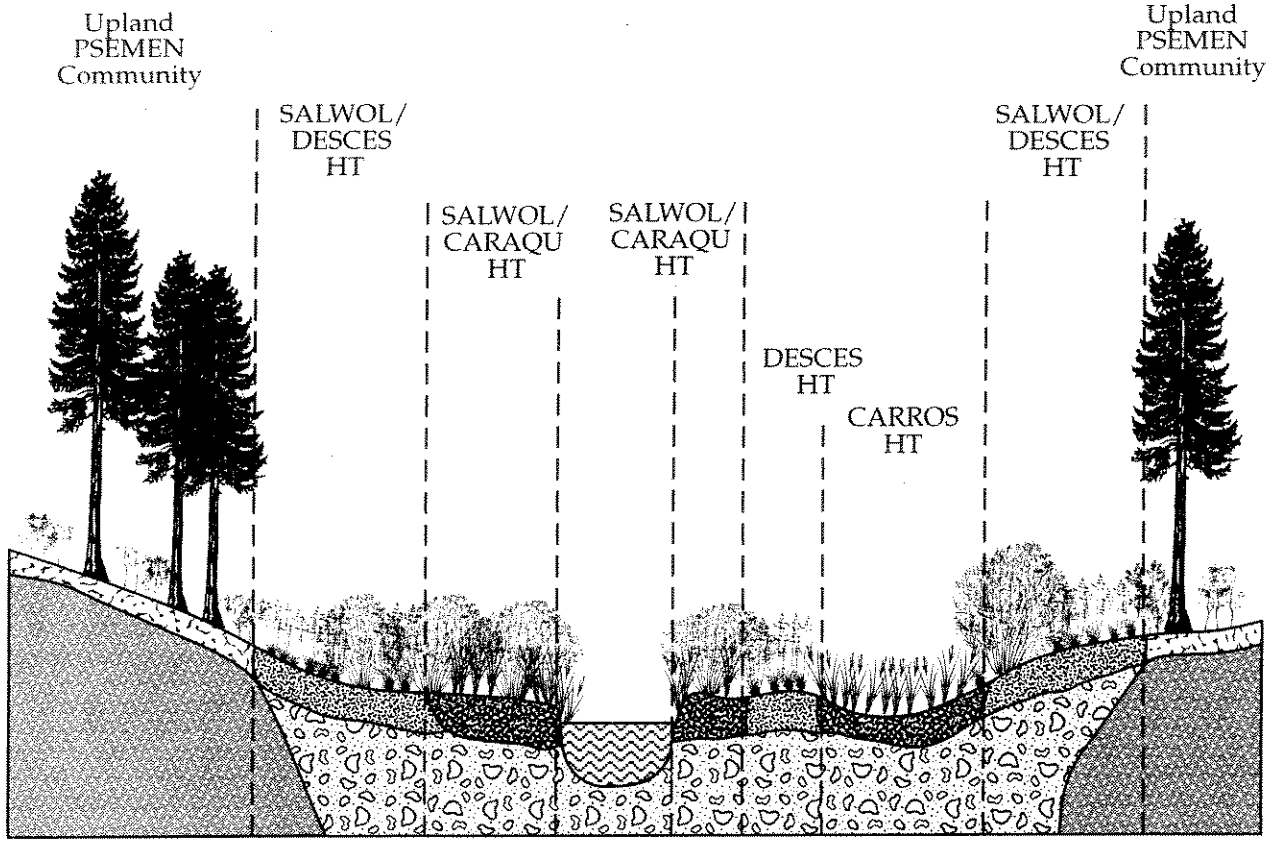
Personal observations by the authors tends to indicate that *Salix geyeriana* (Geyer willow) is a preferentially browsed species by livestock over *Salix boothii* (Booth willow). This may account for the reduced abundance and canopy cover of *Salix geyeriana* (Geyer willow) in select stands of the *Salix geyeriana* (Geyer willow) dominated types.

Wildlife

Abundant food, cover, and proximity to water provide habitat for numerous wildlife species such as mammals and songbirds. Summer and winter use by elk may be moderate (Gaffney 1941). Big game use of *Salix drummondiana* (Drummond willow)

SOUTHWESTERN MONTANA

CROSS-SECTION #2. Willow Complex



These are organic soils (Fibrists) with Histic epipedons usually greater than 40 cm thick and underlain by gravels. Hydric soil and wetland hydrology indicators are present.

These are most often mineral soils overlain by a shallow organic horizon (≤ 15cm) and underlain by gravels. Redoximorphic features and hydric indicators are common.

Upland soils. These soils are gravelly, shallow, and weakly developed (Inceptisols). There is rarely any bare soil or exposed rock, and shallow (<3 cm) duff layers are common.

Valley fill derived mostly from Tertiary sedimentary rocks with some igneous components

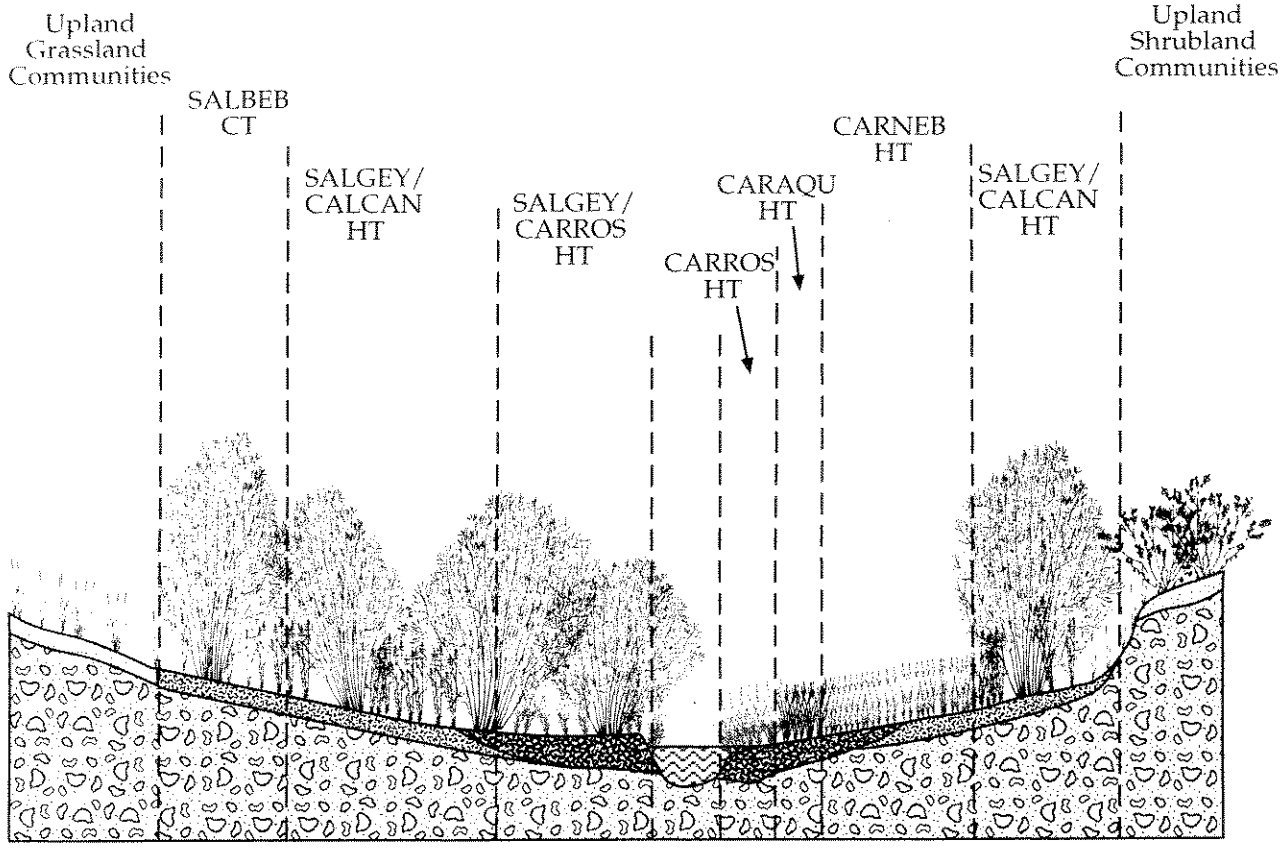
Tertiary sedimentary rock

Open water

Key: PSEMEN=*Pseudotsuga menziesii* (Douglas fir)
CARROS=*Carex rostrata* (beaked sedge)
SALWOL/CARAQU=*Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge)
SALWOL/DESCES=*Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass)
DESCES=*Deschampsia cespitosa* (tufted hairgrass)

SOUTHWESTERN MONTANA

CROSS-SECTION #3. Silted-In Beaver Dam Complex



These are organic soils with Histic epipedons usually greater than 30 cm thick. Redoximorphic features and wetland hydrology indicators are common.

These are most often mineral soils overlain by a shallow organic horizon (≤15 cm). Redoximorphic features and wetland hydology indicators are common.

Valley fill derived mostly from Tertiary sedimentary rocks with some igneous components

These soils are typically shallow and weakly-developed (Inceptisols or, occasionally, Aridisols).

Open water

Key: SALBEB=*Salix bebbiana* (Bebb willow)
SALGEY/CARROS=*Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge)
SALGEY/CALCAN=*Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass)
CARROS=*Carex rostrata* (beaked sedge)
CARAQU=*Carex aquatilis* (water sedge)
CARNEB=*Carex nebrascensis* (Nebraska sedge)

CONIFEROUS TREE TYPES

Abies grandis/Athyrium filix-femina Habitat Type (Grand Fir/Lady Fern Habitat Type)

ABIGRA/ATHFIL (ABGR/ATFI)
Number Of Stands Sampled = 14

LOCATION AND ASSOCIATED LANDFORMS

The *Abies grandis/Athyrium filix-femina* (grand fir/lady fern) habitat type is a minor type, occurring at mid elevations of the mountains and high valleys (Seeley Swan Valley) in western Montana. Elevations of sampled sites range from 869 to 1,409 m (2,850 to 4,620 ft). It occupies benches, toe slopes, and valley bottoms adjacent to mountain streams.

FLORISTIC CHARACTERISTICS

Abies grandis (grand fir) and *Picea* (spruce) are the dominant tree species in late seral stands. However, in some areas, *Abies lasiocarpa* (subalpine fir) persists as a minor climax species at upper elevations or in frost pocket locations. *Pseudotsuga menziesii* (Douglas fir) and *Larix occidentalis* (western larch) are often located on the drier edges of this habitat type. These sites are typically at or below the lower elevational limits of *Abies lasiocarpa* (subalpine fir) and outside the geographic range of *Thuja plicata* (western red cedar).

The overstory canopy cover is typically moderately open and undergrowth shrub cover is abundant. Shrub species with high constancy include: *Acer glabrum* (Rocky Mountain maple), *Rubus parviflorus* (thimbleberry), *Symphoricarpos albus* (common snowberry), and *Linnaea borealis* (twinflower). The herbaceous canopy is also abundant. Herbaceous species usually include: *Athyrium filix-femina* (ladyfern), *Galium triflorum* (sweetscented bedstraw), *Tiarella trifoliata* (trefoil foamflower), *Goodyera oblongifolia* (western rattlesnake-plantain), *Osmorhiza chilensis* (mountain sweet-cicely), *Pyrola secunda* (one-sided wintergreen), *Smilacina stellata* (starry Solomon-plume), and *Streptopus amplexifolius* (clasping-leaved twisted stalk).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Abies grandis (grand fir)	30	20-40	100
Abies lasiocarpa (subalpine fir)	3	0-3	20
Betula papyrifera (paper birch)	3	0-3	20
Larix occidentalis (western larch)	12	0-20	40
Picea spp. (spruce)	20	0-20	60
Populus trichocarpa (black cottonwood)	2	0-3	40
Pseudotsuga menziesii (Douglas fir)	9	0-20	60
Shrubs			
Acer glabrum (Rocky Mountain maple)	13	1-20	100

Alnus incana (mountain alder)	22	0-40	40
Amelanchier alnifolia (western serviceberry)	2	0-3	40
Berberis repens (creeping Oregongrape)	3	0-3	20
Betula occidentalis (water birch)	3	0-3	20
Chimaphila menziesii (little Prince's-pine)	1	0-1	20
Chimaphila umbellata (common Prince's pine)	1	0-1	40
Cornus stolonifera (red-osier dogwood)	40	0-40	20
Crataegus douglasii (black hawthorn)	3	0-3	20
Holodiscus discolor (ocean-spray)	1	0-1	20
Linnaea borealis (twinflower)	9	0-20	60
Lonicera ciliosa (orange honeysuckle)	1	0-1	20
Menziesia ferruginea (fool's huckleberry)	1	0-1	20
Pachistima myrsinites (mountain-boxwood)	1	0-1	20
Philadelphus lewisii (mockorange)	3	0-3	20
Ribes lacustre (swamp currant)	2	0-3	40
Rosa gymnocarpa (baldhip rose)	1	0-1	60
Rubus idaeus (red raspberry)	1	0-1	20
Rubus parviflorus (thimbleberry)	6	0-20	80
Salix scouleriana (Scouler willow)	1	0-1	20
Sambucus racemosa (red elderberry)	1	0-1	40
Sorbus scopulina (Cascade mountain-ash)	1	0-1	40
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	20
Symphoricarpos albus (common snowberry)	24	0-50	60
Symphoricarpos occidentalis (western snowberry)	3	0-3	20
Taxus brevifolia (Pacific yew)	1	0-1	40
Vaccinium globulare (globe huckleberry)	10	0-10	20
Graminoids			
Agrostis stolonifera (redtop)	20	0-20	20
Bromus vulgaris (Columbia brome)	1	0-1	40
Cinna latifolia (drooping woodreed)	1	0-1	60
Elymus glaucus (blue wildrye)	3	0-3	20
Melica subulata (Alaska oniongrass)	1	0-1	20
Phleum pratense (common timothy)	1	0-1	20
Poa pratensis (Kentucky bluegrass)	10	0-10	20
Forbs			
Actaea rubra (baneberry)	1	0-1	20
Adenocaulon bicolor (trail-plant)	12	0-20	40
Anemone piperi (Piper's anemone)	1	0-1	20
Aralia nudicaulis (wild sarsaparilla)	22	0-40	40
Arctium minus (common burdock)	10	0-10	20
Arnica cordifolia (heart-leaf arnica)	20	0-20	20
Arnica latifolia (broadleaf arnica)	20	0-20	20
Aster campestris (meadow aster)	1	0-1	20
Centaurea maculosa (spotted knapweed)	10	0-10	20
Circaea alpina (enchanter's nightshade)	1	0-1	60
Cirsium arvense (Canada thistle)	1	0-1	20
Cirsium vulgare (bull thistle)	3	0-3	20
Claytonia lanceolata (western springbeauty)	3	0-3	20

Clintonia uniflora (queen's cup)	1	0-3	60
Corallorhiza trifida (yellow coral-root)	1	0-1	20
Disporum hookeri (hooker fairy-bell)	40	0-40	20
Epilobium angustifolium (fireweed)	1	0-1	40
Fragaria spp. (strawberry)	1	0-1	20
Fragaria vesca (woods strawberry)	1	0-1	20
Galium aparine (goose-grass)	1	0-1	20
Galium boreale (northern bedstraw)	1	0-1	20
Galium triflorum (sweetscented bedstraw)	1	0-1	80
Geum macrophyllum (large-leaved avens)	10	0-10	20
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	60
Heracleum lanatum (cow-parsnip)	3	0-3	20
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	20
Mitella nuda (bare-stemed mitrewort)	10	0-10	20
Montia sibirica (Siberian springbeauty)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	1	1-3	100
Prunella vulgaris (self-heal)	1	0-1	20
Pyrola asarifolia (pink wintergreen)	3	0-3	40
Pyrola chlorantha (green wintergreen)	1	0-1	20
Pyrola secunda (one-sided wintergreen)	1	0-3	60
Pyrola uniflora (woodnymph)	1	0-1	20
Senecio triangularis (arrowleaf groundsel)	2	0-3	40
Smilacina racemosa (false spikenard)	1	0-1	40
Smilacina stellata (starry Solomon-plume)	5	0-10	60
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	80
Taraxacum officinale (common dandelion)	3	0-3	20
Thalictrum occidentale (western meadowrue)	2	0-3	40
Tiarella trifoliata (trefoil foamflower)	4	0-10	80
Trillium ovatum (white trillium)	1	0-1	20
Veratrum viride (green false hellebore)	1	0-1	20
Viola orbiculata (round-leaved violet)	1	0-1	60
Ferns and Allies			
Athyrium filix-femina (ladyfern)	27	0-60	60
Equisetum arvense (field horsetail)	5	0-10	40
Equisetum hyemale (common scouring-rush)	1	0-1	20
Equisetum laevigatum (smooth scouring-rush)	1	0-1	20
Gymnocarpium dryopteris (oak-fern)	1	0-1	20

SUCCESSIONAL INFORMATION

Following disturbances such as fire or logging, *Abies grandis* (grand fir), *Pseudotsuga menziesii* (Douglas fir), *Larix occidentalis* (western larch), and *Picea* (spruce) establish on this habitat type. In addition, *Betula papyrifera* (paper birch) may occupy some of the wetter sites of this type. Harvested stands are often colonized by a thick cover of *Alnus sinuata* (Sitka alder), *Pteridium aquilinum* (brakenfern), and/or *Rudbeckia occidentalis* (black head), and may slow tree regeneration. As the stand matures, *Abies grandis* (grand fir) is the only species that is successfully reproducing in the understory. Ferguson (1985) has noted *Abies grandis* (grand fir) and *Picea* (spruce) regenerate only on rotting logs and stumps. The undergrowth shrub and herb species list in mid-seral stands is comparable to that of climax stands, except that growth is more luxuriant in mid-seral stands.

SOILS

Soil textures vary from silt to sandy loam. Soils are typically well drained and water tables are usually within 1 m (39 in) of the soil surface in the spring. Cooper and others (1991) describe this habitat type as having high water tables during most of the growing season. Duff layers average 7 cm (3 in).

ADJACENT COMMUNITIES

The *Picea* (spruce) series may sometimes occupy wetter sites and the *Abies lasiocarpa* (subalpine fir) series is located on cooler wet sites. Adjacent upland sites may support the *Abies grandis/Asarum caudatum* (grand fir/wild ginger) habitat type, *Asarum caudatum* (wild ginger) phase, the *Abies grandis/Clintonia uniflora* (grand fir/queen's cup) habitat type, *Clintonia uniflora* (queen's cup) phase (Cooper and others 1991) or sites belonging to the *Pseudotsuga menziesii* (Douglas fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Timber

Timber productivity for *Abies grandis* (grand fir) and *Picea* (spruce) appears high. These sites are easily degraded through any disturbance, and susceptibility to windthrow may be unusually high. Harvested stands are often colonized by a thick cover of *Alnus sinuata* (Sitka alder), *Pteridium aquilinum* (brakenfern), and/or *Rudbeckia occidentalis* (black head), and may retard tree regeneration. High water tables during the spring or most of the season may exclude the use of heavy equipment in these sites.

Wildlife

Early successional stages provide large amounts of browse and forage for elk and deer. Browse and forage are greatly reduced in late-seral stands.

Soil Management and Rehabilitation Opportunities

High water tables may be present during spring or most of the year, and use of heavy equipment may need to be excluded from these sites.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

The *Abies grandis/Athyrium filix-femina* (grand fir/lady fern) habitat type is the same as the *Abies grandis/Senecio triangularis* (grand fir/arrowleaf groundsel) habitat type described for northern Idaho by Cooper and others (1991). In their work, Cooper and others (1991) decided to use *Senecio triangularis* (arrowleaf groundsel) as the diagnostic indicator species in the understory. However, we have chosen to use *Athyrium filix-femina* (lady fern) as the diagnostic indicator species in the understory thereby following the work done by Steele and others (1981) for the Nez Perce National Forest in Idaho where they described the *Abies grandis/Athyrium filix-femina* (grand fir/lady fern) habitat type. Finally, the *Abies grandis/Athyrium filix-femina* (grand fir/lady fern) habitat type is similar to the *Abies grandis/Clintonia uniflora* (grand

fir/queen cup) habitat type, *Aralia nudicaulis* (wild sarsaparilla) phase described by Pfister and others (1977).

Abies lasiocarpa/Actaea rubra Habitat Type
(Subalpine Fir/Baneberry Habitat Type)

ABILAS/ACTRUB (ABLA/ACRU)
Number Of Stands Sampled = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type is an incidental type at mid elevations in the mountains of central and southwestern Montana. Elevations of sampled sites range from 1,747 to 2,165 m (5,730 to 7,100 ft). This habitat type occurs on moist but drained alluvial terraces, lower slopes, and occasionally old landslides.

FLORISTIC CHARACTERISTICS

Climax stands are codominated by *Abies lasiocarpa* (subalpine fir), *Picea* (spruce), and *Pseudotsuga menziesii* (Douglas fir). The shrub understory is dominated by *Spirea betulifolia* (shiny-leaf spiraea) and *Symphoricarpos albus* (common snowberry). The herbaceous understory is dominated by *Carex geyeri* (elk sedge), *Arnica latifolia* (broadleaf arnica), *Actaea rubra* (baneberry), and *Thalictrum occidentale* (western meadowrue). *Actaea rubra* (baneberry) is the characteristic species and typically forms small clumps throughout the stands.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	32	20-40	100
Larix occidentalis (western larch)	20	0-20	20
Picea spp. (spruce)	45	0-60	80
Pinus contorta (lodgepole pine)	20	0-40	60
Pseudotsuga menziesii (Douglas fir)	31	0-60	80
Shrubs			
Acer glabrum (Rocky Mountain maple)	12	0-20	40
Alnus sinuata (Sitka alder)	1	0-1	20
Amelanchier alnifolia (western serviceberry)	1	0-3	60
Berberis repens (creeping oregongrape)	1	0-1	40
Cornus canadensis (bunchberry)	20	0-20	20
Cornus stolonifera (red-osier dogwood)	1	0-1	40
Linnaea borealis (twin flower)	1	0-1	40
Lonicera involucrata (twin-berry)	2	0-3	60
Lonicera utahensis (Utah honeysuckle)	1	0-1	80
Menziesia ferruginea (fool's huckleberry)	1	0-1	20
Pachistima myrsinites (mountain-boxwood)	3	0-3	20
Physocarpus malvaceus (mallow ninebark)	1	0-1	20
Ribes lacustre (swamp currant)	1	1-3	100
Rosa acicularis (prickly rose)	1	0-1	20

Rubus parviflorus(thimbleberry)	2	0-3	80
Salix scouleriana (Scouler willow)	1	0-1	40
Sambucus racemosa (red elderberry)	1	0-1	40
Shepherdia canadensis (Canada buffaloberry)	1	0-1	40
Sorbus scopulina (Cascade mountain-ash)	1	0-1	60
Spiraea betulifolia (shiny-leaf spiraea)	27	0-40	60
Symphoricarpos albus (common snowberry)	7	0-20	60
Vaccinium globulare (globe huckleberry)	12	0-20	40
Vaccinium myrtillus (dwarf bilberry)	1	0-1	20
Graminoids			
Bromus vulgaris (Columbia brome)	2	1-3	100
Carex concinnoides (northwestern sedge)	1	0-1	20
Carex geyeri (elk sedge)	12	0-20	40
Festuca occidentalis (western fescue)	1	0-1	40
Melica subulata (Alaska oniongrass)	2	0-3	40
Forbs			
Actaea rubra (baneberry)	13	1-20	100
Angelica arguta (sharptooth angelica)	1	0-1	20
Aquilegia flavescens (yellow columbine)	1	0-1	40
Arnica cordifolia (heart-leaf arnica)	1	0-1	20
Arnica latifolia (broadleaf arnica)	21	1-60	100
Aster conspicuus(showy aster)	1	0-1	60
Aster engelmannii (Engelmann's aster)	1	0-1	20
Aster foliaceus (leafy aster)	1	0-1	20
Calypso bulbosa (fairy-slipper)	1	0-1	20
Campanula rotundifolia (lady's-thimble)	1	0-1	20
Corallorhiza maculata (spotted coral-root)	1	0-1	20
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	20
Epilobium angustifolium (fireweed)	1	0-1	60
Erythronium grandiflorum (glacier-lily)	1	0-1	60
Fragaria vesca (woods strawberry)	1	0-1	20
Fragaria virginiana (Virginia strawberry)	1	0-1	40
Galium boreale (northern bedstraw)	1	0-1	40
Galium triflorum (sweetscented bedstraw)	1	0-3	80
Geranium richardsonii (white geranium)	2	0-3	40
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-3	80
Heracleum lanatum (cow parsnip)	2	0-3	40
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	20
Hydrophyllum capitatum (ballhead waterleaf)	1	0-1	20
Lathyrus ochroleucus (cream-flowered peavine)	1	0-1	40
Listera caurina (western twayblade)	1	0-1	20
Mitella stauropetala (side-flowered mitrewort)	3	0-3	20
Mitella trifida (three-tooth mitrewort)	3	0-3	20
Myosotis sylvatica (wood forget-me-not)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	1	1-3	100
Osmorhiza occidentalis (western sweet-cicely)	1	0-1	20
Pedicularis bracteosa (bracted lousewort)	1	0-1	60
Pedicularis racemosa (sickletop lousewort)	1	0-1	20

Pyrola asarifolia (pink wintergreen)	1	0-1	40
Pyrola chlorantha (green wintergreen)	1	0-1	20
Pyrola secunda (one-sided wintergreen)	1	1-3	100
Pyrola uniflora (woodnymph)	1	0-1	20
Senecio pseudaureus (streambank groundsel)	1	0-1	40
Smilacina racemosa (false spikenard)	1	0-1	60
Smilacina stellata (starry Solomon-plume)	1	0-3	60
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	20
Taraxacum officinale (common dandelion)	1	0-1	20
Thalictrum occidentale (western meadowrue)	5	1-20	100
Tiarella trifoliata (trefoil foamflower)	1	0-1	20
Trillium ovatum (white trillium)	1	0-1	20
Urtica dioica (stinging nettle)	1	0-1	20
Valeriana dioica (northern valerian)	40	0-80	40
Veratrum viride (green false hellebore)	1	0-1	60
Vicia americana (American vetch)	1	0-1	40
Viola adunca (Hook violet)	1	0-1	20
Viola orbiculata (round-leaved violet)	1	0-3	80
Xerophyllum tenax (beargrass)	1	0-1	20
Zigadenus elegans (glaucous zigadenus)	1	0-1	20
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-1	20
Equisetum arvense (field horsetail)	1	0-1	20
Equisetum hyemale (common scouring-rush)	1	0-1	20

SOILS

Most soils are Mollisols or Entisols (Fluvents). Soils commonly develop from noncalcareous alluvial parent material. Soil texture ranges from silt to loam. Water tables are less than 1 m (39 in) below the soil surface for some part of the growing season. Some sites have organic layers greater than 50 cm (20 in) in depth.

ADJACENT COMMUNITIES

The *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type is the driest wetland type in the *Abies lasiocarpa* series. Adjacent upland sites support other *Abies lasiocarpa* (subalpine fir) habitat types. Adjacent wetter sites include wetland habitat types from the *Abies lasiocarpa* series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Grazing potential is low.

Timber

Timber productivity is moderate to high. *Picea* (spruce) regeneration appears to establish easily wherever the shrub layer is reduced but *Abies lasiocarpa* (subalpine fir) regeneration may be sporadic. When present, *Pinus contorta* (lodgepole pine) and *Pseudotsuga menziesii* (Douglas fir) may be highly productive. Potentially high water tables during the spring and early summer may restrict the use of heavy equipment.

Wildlife

Forage productivity for big game is moderate and cover is low to moderate. This types moderate forage productivity and proximity to streams results in fairly heavy use by moose.

Soil Management and Rehabilitation Opportunities

In spring, when water tables are highest, soils in this habitat type are most susceptible to compaction; developmental activities should be planned with this problem in mind.

Recreational Uses and Considerations

Old growth stands with large diameter trees have high recreational and aesthetic values, but site development should take into account the difficulty of managing sites with high water tables.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

The *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type represents the wet end of the *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type described by Pfister and others (1977) for Montana and Steele and others (1983) for eastern Idaho and western Wyoming. Stands from the wet end of the *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type described by Pfister and others (1977) were used in defining the *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type.

Abies lasiocarpa/Calamagrostis canadensis Habitat Type
(Subalpine Fir/Bluejoint Reedgrass Habitat Type)

ABILAS/CALCAN (ABLA/CACA4)
Number Of Stands Sampled = 27

***(Calamagrostis canadensis* (Bluejoint Reedgrass) Phase = 17 stands)**
***(Ligusticum canbyi* (Canby's Licorice-root) Phase = 5 stands)**
***(Vaccinium cespitosum* (Dwarf Huckleberry) Phase = 5 stands)**

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type is a major type at mid to high elevations. Elevations of sampled sites range from 1,158 to 2,683 m (3,800 to 8,800 ft). It occurs along subirrigated stream terraces, pond margins, wet meadows, and moist toeslopes.

FLORISTIC CHARACTERISTICS

Abies lasiocarpa (subalpine fir) and *Picea* (spruce) may codominate climax stands, typically forming a moderately open to closed canopy. *Picea* (spruce) is often the dominant tree species in late successional stands. *Pinus contorta* (lodgepole pine) is also a major component of most climax stands. The upper limits of this habitat type may extend into the upper subalpine zone in protected basins. In these basins, *Pinus albicaulis* (white-bark pine) may be well represented; however, it is generally located on raised hummocks or drier sites within the stand. The diagnostic grass in all three phases is *Calamagrostis canadensis* (bluejoint reedgrass).

In the *Calamagrostis canadensis* (bluejoint reedgrass) phase, *Vaccinium scoparium* (whortleberry) may be present on drier raised hummocks. Herbaceous species include an abundant canopy cover of *Calamagrostis canadensis* (bluejoint reedgrass), *Senecio triangularis* (arrowleaf groundsel), *Thalictrum occidentale* (western meadowrue), and *Arnica latifolia* (broadleaf arnica).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Calamagrostis canadensis (bluejoint reedgrass) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	32	20-60	100
Picea spp. (spruce)	38	3-60	100
Pinus albicaulis (white-bark pine)	1	0-1	20
Pinus contorta (lodgepole pine)	17	0-40	50
Shrubs			
Alnus incana (mountain alder)	2	0-3	20
Amelanchier alnifolia (western serviceberry)	1	0-1	10
Berberis repens (creeping Oregongrape)	3	0-3	10
Chimaphila umbellata (common Prince's pine)	1	0-1	10
Cornus canadensis (bunchberry)	1	0-1	10
Cornus stolonifera (red-osier dogwood)	1	0-1	10
Gaultheria humifusa (alpine wintergreen)	1	0-1	20
Juniperus communis (common juniper)	1	0-1	20
Ledum glandulosum(Labrador-tea)	2	0-3	50
Linnaea borealis (twinflower)	20	0-20	10
Lonicera involucrata (twin-berry)	1	0-1	30
Lonicera utahensis (Utah honeysuckle)	1	0-3	40
Menziesia ferruginea (fool's huckleberry)	1	0-1	20
Ribes hudsonianum (stinking currant)	1	0-1	20
Ribes lacustre (swamp currant)	2	0-3	50
Rosa acicularis (prickly rose)	1	0-1	20
Rosa gymnocarpa (baldhip rose)	1	0-1	20
Rubus idaeus (red raspberry)	1	0-1	20
Rubus parviflorus (thimbleberry)	1	0-1	10
Salix scouleriana (Scouler willow)	1	0-1	10
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	20
Symphoricarpos albus (common snowberry)	1	0-1	10
Vaccinium globulare (globe huckleberry)	2	0-3	50

Vaccinium scoparium (whortleberry)	13	1-60	100
Graminoids			
Agrostis spp. (bentgrass)	1	0-1	10
Bromus ciliatus (fringed brome)	1	0-1	10
Bromus vulgaris (Columbia brome)	3	0-3	10
Calamagrostis canadensis (bluejoint reedgrass)	30	20-60	100
Calamagrostis rubescens (pinegrass)	1	0-3	30
Calamagrostis stricta (narrow-spiked reedgrass)	17	0-30	12
Carex concinnoides (northwestern sedge)	1	0-1	10
Carex disperma (soft-leaved sedge)	5	0-20	40
Carex rossii (Ross sedge)	1	0-1	30
Carex rostrata (beaked sedge)	1	0-1	10
Carex scopulorum (Holm's Rocky Mountain sedge)	20	0-60	30
Carex spp. (sedge)	3	0-3	10
Deschampsia cespitosa (tufted hairgrass)	1	0-1	10
Elymus glaucus (blue wildrye)	2	0-3	20
Glyceria elata (tall mannagrass)	3	0-3	10
Juncus spp. (rush)	1	0-1	10
Luzula hitchcockii (smooth woodrush)	3	0-3	10
Luzula parviflora (small-flowered woodrush)	1	0-1	40
Melica subulata (Alaska oniongrass)	1	0-1	10
Phleum alpinum (alpine timothy)	1	0-1	20
Poa interior (inland bluegrass)	1	0-1	10
Poa scabrella (pine bluegrass)	1	0-1	10
Trisetum spicatum (spike trisetum)	1	0-1	20
Forbs			
Achillea millefolium (common yarrow)	1	0-1	10
Actaea rubra (baneberry)	3	0-3	10
Angelica arguta (sharptooth angelica)	1	0-1	10
Antennaria microphylla (rosy pussy-toes)	1	0-1	10
Antennaria racemosa (raceme pussytoes)	1	0-1	10
Aquilegia flavescens (yellow columbine)	1	0-1	10
Aralia nudicaulis (wild sarsaparilla)	1	0-1	10
Arenaria macrophylla (bigleaf sandwort)	1	0-1	10
Arnica cordifolia (heart-leaf arnica)	2	0-3	30
Arnica latifolia (broadleaf arnica)	14	0-40	60
Arnica mollis (hairy arnica)	1	0-1	10
Aster conspicuus(showy aster)	1	0-1	20
Aster foliaceus (leafy aster)	1	0-1	10
Aster laevis (smooth aster)	1	0-1	10
Aster spp. (aster)	1	0-1	10
Campanula rotundifolia (lady's-thimble)	1	0-1	10
Conyza canadensis (horseweed)	20	0-20	10
Dodecatheon jeffreyi (tall mountain shooting star)	2	0-3	40
Epilobium alpinum (alpine willow-herb)	1	0-1	30
Epilobium angustifolium (fireweed)	1	0-1	40
Erigeron peregrinus (subalpine daisy)	7	0-20	30
Erythronium grandiflorum (glacier-lily)	1	0-1	40
Fragaria virginiana (Virginia strawberry)	1	0-1	50

Galium boreale (northern bedstraw)	1	0-1	10
Galium triflorum (sweetscented bedstraw)	1	0-1	20
Gentiana calycosa (explorer's gentian)	1	0-1	10
Geranium richardsonii (white geranium)	1	0-1	30
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	10
Habenaria obtusata (blunt-leaf rein-orchid)	1	0-1	20
Heracleum lanatum (cow-parsnip)	1	0-1	10
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	10
Hieracium gracile (alpine hawkweed)	1	0-1	20
Ligusticum canbyi (Canby's licorice-root)	1	0-1	30
Ligusticum tenuifolium (slender-leafed licorice-root)	10	0-20	20
Listera cordata (heart-leaf twayblade)	1	0-1	20
Lupinus spp. (lupine)	1	0-1	10
Mitella breweri (Brewer's mitrewort)	1	0-1	10
Mitella pentandra (five-stamened mitrewort)	1	0-3	50
Mitella stauropetala (side-flowered mitrewort)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	60
Pedicularis bracteosa (bracted lousewort)	1	0-1	40
Pedicularis contorta (coiled-beak lousewort)	1	0-1	10
Pedicularis racemosa (sickletop lousewort)	1	0-1	10
Potentilla flabellifolia (fan-leaf cinquefoil)	1	0-1	10
Prenanthes sagittata (arrow-leaf rattlesnake-root)	1	0-1	10
Prunella vulgaris (self-heal)	1	0-1	10
Pyrola asarifolia (pink wintergreen)	1	0-1	50
Pyrola secunda (one-sided wintergreen)	1	0-3	80
Pyrola uniflora (woodnymph)	1	0-1	30
Ranunculus spp. (buttercup)	1	0-1	10
Ranunculus uncinatus (little buttercup)	1	0-1	20
Rubus pubescens (dwarf red blackberry)	1	0-1	10
Saxifraga arguta (brook saxifrage)	10	0-20	20
Senecio pseudaureus (streambank groundsel)	1	0-1	40
Senecio triangularis (arrowleaf groundsel)	9	0-40	80
Smilacina stellata (starry Solomon-plume)	1	0-1	10
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-3	70
Thalictrum occidentale (western meadowrue)	2	0-3	70
Tiarella trifoliata (trefoil foamflower)	1	0-1	10
Trautvetteria caroliniensis (false bugbane)	1	0-1	6
Trifolium longipes (long-stalked clover)	1	0-1	20
Trillium ovatum (white trillium)	1	0-1	20
Trollius laxus (American globeflower)	1	0-1	40
Valeriana sitchensis (Sitka valerian)	1	0-3	60
Veratrum viride (green false hellebore)	2	0-3	30
Viola adunca (Hook violet)	1	0-3	30
Viola canadensis (Canada violet)	3	0-3	10
Viola macloskeyi (small white violet)	3	0-3	10
Viola orbiculata (round-leaved violet)	2	0-3	70
Xerophyllum tenax (beargrass)	4	0-20	50
Zigadenus elegans (glaucous zigadenus)	1	0-1	10

Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-1	10
Equisetum arvense (field horsetail)	5	0-20	40

The *Ligusticum canbyi* (Canby's licorice-root) phase is characterized by a high constancy of wet site herbs and a poorly represented shrub layer. *Vaccinium scoparium* (whortleberry) and *Ribes lacustre* (swamp currant) typically have sparse canopy coverages. Herbaceous species include: *Calamagrostis canadensis* (bluejoint reedgrass), *Ligusticum canbyi* (Canby's licorice-root), *Senecio triangularis* (arrowleaf groundsel), and *Dodecatheon jeffreyi* (tall mountain shooting star).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands of the *Ligusticum canbyi* (Canby's licorice-root) phase. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	20	0-20	80
Picea spp. (spruce)	35	0-60	80
Pinus contorta(lodgepole pine)	27	0-50	40
Shrubs			
Lonicera involucrata (twin-berry)	2	0-3	40
Ribes lacustre (swamp currant)	1	0-1	60
Vaccinium cespitosum (dwarf huckleberry)	1	0-1	20
Vaccinium scoparium (whortleberry)	5	0-10	60
Graminoids			
Calamagrostis canadensis (bluejoint reedgrass)	42	30-60	100
Forbs			
Arnica latifolia (broadleaf arnica)	1	0-1	40
Dodecatheon jeffreyi (tall mountain shooting star)	9	0-20	60
Erythronium grandiflorum (glacier-lily)	1	0-1	40
Galium triflorum (sweetscented bedstraw)	1	0-1	40
Geum macrophyllum (larged-leaved avens)	2	0-3	40
Ligusticum canbyi (Canby's licorice-root)	8	3-20	100
Lupinus argenteus (silvery lupine)	1	0-3	60
Pyrola asarifolia (pink wintergreen)	1	0-3	60
Senecio triangularis (arrowleaf groundsel)	14	0-40	60
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	60
Thalictrum occidentale (western meadowrue)	12	0-20	40
Trautvetteria caroliniensis (false bugbane)	10	0-10	20
Trollius laxus (American globeflower)	2	0-3	40
Viola orbiculata (round-leaved violet)	2	0-3	40
Ferns and Allies			
Equisetum pratense (meadow horsetail)	5	0-10	40

In the *Vaccinium cespitosum* (dwarf huckleberry) phase the shrub layer cover is abundant, and *Vaccinium cespitosum*

(dwarf huckleberry) and *Vaccinium scoparium* (whortleberry) are typically the dominant shrub species. Herbaceous species include: *Calamagrostis canadensis* (bluejoint reedgrass), *Arnica cordifolia* (heart-leaf arnica), and *Valeriana sitchensis* (Sitka valerian). Cooper and others (1991) indicate that this phase occurs in frost pockets that develop in lower elevation valleys or upland benches.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands of the *Vaccinium cespitosum* (dwarf huckleberry) phase. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	13	1-20	100
Picea spp. (spruce)	8	0-20	60
Pinus contorta (lodgepole pine)	56	40-80	100
Shrubs			
Juniperus communis (common juniper)	2	0-3	40
Ledum glandulosum (Labrador-tea)	2	0-3	40
Lonicera utahensis (Utah honeysuckle)	1	0-3	60
Shepherdia canadensis (Canada buffaloberry)	1	0-1	40
Spiraea betulifolia (shiny-leaf spiraea)	2	0-3	40
Vaccinium cespitosum (dwarf huckleberry)	25	3-60	100
Vaccinium scoparium (whortleberry)	27	0-40	60
Graminoids			
Calamagrostis canadensis (bluejoint reedgrass)	36	20-60	100
Calamagrostis rubescens (pinegrass)	30	0-60	40
Carex geyeri (elk sedge)	10	0-20	40
Elymus glaucus (blue wildrye)	2	0-3	40
Luzula campestris (field woodrush)	1	0-1	40
Trisetum spicatum (spike trisetum)	1	0-1	40
Forbs			
Achillea millefolium (common yarrow)	1	0-1	40
Antennaria racemosa (raceme pussy-toes)	1	0-1	40
Arnica cordifolia (heart-leaf arnica)	14	0-20	60
Arnica latifolia (broadleaf arnica)	2	0-3	60
Epilobium angustifolium (fireweed)	1	0-1	60
Erythronium grandiflorum (Glacier-lily)	3	0-3	40
Fragaria virginiana (Virginia strawberry)	1	0-3	60
Heracleum lanatum (cow-parsnip)	1	0-1	40
Potentilla diversifolia (diverse-leaved cinquefoil)	1	0-1	40
Pyrola secunda (one-sided wintergreen)	1	0-1	40
Taraxacum officinale (common dandelion)	1	0-1	40
Thalictrum occidentale (western meadowrue)	2	0-3	40
Valeriana sitchensis (Sitka valerian)	9	0-20	60
Veratrum viride (green false hellebore)	2	0-3	40
Viola adunca (Hook violet)	1	0-1	40

Viola orbiculata (round-leaved violet)	2	0-1	40
Zigadenus elegans (glaucous zigadenus)	1	0-1	40
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	40

SUCCESSIONAL INFORMATION

Pinus contorta (lodgepole pine) and *Picea* (spruce) are the major seral conifers of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type, establishing after logging or the occasional hot fire. In time, *Abies lasiocarpa* (subalpine fir) and *Picea* (spruce) eventually dominate the stands.

On some sites where big game browse is fairly productive, big game has had a significant impact on secondary succession (Steele and others 1983). In some stands, overwintering moose may browse young *Abies lasiocarpa* (subalpine fir) to the point that succession is slowed dramatically. In these instances, the stands may superficially appear as *Pseudotsuga menziesii* (Douglas fir) or *Picea* (spruce) climax. In the latter case, the stands may key to the *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type. The *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type is considered a late seral stage of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type described by Pfister and others (1977), Steele and others (1981, 1983), and Mauk and Henderson (1984). Only close observation of these stands will reveal the remnants of *Abies lasiocarpa* (subalpine fir) as the indicated climax species. In other stands the greatest impacts may be on the major seral shrub species and *Populus tremuloides* (quaking aspen).

SOILS

Soil textures range from silt to sandy loam. These soils are typically poorly drained and have developed from noncalcareous parent material. Duff layers were absent on sites subject to flooding, yet were 10 to 15 cm (4 to 5 in) on sites near seeps. Soil reaction ranged from strongly acid to slightly acid (pH 6.0 to 5.0).

ADJACENT COMMUNITIES

Wetter sites are often dominated by various *Carex* (sedge) species and stands of *Alnus incana* (mountain alder) and *Calamagrostis inexpansa* (northern reedgrass). Adjacent drier, well drained sites support the *Abies lasiocarpa/Vaccinium scoparium* (subalpine fir/whortleberry) and *Abies lasiocarpa/Menziesia ferruginea* (subalpine fir/fool's huckleberry) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value is moderate to high. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Continued close utilization results in decreased *Calamagrostis canadensis* (bluejoint reedgrass) production.

In addition, the adjacent streams may attract many animals. However, during wet periods, grazing can churn the wet soil and destroy plant cover, as well as limit conifer establishment.

Timber

Timber productivity is moderate to high. *Picea engelmannii* (Engelmann spruce) and *Pinus contorta* (lodgepole pine) are the most productive timber species on these sites. Clearcutting may be the preferred harvest method because of the shallow rooting and subsequent windthrow on these high water table sites. Narrow stands along streams can sometimes be selectively

cut at light levels (less than 30 percent of the basal area) with minimal damage to the site. Regeneration difficulties may result from high water tables and competition from graminoids after harvest, especially where sites are clearcut. Site preparation should be restricted to a brief period in late summer when sites are dry enough to support machinery. Planting of *Picea* species (spruce) in contour trenches has been successful where grazing was restricted. When all things are considered, this type may be more of a "problem" than a "resource" from a timber management standpoint, due to the high water table and regeneration problems.

Wildlife

Browse production and cover levels are good to excellent for elk, deer, bear, and moose. Good cover is also provided for upland game and small mammals. Overwintering moose can have a tremendous impact on seedlings of *Abies lasiocarpa* (subalpine fir) (see the discussion in the seral stages section of this habitat type). Reduction or elimination of the seral shrub species tends to hasten succession toward climax with less suitable food being available for big game (Steele and others 1983). In this case, logging or burning the stand may renew production of the browse species.

Soil Management and Rehabilitation Opportunities

Wet and moist soils are subject to compaction or other damage for a major portion of the growing season. Heavy equipment should not be used on this type in spring and summer when water tables are high. Roads and trails should be located on adjacent uplands. Protection of water resources is a major consideration in any management activity in this habitat type. *Calamagrostis canadensis* (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Recreational Uses and Considerations

The streamside locations may attract recreationists, but these wet sites are poorly suited for roads, trails, and recreational developments.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

This habitat type and its phases are equivalent to that described by Cooper and others (1991) for northern Idaho. This habitat type is also equivalent to that described by Pfister and others (1977) except that the *Galium triflorum* (sweetscented bedstraw) phase was deleted and a *Ligusticum canbyi* (Canby's licorice-root) phase was added. The habitat type has also been described for Idaho and western Wyoming by Steele and others (1981, 1983). Similar community types have been described for the east slope of the Canadian Rockies by Ogilvie (1962), the Uinta Range in Utah by Mauk and Henderson (1984), and for Utah and southeastern Idaho (Padgett and others 1989).

Abies lasiocarpa/Galium triflorum Habitat Type
(Subalpine Fir/Sweetscented Bedstraw Habitat Type)

ABILAS/GALTRI (ABLA/GATR3)
Number Of Stands Sampled = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type is a minor type in the mountains of central and eastern Montana. Sites are located on moist valley bottoms and occasionally near seeps. In dry mountain areas, sites are confined to stream bottoms. It occurs at middle elevations from approximately 1,439 to 2,440 m (4,720 to 8,000 ft).

FLORISTIC CHARACTERISTICS

Picea (spruce) rather than *Abies lasiocarpa* (subalpine fir) is usually the overstory dominant in all but the oldest stands of this habitat type. In those stands with large amounts of *Picea* (spruce), the stand structure data indicates that *Abies lasiocarpa* (subalpine fir) is potentially the climax dominant. *Pseudotsuga menziesii* (Douglas fir) and *Pinus contorta* (lodgepole pine) are present in seral stands. Characteristic undergrowth species are *Galium triflorum* (sweetscented bedstraw), *Osmorhiza chilensis* (mountain sweet-cicely), *Angelica arguta* (sharptooth angelica), *Pyrola secunda* (one-sided wintergreen), and *Smilacina stellata* (starry Solomon-plume).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	25	3-60	100
Picea spp. (spruce)	66	60-80	100
Pinus contorta (lodgepole pine)	12	0-20	40
Populus tremuloides (quaking aspen)	3	0-3	20
Pseudotsuga menziesii (Douglas fir)	20	0-20	20
Shrubs			
Acer glabrum (Rocky Mountain maple)	40	0-40	20
Amelanchier alnifolia (western serviceberry)	1	0-3	60
Arctostaphylos uva-ursi (kinnikinnick)	1	0-1	20
Berberis repens (creeping oregongrape)	2	0-3	80
Chimaphila umbellata (common Prince's pine)	1	0-1	20
Clematis occidentalis (Columbia clematis)	1	0-1	20
Cornus canadensis (bunchberry)	10	0-10	20
Cornus stolonifera (red-osier dogwood)	2	0-3	40
Crataegus douglasii (black hawthorn)	1	0-1	20
Juniperus communis (common juniper)	1	0-1	20
Ledum glandulosum (Labrador-tea)	3	0-3	20
Linnaea borealis (twinflower)	22	0-40	40
Lonicera involucrata (twin-berry)	2	0-3	60
Lonicera utahensis (Utah honeysuckle)	1	0-1	40
Menziesia ferruginea (fool's huckleberry)	3	0-3	20
Prunus virginiana (common chokecherry)	3	0-3	20

Rhamnus alnifolia (alder buckthorn)	3	0-3	20
Ribes lacustre (swamp currant)	1	0-1	80
Rosa acicularis (prickly rose)	1	0-1	60
Rubus parviflorus (thimbleberry)	3	0-3	20
Shepherdia canadensis (Canada buffaloberry)	3	0-3	20
Spiraea betulifolia (shiny-leaf spiraea)	8	0-20	60
Symphoricarpos albus (common snowberry)	8	0-20	60
Vaccinium globulare (globe huckleberry)	20	0-20	20
Vaccinium myrtillus (dwarf bilberry)	3	0-3	20
Vaccinium scoparium (whortleberry)	12	0-20	40
Graminoids			
Bromus carinatus (mountain brome)	2	0-3	40
Bromus ciliatus (fringed brome)	1	0-1	20
Bromus inermis (smooth brome)	1	0-1	20
Bromus vulgaris (columbia brome)	1	0-3	60
Calamagrostis canadensis (bluejoint reedgrass)	1	0-1	20
Calamagrostis rubescens (pinegrass)	8	0-20	60
Carex concinnoides (northwestern sedge)	1	0-1	20
Carex geyeri (elk sedge)	1	0-1	40
Carex leptalea (bristle-stalked sedge)	1	0-1	20
Elymus glaucus (blue wildrye)	1	0-1	80
Festuca occidentalis (western fescue)	1	0-1	20
Glyceria borealis (northern mannagrass)	1	0-1	20
Oryzopsis asperifolia (roughleaf ricegrass)	3	0-3	20
Forbs			
Actaea rubra (baneberry)	1	0-1	80
Allium cernuum (nodding onion)	1	0-1	20
Angelica arguta (sharptooth angelica)	1	1-3	100
Aquilegia flavescens (yellow columbine)	1	0-1	40
Arnica cordifolia (heart-leaf arnica)	3	0-3	60
Arnica latifolia(broadleaf arnica)	25	0-40	40
Aster conspicuus (showy aster)	14	0-40	60
Aster engelmannii (Engelmann's aster)	1	0-1	20
Aster foliaceus (leafy aster)	1	0-1	20
Aster laevis (smooth aster)	1	0-1	20
Aster modestus (few-flowered aster)	1	0-1	20
Campanula parryi (Parry's bellflower)	1	0-1	20
Campanula rotundifolia (lady's-thimble)	1	0-1	40
Castilleja miniata (scarlet paintbrush)	1	0-1	20
Cerastium arvense (field chickweed)	1	0-1	20
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	60
Epilobium angustifolium (fireweed)	1	0-1	60
Fragaria vesca (woods strawberry)	1	0-1	20
Fragaria virginiana (Virginia strawberry)	1	0-1	80
Galium boreale (northern bedstraw)	1	0-1	60
Galium triflorum (sweetscented bedstraw)	1	1-3	100
Geranium richardsonii (white geranium)	1	0-1	60
Geranium viscosissimum (sticky geranium)	1	0-1	20
Geum macrophyllum (large-leaved avens)	1	0-1	20

Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	60
Habernaria saccata (slender bog-orchid)	1	0-1	20
Hedysarum sulphurescens (yellow hedysarum)	1	0-1	20
Heracleum lanatum (cow-parsnip)	1	0-1	40
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	40
Mitella nuda (bare-stemed mitrewort)	10	0-10	20
Mitella stauropetala (side-flowered mitrewort)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	1	1-3	100
Osmorhiza occidentalis (western sweet-cicely)	1	0-1	20
Pedicularis bracteosa (bracted lousewort)	1	0-1	20
Potentilla richardsonii (Richardson's pondweed)	20	0-20	20
Pyrola asarifolia (pink wintergreen)	1	0-1	60
Pyrola chlorantha (green wintergreen)	1	0-1	60
Pyrola secunda (one-sided wintergreen)	1	1-3	100
Pyrola uniflora (woodnymph)	1	0-1	40
Senecio pseudaureus (streambank groundsel)	1	0-1	20
Senecio triangularis (arrowleaf groundsel)	1	0-1	40
Smilacina racemosa (false spikenard)	1	0-1	40
Smilacina stellata (starry Solomon-plume)	1	1-1	100
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	40
Taraxacum officinale (common dandelion)	1	0-1	40
Thalictrum occidentale (western meadowrue)	10	0-20	80
Thalictrum venulosum (veiny meadowrue)	1	0-1	20
Trillium ovatum (white trillium)	1	0-1	20
Valeriana sitchensis (Sitka valerian)	1	0-1	20
Viola adunca (Hook violet)	1	0-1	20
Viola canadensis (Canada violet)	1	0-1	40
Viola orbiculata (round-leaved violet)	1	0-1	60
Xerophyllum tenax (beargrass)	1	0-1	20
Zigadenus elegans (glaucous zigadenus)	1	0-1	20
Ferns and Allies			
Botrychium virginianum (Virginia grape-fern)	1	0-1	40
Equisetum arvense (field horsetail)	25	0-80	80
Equisetum hyemale (common scouring-rush)	1	0-1	20

SUCCESSIONAL INFORMATION

Picea (spruce), *Pseudotsuga menziesii* (Douglas fir), and *Pinus contorta* (lodgepole pine) are usually present in seral stands.

On some sites where big game browse is fairly productive, big game has had a significant impact on secondary succession (Steele and others 1983). In some stands, overwintering moose may browse young *Abies lasiocarpa* (subalpine fir) to the point that succession is slowed dramatically. In these instances, the stands may superficially appear as *Pseudotsuga menziesii* (Douglas fir) or *Picea* (spruce) climax. Only close observation of these stands will reveal the remnants of *Abies lasiocarpa* (subalpine fir) as the indicated climax species. In other stands the greatest impacts may be on the major seral shrub species and *Populus tremuloides* (quaking aspen).

SOILS

Soils textures range from loams to silts. Gravels are largely absent from surface horizons. Sites may have surface water in early spring and generally remain moist throughout the summer. Duff layers averaged 6 cm (2.4 in) in depth. Soil reactions ranged from strongly acid to neutral.

ADJACENT COMMUNITIES

Wetter extremes of this habitat type are transitional to the *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/clasping-leaved twisted stalk) habitat type, the *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type, or the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type. Adjacent drier sites support a range of habitat types in the *Pseudotsuga menziesii* (Douglas fir), *Abies lasiocarpa* (subalpine fir), and *Picea engelmannii* (Engelmann spruce) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value is moderate to high. Livestock may use this type for shade and bedding, especially where stands are near meadows and water. Grazing during wet periods, however, can churn the wet soil and destroy plant cover as well as limit conifer establishment.

Timber

Timber productivity is moderate. High water tables in spring may preclude logging activities at that time. Partial cutting generally favors *Abies lasiocarpa* (subalpine fir). *Picea* (spruce), *Pseudotsuga menziesii* (Douglas fir), and *Pinus contorta* (lodgepole pine) will be favored by complete stand removal, and may result in mixed stands depending upon the site and exiting coniferous species.

Wildlife

Browse production and cover levels are good to excellent for elk, deer, bear, and moose. Good cover is also provided for upland game and small mammals. Overwintering moose can have a tremendous impact on seedlings of *Abies lasiocarpa* (subalpine fir) (see the discussion in the seral stages section of this habitat type). Reduction or elimination of the seral shrub species tends to hastens succession toward climax with less suitable food being available for big game (Steele and others 1983). In this case, logging or burning the stand may renew production of the browse species.

Soil Management and Rehabilitation Opportunities

Moist, fine textured soils are subject to early season compaction. Equipment should not be used on this type in spring or early summer when the soil is moist due to high water tables.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

This habitat type represents a finer subdivision of the *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type described by Pfister and others (1977) for Montana. The *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type from the 1977 document *Forest Habitat Types of Montana* by Pfister and others was redefined with some stands becoming part of either the *Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) habitat type or the *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat type described in this document.

Abies lasiocarpa/Ledum glandulosum Habitat Type
(Subalpine Fir/Labrador Tea Habitat Type)

ABILAS/LEDGLA (ABLA/LEGL)
Number Of Stands Sampled = 17

(*Calamagrostis canadensis* (Bluejoint Reedgrass) Phase = 9 stands)
(*Ledum glandulosum* (Labrador Tea) Phase = 8 stands)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Ledum glandulosum* (subalpine fir/Labrador tea) habitat type is a minor type at mid to high elevations in Montana. The greatest amount is located in the eastern portion of the Kootenai National Forest and the western portion of the Flathead National Forest near the Tally Lake Ranger District. The *Calamagrostis canadensis* (bluejoint reedgrass) phase represents the wet phase while the *Ledum glandulosum* (Labrador tea) phase represents the dry phase of this habitat type. The *Calamagrostis canadensis* (bluejoint reedgrass) phase is associated with low gradient streams and wet meadows. The *Ledum glandulosum* (Labrador tea) phase is associated with hillsides that are typically only wet in the spring and/or early summer. Elevations of sampled sites range from 1,402 to 2,684 m (4,600 to 8,800 ft).

FLORISTIC CHARACTERISTICS

Pinus contorta (lodgepole pine) and *Picea engelmannii* (Engelmann spruce) are the dominant conifers. The undergrowth is dominated by *Ledum glandulosum* (Labrador tea), *Calamagrostis canadensis* (bluejoint reedgrass), and *Vaccinium scoparium* (whortleberry). Associated forbs of this habitat type include *Arnica latifolia* (broadleaf arnica).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Calamagrostis canadensis (bluejoint reedgrass) wet phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	16	3-40	100
Picea spp. (spruce)	28	10-60	100
Pinus albicaulis (white-bark pine)	1	0-1	17
Pinus contorta (lodgepole pine)	16	0-20	67
Pseudotsuga menziesii (Douglas fir)	1	0-1	17
Shrubs			
Amelanchier alnifolia (western serviceberry)	1	0-1	17
Cornus canadensis (bunchberry)	2	0-3	50

Ledum glandulosum (Labrador-tea)	48	30-70	100
Linnaea borealis (twinflower)	9	0-20	50
Lonicera caerulea (sweet-berry honeysuckle)	1	0-1	17
Lonicera involucrata (twin-berry)	1	0-1	17
Lonicera utahensis (Utah honeysuckle)	3	0-3	17
Pachistima myrsinites (mountain-boxwood)	1	0-1	17
Phyllodoce empetriformis (red mountain-heath)	1	0-1	17
Rosa woodsii (woods rose)	1	0-1	17
Salix scouleriana (Scouler willow)	1	0-1	17
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	17
Vaccinium cespitosum (dwarf huckleberry)	5	0-10	33
Vaccinium myrtillus (dwarf bilberry)	40	0-40	17
Vaccinium scoparium (whortleberry)	20	0-60	83
Graminoids			
Bromus inermis (smooth brome)	3	0-3	17
Calamagrostis canadensis (bluejoint reedgrass)	21	3-60	100
Calamagrostis rubescens (pinegrass)	3	0-3	17
Calamagrostis stricta (narrow-spiked reedgrass)	3	0-3	17
Carex brevior (short-beaked sedge)	1	0-1	17
Cares disperma (soft-leaved sedge)	1	0-1	17
Carex illota (sheep sedge)	10	0-10	17
Carex microptera (small-winged sedge)	3	0-3	17
Carex scopulorum (Holm's Rocky Mountain sedge)	22	0-40	33
Deschampsia cespitosa (tufted hairgrass)	1	0-1	17
Elymus glaucus (blue wildrye)	20	0-20	17
Juncus drummondii (Drummond's rush)	1	0-3	50
Luzula parviflora (small-flowered woodrush)	1	0-1	33
Melica subulata (Alaska oniongrass)	10	0-10	17
Trisetum canescens (tall trisetum)	1	0-1	17
Forbs			
Arnica cordifolia (heart-leaf arnica)	2	0-3	33
Arnica latifolia (broadleaf arnica)	11	0-30	83
Arnica mollis (hairy arnica)	8	0-20	50
Campanula rotundifolia (lady's-thimble)	1	0-1	33
Clintonia uniflora (queen's cup)	2	0-3	33
Dodecatheon jeffreyi (tall mountain shooting star)	3	0-3	33
Epilobium alpinum (alpine willow-herb)	1	0-1	17
Epilobium angustifolium (fireweed)	1	0-1	33
Erigeron peregrinus (subalpine daisy)	1	0-3	50
Erythronium grandiflorum (glacier-lily)	2	0-3	33
Fragaria virginiana (Virginia strawberry)	1	0-3	50
Galium triflorum (sweetscented bedstraw)	1	0-1	17
Habernaria dilatata (white orchis)	1	0-1	50
Haplopappus lanuginosus (woolly goldenweed)	1	0-1	17
Heracleum lanatum (cow-parsnip)	1	0-1	17
Hieracium umbellatum (narrow-leaved hawkweed)	1	0-1	17
Ligusticum tenuifolium (slender-leafed licorice-root)	2	0-3	33
Listera cordata (heart-leaf twayblade)	1	0-1	17
Lupinus argenteus (silvery lupine)	1	0-1	33

Lupinus spp. (lupine)	1	0-1	17
Mitella breweri (Brewer's mitrewort)	1	0-1	17
Mitella pentandra (five-stamened mitrewort)	1	0-1	17
Mitella spp. (mitrewort)	1	0-1	17
Montia chamissoi (water montia)	1	0-1	17
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	17
Pedicularis groenlandica (elephant's head)	1	0-1	17
Pyrola asarifolia (pink wintergreen)	1	0-1	33
Pyrola minor (snowline pyrola)	1	0-1	33
Pyrola secunda (one-sided wintergreen)	1	0-1	50
Pyrola spp. (wintergreen)	1	0-1	17
Ranunculus spp. (buttercup)	1	0-1	17
Ranunculus uncinatus (little buttercup)	1	0-1	17
Saxifraga arguta (brook saxifrage)	1	0-1	17
Senecio triangularis (arrowleaf groundsel)	1	0-1	50
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-1	33
Taraxacum officinale (common dandelion)	1	0-1	17
Thalictrum venulosum (veiny meadowrue)	3	0-3	17
Tiarella trifoliata (trefoil foamflower)	1	0-1	17
Trifolium longipes (long-stalked clover)	1	0-1	17
Trollius laxus (American globeflower)	1	0-3	50
Valeriana sitchensis (Sitka valeriana)	1	0-1	33
Veratrum viride (green false hellebore)	3	0-3	17
Veronica wormskjoldii (Wormsskjold speedwell)	1	0-1	17
Viola macloskeyi (small white violet)	30	0-30	17
Viola orbiculata (round-leaved violet)	1	0-3	67
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	33
Equisetum hyemale (common scouring-rush)	10	0-10	11
Equisetum pratense (meadow horsetail)	1	0-1	17
Lycopodium sitchense (Alaska clubmoss)	3	0-3	17

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Ledum glandulosum (Labrador tea) dry phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	10	3-20	100
Picea spp. (spruce)	36	20-60	100
Pinus albicaulis (white-bark pine)	14	0-20	60
Pinus contorta (lodgepole pine)	20	0-20	80
Shrubs			
Cornus canadensis (bunchberry)	3	0-3	13
Gaultheria humifusa (alpine wintergreen)	22	0-40	40

Ledum glandulosum (Labrador tea)	36	20-40	100
Lonicera caerulea (sweet-berry honeysuckle)	1	0-1	20
Lonicera involucrata (twin-berry)	1	0-1	20
Lonicera utahensis (Utah honeysuckle)	1	0-1	20
Linnaea borealis (twinflower)	20	0-20	13
Phyllodoce empetriformis (red mountain-heath)	7	0-20	60
Vaccinium globulare (globe huckleberry)	20	0-20	20
Vaccinium scoparium (whortleberry)	40	20-60	100
Graminoids			
Calamagrostis canadensis (bluejoint reedgrass)	3	0-3	60
Calamagrostis rubescens (pinegrass)	5	0-10	25
Carex brevior (short-beaked sedge)	1	0-1	20
Carex geyeri (elk sedge)	1	0-1	20
Carex illota (sheep sedge)	20	0-20	20
Carex microptera (small-winged sedge)	3	0-3	20
Carex rossii (Ross sedge)	1	0-1	20
Carex scopulorum (Holm's Rocky Mountain sedge)	20	0-40	40
Deschampsia cespitosa (tufted hairgrass)	1	0-1	20
Elymus glaucus (blue wildrye)	3	0-3	20
Juncus drummondii (Drummond's rush)	3	0-3	40
Juncus mertensianus (Merten's rush)	1	0-1	20
Luzula parviflora (small-flowered woodrush)	1	0-1	20
Poa nervosa (Wheeler's bluegrass)	1	0-1	20
Trisetum spicatum (spike trisetum)	1	0-1	20
Forbs			
Angelica arguta (sharptooth angelica)	1	0-1	20
Antennaria microphylla (rosy pussy-toes)	1	0-1	20
Antennaria racemosa (raceme pussy-toes)	1	0-1	20
Aquilegia flavescens (yellow columbine)	1	0-1	40
Arnica cordifolia (heart-leaf arnica)	20	0-20	20
Arnica latifolia (broadleaf arnica)	7	0-20	80
Arnica mollis (hairy arnica)	3	0-3	20
Aster engelmannii (Engelmann's aster)	1	0-1	20
Aster laevis (smooth aster)	1	0-1	20
Aster spp. (aster)	1	0-1	20
Castilleja rhexifolia (rhexia-leaved paintbrush)	1	0-1	40
Dodecatheon jeffreyi (tall mountain shooting star)	8	0-20	60
Epilobium alpinum (alpine willow-herb)	1	0-1	20
Epilobium angustifolium (fireweed)	1	0-1	80
Erigeron peregrinus (subalpine daisy)	1	0-1	60
Erythronium grandiflorum (glacier-lily)	1	0-3	60
Fragaria virginiana (Virginia strawberry)	1	0-1	20
Gentiana calycosa (explorer's gentian)	1	0-1	20
Habernaria dilatata (white orchis)	1	0-1	20
Hieracium gracile (alpine hawkweed)	1	0-1	20
Ligusticum canbyi (Canby's licorice-root)	1	0-1	20
Ligusticum tenuifolium (slender-leafed licorice-root)	1	0-1	60
Lupinus argenteus (silvery lupine)	1	0-1	20

Lupinus spp. (lupine)	2	0-3	40
Mitella breweri (Brewer's mitrewort)	1	0-1	20
Mitella pentandra (five-stamened mitrewort)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	2	0-3	40
Pedicularis bracteosa (bracted lousewort)	1	0-1	60
Pedicularis contorta (coiled-beak lousewort)	1	0-1	20
Pyrola asarifolia (pink wintergreen)	1	0-1	20
Pyrola chlorantha (green wintergreen)	1	0-1	20
Pyrola minor (snowline pyrola)	1	0-1	20
Pyrola secunda (one-sided wintergreen)	1	0-1	20
Senecio triangularis (arrowleaf groundsel)	1	1-1	100
Thalictrum occidentale (western meadowrue)	1	0-1	20
Trollius laxus (American globeflower)	1	0-3	80
Valeriana sitchensis (Sitka valeriana)	1	0-1	80
Veratrum viride (green false hellebore)	12	0-20	40
Veronica wormskjoldii (Wormsskjold speedwell)	1	0-1	40
Viola macloskeyi (small white violet)	3	0-3	20
Viola orbiculata (round-leaved violet)	2	0-3	40
Xerophyllum tenax (beargrass)	20	0-20	20
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-1	20

SUCCESSIONAL INFORMATION

Pinus contorta (lodgepole pine) and *Picea* species (spruce) are the major seral dominants in younger stands. On some sites where big game browse is fairly productive, big game has had a significant impact on secondary succession (Steele and others 1983). In some stands, overwintering moose may browse young *Abies lasiocarpa* (subalpine fir) to the point that succession is slowed dramatically. In these instances, the stands may superficially appear as *Pseudotsuga menziesii* (Douglas fir) or *Picea* (spruce) climax. Only close observation of these stands will reveal the remnants of *Abies lasiocarpa* (subalpine fir) as the indicated climax species. In other stands the greatest impacts may be on the major seral shrub species and *Populus tremuloides* (quaking aspen).

SOILS

Soils of the *Calamagrostis canadensis* (bluejoint reedgrass) phase are poorly to somewhat poorly drained and are generally Aquic Cryaquolls or Aquic Cryoborolls. The soils typically have thick organic layers over alluvium or glacial till. Soil textures are generally silty clay. Water tables are at the soil surface in the early spring and typically do not drop below 50 cm (20 in) during the growing season. Soil reaction varies from strongly acid to neutral (pH 5.0 to 7.0). Soils of the *Ledum glandulosum* (Labrador tea) phase are moderately well drained and are Typic or Andic Cryoborolls. Soil textures are generally sandy that have developed from quartzite substrates. Soils are wet only in the spring to early summer.

ADJACENT COMMUNITIES

Adjacent wetter communities of the *Calamagrostis canadensis* (bluejoint reedgrass) phase may include various *Salix* (willow) and/or *Carex* (sedge) communities. Adjacent wetter communities of the *Ledum glandulosum* (Labrador tea) phase may include the *Calamagrostis canadensis* (bluejoint reedgrass) phase. Adjacent drier sites are the *Abies lasiocarpa/Linnaea borealis* (subalpine fir/twinflower), *Abies lasiocarpa/Xerophyllum tenax* (subalpine fir/beargrass), or the *Abies lasiocarpa/Menziesia ferruginea* (subalpine fir/fool's huckleberry) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock
The *Abies lasiocarpa/Ledum glandulosum* (subalpine fir/Labrador tea) habitat type provides limited forage for livestock.

Timber
Timber productivity is moderate. Sites are generally wet year around in the *Calamagrostis canadensis* (bluejoint reedgrass) phase which will either limit or exclude timber harvest. On the other hand, sites in the *Ledum glandulosum* (Labrador tea) phase generally dry out during the summer. Once dry, the sites offer minimal problems for timber harvest. Timber harvest may cause a rise in the water table resulting in difficulties in regeneration. Partial cutting will favor *Abies lasiocarpa* (subalpine fir) while clearcutting will favor *Pinus contorta* (lodgepole pine) and *Picea* (spruce).

Wildlife
Moose, elk, and deer use this type for shade, hiding cover, and bedding. In addition, browse production are good to excellent for elk, deer, bear, and moose. Overwintering moose can have a tremendous impact on seedlings of *Abies lasiocarpa* (subalpine fir) (see the discussion in the seral stages section of this habitat type). Reduction or elimination of the seral shrub species tends to hastens succession toward climax with less suitable food being available for big game (Steele and others 1983). In this case, logging or burning the stand may renew production of the browse species.

Fire
Limited information is available on the response of this type to fire.

Soil Management and Rehabilitation Opportunities
Prior to any road or trail construction, proper consideration should be given to damage that may result both on site and off site from the removal of the protective organic layer. Special consideration should also be made for the possible mechanical damage to the sites with high water tables. It may be more appropriate to locate roads on adjacent uplands.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

The *Abies lasiocarpa/Ledum glandulosum* (subalpine fir/Labrador tea) habitat type was first described by Hansen and others (1989) for Montana. The *Abies lasiocarpa/Ledum glandulosum* (subalpine fir/Labrador tea) habitat type was not previously described in the document *Forest Habitat Types of Montana* by Pfister and others (1977). Pfister and others (1977) in Montana, Cooper and others (1991) in northern Idaho, Steele and others (1981) in eastern Idaho and western Wyoming, and Steele and others (1983) in central Idaho recognized this habitat type as a separate phase of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type.

Abies lasiocarpa/Oplopanax horridum Habitat Type
(Subalpine Fir/Devil' Club Habitat Type)

ABILAS/OPLHOR (ABLA/OPHO)
Number Of Stands Sampled = 3

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) habitat type is an incidental type at mid elevations in the mountains of northwest Montana. Elevations of sampled sites range from 1,200 to 1,500 m (3,900 to 5,000 ft). This habitat type occurs on wet bottoms and sites near streams, springs, or seepage areas where the water table remains near the soil surface all year. Although normally restricted to wet bottoms and sites near streams and springs, the occurrence of seeps in some drainages, such as the Swan and Stillwater, effectively expands the acreage of this type considerably. It often forms narrow stringers along streams.

FLORISTIC CHARACTERISTICS

Climax stands are codominated by *Abies lasiocarpa* (subalpine fir) and *Picea* (spruce). *Pseudotsuga menziesii* (Douglas fir), *Larix occidentalis* (western larch), and *Pinus monticola* (white pine) are scattered throughout the stands; *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) may occur as sporadic accidentals. This habitat type often supports very large old growth trees. The undergrowth is dominated by *Oplopanax horridus* (devil's club), *Taxus brevifolia* (Pacific yew), *Aralia nudicaulis* (wild sarsaparilla), *Clintonia uniflora* (queen's cup), *Tiarella trifoliata* (trefoil foamflower), *Athyrium filix-femina* (ladyfern), and *Gymnocarpium dryopteris* (oak-fern) (Appendix 00).

SOILS

Parent materials are noncalcareous. Soil texture varies widely from fine to coarse, but loams predominate. Drainage also varies widely from well drained to poorly drained (Pfister and Sherwood 1989). Water tables remain within 1 m (39 in) of the soil surface throughout the year. Duff layers are commonly 7-10 cm (3-4 in).

ADJACENT COMMUNITIES

Adjacent wetter sites support *Carex* (sedge) communities and drier sites may include the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type. The *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type occupies similar sites, except that it is typically located at warmer, lower elevations.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock
Grazing potential is very low.

Timber
Timber productivity is moderate to high, but sites require careful attention and caution for intensive timber management. High water tables during most of the season may preclude the use of heavy equipment. Heavy equipment operation should be restricted to those times of year when soils are frozen and snow covered.

Proper riparian or wetland management needs to be seriously considered for the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) habitat type. Shallow rooted species, fine textured soils, and high water tables contribute to a high degree of instability, especially following logging of adjacent stands. Logging only one side of a stream, sometimes effective in reducing blowdown, does not seem to substantially increase the ability of the Streamside Management Zone (SMZ) to remain intact. Heavy partial cutting or harvesting of adjacent stands by even aged systems will accelerate windthrow of large trees, especially *Picea engelmannii* (Engelmann spruce), in residual stands. Removal of decadent, old growth trees, leaving

younger, wind resistant species often leaves the SMZ in better condition to withstand winds following logging. However, this may directly conflict with some agency management objectives; if retention of old growth for fish (woody debris recruitment) and wildlife habitat (including nesting and roosting trees) is an objective, prescriptions must be designed to minimize blowdown or losses to water quality (fisheries habitat) may result (Pfister and Sherwood 1989). If large numbers of uprooted trees lead to water quality degradation, then removal may be appropriate. Silvicultural prescriptions must be clearly defined, objectives should be obtainable, and proposed treatments should be carefully evaluated against their chances for success.

These sites may need to be regenerated quickly to avoid losses to competing vegetation; recommended species are *Picea engelmannii* (Engelmann spruce), *Larix occidentalis* (western larch), and *Pseudotsuga menziesii* (Douglas fir). While natural regeneration of these sites is known to be a problem, in some parts of the Flathead National Forest, planting of *Larix occidentalis* (western larch) has been successful following clearcutting (Pfister and Sherwood 1989).

Wildlife

Forage productivity for deer and elk is probably low. This habitat type along with other moist old growth communities are rare in Montana. Many wildlife species, such as chestnut-backed chickadees and goshawks, are partially to strongly dependent on huge old growth trees for forage, cover, and nesting sites.

Fire

Fires are rare on these sites due to the high water tables.

Soil Management and Rehabilitation Opportunities

Characteristically high water tables may cause restrictions to development (road construction, trails, etc.). Proposed timber management activities, especially road layout, design, and construction, may require consultation with specialists (hydrologists, soil scientists, engineers, etc.) to minimize on site and off site impacts. Heavy equipment operation should be restricted to winter, when soils are frozen and snow covered.

Recreational Uses and Considerations

Old growth stands with large diameter trees have high recreational and aesthetic value, but managers in charge of site development should take into account the difficulty of managing sites with high water tables.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

This discussion is an expanded description of this habitat type as defined by Pfister and others (1977). Similar habitat types were described by Illingworth and Arlidge (1960) for eastern British Columbia and by Ogilvie (1962) for southwestern Alberta.

Abies lasiocarpa/Streptopus amplexifolius Habitat Type
(Subalpine Fir/Twisted Stalk Habitat Type)

ABILAS/STRAMP (ABLA/STAM2)
Number Of Stands Sampled = 53

(*Menziesia ferruginea* (fool's huckleberry) Phase = 8 stands)
(*Streptopus amplexifolius* (Twisted Stalk) Phase = 45 stands)

LOCATION AND ASSOCIATED LANDFORMS

The *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat type is a minor type at mid elevations. Elevations of sampled sites range from 1,250 to 2,683 m (4,100 to 8,800 ft). It occurs along slopes with seeps and subirrigated alluvial terraces. It also occurs along small streams.

FLORISTIC CHARACTERISTICS

Abies lasiocarpa (subalpine fir) and *Picea* (spruce) are codominant in all late seral stands sampled. The *Menziesia ferruginea* (fool's huckleberry) phase is characterized by an open canopy structure dominated at all successional stages by *Picea* (spruce) and *Abies lasiocarpa* (subalpine fir). The undergrowth is dominated by a dense shrub layer of *Menziesia ferruginea* (fool's huckleberry) and *Vaccinium globulare* (globe huckleberry), and supports a variable assemblage of *Arnica latifolia* (broadleaf arnica), *Tiarella trifoliata* (trefoil foamflower), *Streptopus amplexifolius* (clasping-leaved twisted stalk), and *Clintonia uniflora* (queen's cup).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Menziesia ferruginea (fool's huckleberry) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	38	10-60	100
Picea engelmannii (Engelmann spruce)	36	0-60	63
Shrubs			
Lonicera utahensis (Utah honeysuckle)	5	0-20	50
Menziesia ferruginea (fool's huckleberry)	64	20-80	100
Ribes lacustre (swamp currant)	1	0-1	63
Vaccinium globulare (globe huckleberry)	15	3-20	100
Graminoids			
Luzula hitchcockii (smooth woodrush)	1	0-3	50
Forbs			
Arnica latifolia (broadleaf arnica)	28	0-40	50
Clintonia uniflora (queen's cup)	11	0-20	50
Ligusticum canbyi (Canby's licorice-root)	1	0-3	50
Mitella breweri (Brewer's mitrewort)	2	0-3	50
Mitella pentandra (five-stamened mitrewort)	2	0-3	25
Senecio triangularis (arrowleaf groundsel)	2	0-3	50
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	75
Tiarella trifoliata (trefoil foamflower)	11	0-20	88

Ferns and Allies			
Gymnocarpium dryopteris (oak-fern)	4	0-10	38

The *Streptopus amplexifolius* (twisted stalk) phase supports a high coverage of wet site forbs and lacks the high shrub coverage typical of the *Menziesia ferruginea* (fool's huckleberry) phase. Shrub species present may include: *Ribes lacustre* (swamp currant), *Rubus parviflorus* (thimbleberry), and *Vaccinium globulare* (globe huckleberry). Characteristic herbaceous species include: *Thalictrum occidentale* (western meadowrue), *Senecio triangularis* (arrowleaf groundsel), *Galium triflorum* (sweetscented bedstraw),*Osmorhiza chilensis* (mountain sweet-cicely), *Streptopus amplexifolius* (clasping-leaved twisted stalk), and *Pyrola secunda* (one-sided wintergreen).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands of the Streptopus amplexifolius (twisted stalk) phase.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	**Range**	**Constancy**
Trees			
Abies lasiocarpa (subalpine fir)	26	1-60	100
Larix occidentalis (western larch)	3	0-3	12
Picea spp. (spruce)	40	0-80	94
Pinus contorta (lodgepole pine)	2	0-3	24
Pinus monticola (western white pine)	3	0-3	12
Pseudotsuga menziesii (Douglas fir)	15	0-60	35
Shrubs			
Acer glabrum (Rocky Mountain maple)	10	0-20	24
Alnus incana (mountain alder)	2	0-3	24
Alnus sinuata (Sitka alder)	15	0-40	18
Amelanchier alnifolia (western serviceberry)	1	0-3	29
Berberis repens (creeping Oregongrape)	1	0-1	12
Cassiope mertensiana (Mertens' mountain heather)	1	0-1	6
Chimaphila umbellata (common Prince's pine)	1	0-1	24
Clematis occidentalis (Columbia clematis)	1	0-1	6
Cornus canadensis (bunchberry)	12	0-20	12
Cornus stolonifera (red-osier dogwood)	4	0-20	47
Juniperus communis (common juniper)	1	0-1	6
Ledum glandulosum (Labrador-tea)	2	0-3	12
Linnaea borealis (twinflower)	16	0-40	47
Lonicera involucrata (twin-berry)	1	0-1	18
Lonicera utahensis (Utah honeysuckle)	1	0-3	41
Menziesia ferruginea (fool's huckleberry)	1	0-3	29
Pachistima myrsinites (mountain-boxwood)	20	0-20	18
Phyllodoce empetriformis (red mountain-heath)	1	0-1	6
Rhamnus alnifolia (alder buckthorn)	1	0-1	6
Ribes hudsonianum (stinking currant)	1	0-1	12
Ribes lacustre (swamp currant)	3	0-20	82
Ribes viscosissimum (sticky currant)	3	0-3	6

Rosa acicularis (prickly rose)	1	0-1	29
Rosa gymnocarpa (baldhip rose)	1	0-1	6
Rubus idaeus (red raspberry)	1	0-1	29
Rubus parviflorus (thimbleberry)	9	0-20	53
Salix barclayi (Barclay's willow)	1	0-1	6
Salix scouleriana (Scouler willow)	1	0-1	12
Sambucus racemosa (red elderberry)	1	0-1	6
Sorbus scopulina (Cascade mountain-ash)	1	0-1	24
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	29
Symphoricarpos albus (common snowberry)	3	0-3	12
Taxus brevifolia (Pacific yew)	1	0-1	12
Vaccinium globulare (globe huckleberry)	8	0-40	53
Vaccinium myrtillus (dwarf bilberry)	1	0-1	6
Vaccinium scoparium (whortleberry)	4	0-20	41
Graminoids			
Agropyron exarata (spike bentgrass)	1	0-1	6
Bromus anomalus (nodding brome)	1	0-1	6
Bromus carinatus (mountain brome)	1	0-3	18
Bromus vulgaris (Columbia brome)	13	0-40	29
Calamagrostis canadensis (bluejoint reedgrass)	1	0-3	18
Calamagrostis rubescens (pinegrass)	10	0-20	12
Carex concinnoides (northwestern sedge)	1	0-1	6
Cares disperma (soft-leaved sedge)	1	0-3	18
Carex geyeri (elk sedge)	6	0-20	24
Carex microptera (small-winged sedge)	1	0-1	6
Carex nigricans (black alpine sedge)	1	0-1	6
Carex rossii (Ross sedge)	1	0-1	12
Carex rostrata (beaked sedge)	3	0-3	6
Carex spp. (sedge)	1	0-1	18
Cinna latifolia (drooping woodreed)	1	0-1	18
Elymus glaucus (blue wildrye)	1	0-1	18
Festuca idahoensis (Idaho fescue)	60	0-60	6
Festuca occidentalis (western fescue)	1	0-1	12
Juncus drummondii (Drummond's rush)	1	0-1	6
Luzula hitchcockii (smooth woodrush)	20	0-20	6
Luzula parviflora (small-flowered woodrush)	1	0-1	35
Luzula piperi (Piper's woodrush)	3	0-3	6
Melica bulbosa (oniongrass)	1	0-1	6
Melica subulata (Alaska oniongrass)	1	0-1	12
Poa alpina (alpine bluegrass)	1	0-1	6
Poa interior (inland bluegrass)	1	0-1	12
Poa nervosa (Wheeler's bluegrass)	1	0-1	12
Poa spp. (bluegrass)	1	0-1	12
Trisetum spicatum (spike trisetum)	1	0-1	6
Forbs			
Achillea millefolium (common yarrow)	1	0-1	6
Actaea rubra (baneberry)	2	0-3	35
Allium brevistylum (short-style onion)	1	0-1	6

Allium textile (textile onion)	1	0-1	6
Anemone piperi (Piper's anemone)	1	0-1	6
Angelica arguta (sharptooth angelica)	1	0-3	18
Aquilegia flavescens (yellow columbine)	1	0-1	18
Aralia nudicaulis (wild sarsaparilla)	40	0-40	12
Arenaria macrophylla (bigleaf sandwort)	1	0-1	18
Arnica cordifolia (heart-leaf arnica)	1	0-3	24
Arnica latifolia (broadleaf arnica)	14	0-40	53
Arnica mollis (hairy arnica)	3	0-3	6
Aster conspicuus(showy aster)	2	0-3	24
Aster engelmannii (Engelmann's aster)	3	0-3	6
Aster foliaceus (leafy aster)	1	0-1	6
Aster laevis (smooth aster)	1	0-1	12
Balsamorhiza sagittata (arrowleaf balsamroot)	1	0-1	6
Calypso bulbosa (fairy-slipper)	1	0-1	6
Campanula rotundifolia (lady's-thimble)	1	0-1	18
Castilleja rhexifolia (rhexia-leaved paintbrush)	1	0-1	6
Circaea alpina (enchanter's nightshade)	20	0-20	6
Cirsium spp. (thistle)	1	0-1	6
Claytonia lanceolata (western springbeauty)	1	0-1	6
Clintonia uniflora (queen's cup)	20	0-20	18
Coptis occidentalis (western goldthread)	30	0-40	12
Corallorhiza trifida (yellow coral-root)	1	0-1	6
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	12
Dodecatheon jeffreyi (tall mountain shooting star)	3	0-3	6
Epilobium alpinum (alpine willow-herb)	1	0-1	18
Epilobium angustifolium (fireweed)	1	0-3	35
Erigeron peregrinus (subalpine daisy)	1	0-3	18
Erythronium grandiflorum (glacier-lily)	1	0-1	12
Fragaria vesca (woods strawberry)	1	0-1	24
Fragaria virginiana (Virginia strawberry)	1	0-1	24
Galium boreale (northern bedstraw)	1	0-1	6
Galium triflorum (sweetscented bedstraw)	4	0-20	76
Gentiana affinis (pleated gentian)	1	0-1	6
Geranium richardsonii (white geranium)	2	0-3	12
Geranium viscosissimum (sticky geranium)	1	0-1	6
Geum macrophyllum (large-leaved avens)	1	0-1	6
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-3	35
Habenaria obtusata (blunt-leaf rein-orchid)	1	0-1	6
Habenaria saccata (slender bog-orchid)	3	0-3	6
Hackelia floribunda (showy stickseed)	1	0-1	6
Heracleum lanatum (cow-parsnip)	1	0-1	24
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	18
Hieracium gracile (alpine hawkweed)	1	0-1	18
Hydrophyllum capitatum (ballhead waterleaf)	1	0-1	6
Ligusticum canbyi (Canby's licorice -root)	1	0-1	6
Ligusticum tenuifolium (slender-leafed licorice-root)	1	0-1	12
Listera borealis (northern twayblade)	1	0-1	6
Listera cordata (heart-leaf twayblade)	1	0-1	18

Lupinus spp. (lupine)	1	0-1	6
Mertensia ciliata (mountain bluebell)	5	0-20	24
Mitella breweri (Brewer's mitrewort)	3	0-3	6
Mitella pentandra (five-stamened mitrewort)	3	0-10	35
Mitella spp. (mitrewort)	1	0-1	6
Mitella stauropetala (side-flowered mitrewort)	1	0-1	18
Montia spp. (montia)	3	0-3	6
Myosotis sylvatica (wood forget-me-not)	1	0-1	6
Osmorhiza chilensis (mountain sweet-cicely)	6	0-40	71
Osmorhiza occidentalis (western sweet-cicely)	1	0-1	6
Parnassia fimbriata (fringed grass-of-parnassus)	10	0-20	12
Pedicularis bracteosa (bracted lousewort)	1	0-1	6
Pedicularis racemosa (sickletop lousewort)	1	0-1	6
Phacelia hastata (silverleaf phacelia)	1	0-1	6
Polygonum bistortoides (American bistort)	1	0-1	6
Prenanthes sagittata (arrow-leaf rattlesnake-root)	1	0-1	12
Pyrola asarifolia (pink wintergreen)	1	0-1	35
Pyrola chlorantha (green wintergreen)	1	0-1	41
Pyrola secunda (one-sided wintergreen)	2	0-3	71
Pyrola uniflora (woodnymph)	1	0-3	29
Ranunculus eschscholtzii (subalpine buttercup)	1	0-1	6
Ranunculus uncinatus (little buttercup)	2	0-3	12
Ranunculus verecundus (modest buttercup)	1	0-1	6
Saxifraga arguta (brook saxifrage)	11	0-40	35
Senecio pseudaureus (streambank groundsel)	1	0-1	6
Senecio triangularis (arrowleaf groundsel)	10	0-40	76
Silene menziesii (Menzies' silene)	1	0-1	6
Smilacina racemosa (false spikenard)	1	0-1	12
Smilacina stellata (starry Solomon-plume)	1	0-3	35
Stellaria spp. (starwort)	1	0-1	6
Streptopus amplexifolius (clasping-leaved twisted stalk)	3	0-20	71
Taraxacum officinale (common dandelion)	1	0-1	29
Thalictrum occidentale (western meadowrue)	5	0-20	88
Tiarella trifoliata (trefoil foamflower)	12	0-20	12
Trifolium longipes (long-stalked clover)	1	0-1	6
Trillium ovatum (white trillium)	1	0-1	24
Trollius laxus (American globeflower)	10	0-20	12
Urtica dioica (stinging nettle)	1	0-1	18
Valeriana sitchensis (Sitka valerian)	2	0-3	12
Veratrum viride (green false hellebore)	4	0-20	41
Veronica wormskjoldii (Wormsskjold speedwell)	1	0-1	12
Vicia americana (American vetch)	1	0-1	6
Viola canadensis (Canada violet)	1	0-1	6
Viola orbiculata (round-leaved violet)	1	0-3	59
Xerophyllum tenax (beargrass)	10	0-20	12
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-1	12
Cystopteris fragilis (brittle bladder-fern)	3	0-3	6

Equisetum arvense (field horsetail)	5	0-20	24
Gymnocarpium dryopteris (oak-fern)	9	0-20	18
Lycopodium annotinum (stiff clubmoss)	7	0-20	18

SUCCESSIONAL INFORMATION

Abies lasiocarpa (subalpine fir) and *Picea* (spruce) are typically codominants in seral stands. Other seral trees in the *Menziesia ferruginea* (fool's huckleberry) phase may include: the sporadic occurrence of *Pinus monticola* (white pine), *Pinus contorta* (lodgepole pine), *Pseudotsuga menziesii* (Douglas fir), *Larix occidentalis* (western larch), and *Abies grandis* (grand fir) on lower elevation sites. Seral tree species apparently are even more limited in the *Ligusticum canbyi* (Canby's licorice-root) phase with *Pseudotsuga menziesii* (Douglas fir) and *Pinus contorta* (lodgepole pine) occupying the better drained microsites. However, in both phases, the understory is similar in vegetation composition to that of the late seral to climax stage.

SOILS

Alluvial parent material is commonly associated with sites of the *Streptopus amplexifolius* (twisted stalk) phase, with coarse fragment inclusions of granite, sandstone, quartzite, and mica schist. Sites of the *Menziesia ferruginea* (fool's huckleberry) phase are commonly found having up to a 33 cm (13 in) ash cap. On nearly all sites of the *Streptopus amplexifolius* (twisted stalk) phase and half of the *Menziesia ferruginea* (fool's huckleberry) sites a clay pan or layer of compacted glacial till was found in the soil profile. The origins of these restrictive layers are unknown. The layers are thought to be fragipans and are occasionally overlain by argillic horizons. Soil textures vary little from silty clay loam to loam. Coarse fragment content varies widely with an average of 16 percent throughout the profiles for both phases. Effective rooting depths are relatively shallow; perhaps due, in part, to both high water tables and the restrictive layers. Soil reaction ranges from strongly acid to moderately acid (pH 5.0 to 5.5).

ADJACENT COMMUNITIES

Adjacent wetter communities include *Rhamnus alnifolia* (alder buckthorn) and *Salix drummondiana* (Drummond willow) Adjacent upland sites support other *Abies lasiocarpa* (subalpine fir) habitat types, *Abies lasiocarpa/Clintonia uniflora* (subalpine fir/queen cup) habitat type, *Menziesia ferruginea* (fool's huckleberry) phase, or the *Abies lasiocarpa/Menziesia ferruginea* (subalpine fir/fool's huckleberry) habitat type.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value is high in the *Streptopus amplexifolius* (twisted stalk) phase and moderate in the *Menziesia ferruginea* (fool's huckleberry) phase. In addition, the adjacent streams may attract many animals. Grazing during wet periods can churn the wet soil and destroy plant cover as well as limit conifer establishment.

Timber

Timber productivity for *Abies lasiocarpa* (subalpine fir) and *Picea* (spruce) ranges from moderate, where cold air drainage is impeded and soils are saturated throughout the year, to high on sites with better drainage. On better drained sites, *Picea* (spruce) may have very high site index values.

Blowdown may be a hazard in this habitat type. Removal of decadent, old growth trees, leaving younger, windfirm species often leaves the Streamside Management Zone in better condition to withstand winds following logging. However, if retention of old growth for fish and wildlife habitat (including cavity dwelling birds) is a primary objective, then prescriptions must be designed to minimize blowdown. Cooper and others (1991) report that clear cutting will reduce the high probability of windthrow associated with partial cutting, but the resulting rise in water tables may produce herb-dominated meadows that

reforest very slowly. Light selection cutting may avoid these problems, but heavy equipment use should be delayed until the late summer. Roads, trails, or other site development should be avoided. Cole (1983) showed trails crossing this habitat type to be in much poorer condition than those located in habitat types with better drainages.

Major seral species are *Larix occidentalis* (western larch) and *Picea engelmannii* (Engelmann spruce). *Pseudotsuga menziesii* (Douglas fir) is a minor seral along with *Pinus contorta* (lodgepole pine). Even aged management offers greater promise for production of seral species. Partial cutting will lead to dominance by the less desirable climax species.

Exposure of bare soil may be required for regeneration of *Larix occidentalis* (western larch) and *Pseudotsuga menziesii* (Douglas fir). Some areas have shown good success with regeneration of *Larix occidentalis* (western larch) on seed tree cuts.

Heavy partial cutting or harvesting of adjacent stands by even aged systems will accelerate windthrow of large trees (especially *Picea engelmannii* [Engelmann spruce]) in residual stands. If large number of uprooted trees lead to water quality problems, then removal may be appropriate. Silvicultural prescriptions must be tempered by clearly defined, obtainable objectives and on site evaluation of existing stands.

Wildlife

Browse production and cover levels in early successional stages is good to excellent for elk, deer, bear, and moose. Good cover is also provided for upland game and small mammals. Elk and deer may use low elevation stands as winter range if snow depths are low. Overwintering moose can have a tremendous impact on seedlings of *Abies lasiocarpa* (subalpine fir). Reduction or elimination of the seral shrub species tends to hastens succession toward climax with less suitable food being available for big game (Steele and others 1983). In this case, logging or burning the stand may renew production of the browse species.

Soil Management and Rehabilitation Opportunities

Moist, fine textured soils are subject to compaction and damage in spring and early summer when water tables are high. Heavy equipment should be restricted to this habitat type when soils have dried out or are frozen and snow covered to reduce the danger of soil compaction. Efforts to minimize displacement or disturbance of the soil surface during timber management activities should be made to maintain the high productivity of these sites.

Heavy equipment use should be delayed until the late summer. Roads, trails, or other site development should be avoided and should be located on adjacent uplands. Cole (1983) showed trails crossing this habitat type to be in much poorer condition than those located in habitat types with better drainage.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

In an earlier regional draft for northwestern Montana, we followed Cooper and others (1991) in recognizing both the

Ligusticum canbyi (Canby's licorice-root) phase and the *Menziesia ferruginea* (fool's huckleberry) phase of the *Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/twisted stalk) habitat type. However, upon further analysis, we have decided to drop the *Ligusticum canbyi* (Canby's licorice-root) phase and follow the work of Mauk and Henderson (1984) and Youngblood and Mauk (1985) in the Uinta Mountains of Utah, and Steele and others (1983) in the Teton and Absaroka Mountains of Wyoming by including the *Ligusticum canbyi* (Canby's licorice-root) phase within the *Streptopus amplexifolius* (twisted stalk) phase. In addition, many stands from Pfister and others (1977) *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint) habitat type, *Galium triflorum* (sweetscented bedstraw) phase and the *Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) habitat type fit the *Streptopus amplexifolius* (twisted stalk) phase and were included in the analysis and writeup. Stands from the work by Lillybridge and Williams (1984) *Abies lasiocarpa/Cornus canadensis* (subalpine fir/bunchberry) association, *Abies lasiocarpa/Linnaea borealis* (subalpine fir/twinflower) association, and the *Abies lasiocarpa/Rhododendron albiflorum* (subalpine fir/white rhododendron) association fit either the *Streptopus amplexifolius* (twisted stalk) phase or the *Menziesia ferruginea* (fool's huckleberry) phase. In southern Alberta, Ogilvie's (1962) *Abies lasiocarpa-Picea engelmannii/Tiarella trifoliata-Menziesii ferruginea* (subalpine fir-Engelmann spruce/trefoil foamflower-fool's huckleberry) habitat type closely corresponds to the *Menziesia ferruginea* (fool's huckleberry) phase.

Juniperus scopulorum/Cornus stolonifera Habitat Type
(Rocky Mountain Juniper/Red-Osier Dogwood Habitat Type)

JUNSCO (JUSC2)
Number Of Stands Sampled = 27

LOCATION AND ASSOCIATED LANDFORMS

The *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type is a minor type at lower elevations in valleys and foothills of the mountainous portions of Montana. Elevations of sampled sites range from 1,171 to 1,867 m (3,840 to 6,120 ft). The type forms either a narrow band along streams of V-shaped canyons, or relatively broad stands on older alluvial terraces of floodplains of major streams or rivers such as along the upper Yellowstone River.

FLORISTIC CHARACTERISTICS

The *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type has a relatively open canopy of widely scattered *Juniperus scopulorum* (Rocky Mountain juniper). Mid/late seral stands may be dominated by *Populus angustifolia* (narrowleaf cottonwood), *Populus deltoides* (Great Plains cottonwood), and *Populus trichocarpa* (black cottonwood). The undergrowth is quite variable. Associated species include: *Cornus stolonifera* (red-osier dogwood), *Rosa woodsii* (woods rose), *Agrostis stolonifera* (redtop), *Toxicodendron rydbergii* (poison ivy), *Smilacina stellata* (starry Solomon-plume), and *Symphoricarpos occidentalis* (western snowberry).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***mid/late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Juniperus scopulorum (Rocky Mountain juniper)	60	40-80	100
Populus angustifolia (narrowleaf cottonwood)	53	0-80	28
Populus deltoides (Great Plains cottonwood)	60	0-60	3
Populus trichocarpa (black cottonwood)	10	0-20	50

Shrubs			
Amelanchier alnifolia (western serviceberry)	10	0-10	25
Berberis repens (creeping Oregongrape)	1	0-1	25
Clematis ligusticifolia (western virgins-bower)	1	0-1	25
Cornus stolonifera (red-osier dogwood)	15	0-60	28
Prunus virginiana (common chokecherry)	1	0-1	25
Rhus aromatica (fragrant sumac)	40	0-40	25
Rosa woodsii (woods rose)	12	0-30	75
Solanum dulcamara (climbing nightshade)	10	0-10	25
Symphoricarpos occidentalis (western snowberry)	5	0-10	50
Toxicodendron rydbergii (poison ivy)	20	0-40	50
Graminoids			
Agropyron repens (quackgrass)	3	0-3	25
Agrostis stolonifera (redtop)	25	0-40	50
Bromus inermis (smooth brome)	1	0-1	25
Bromus tectorum (cheatgrass)	20	0-20	25
Dactylis glomerata (orchard-grass)	10	0-10	25
Dichanthelium acuminatum (western witchgrass)	10	0-10	25
Elymus canadensis (Canada wildrye)	20	0-20	25
Poa compressa (Canada bluegrass)	1	0-1	25
Poa pratensis (Kentucky bluegrass)	20	0-20	25
Forbs			
Allium schoenoprasum (chives)	1	0-1	25
Apocynum androsaemifolium (spreading dogbane)	40	0-40	25
Arctium minus (common burdock)	1	0-1	25
Artemisia lindleyana (riverbank wormwood)	3	0-3	25
Artemisia ludoviciana (prairie sagewort)	1	0-1	25
Asparagus officinalis (asparagus)	1	0-1	25
Aster laevis (smooth aster)	1	0-1	25
Aster pansus (tuffed white prairie aster)	1	0-1	25
Centaurea maculosa (spotted knapweed)	1	0-1	25
Chenopodium album (lambsquarter)	1	0-1	25
Cirsium arvense (Canada thistle)	2	0-3	50
Erigeron filifolius (Evermann's fleabane)	1	0-1	25
Filago arvensis (field filago)	1	0-1	25
Fragaria vesca (woods strawberry)	1	0-1	25
Gaillardia aristata (blanket-flower)	2	0-3	50
Glycyrrhiza lepidota (American licorice)	20	0-20	25
Hypericum perforatum (common St. John's-wort)	2	0-3	50
Lactuca serriola (prickly lettuce)	1	0-1	25
Medicago lupulina (black medic)	1	0-1	25
Melilotus alba (white sweet-clover)	10	0-1	25
Melilotus officinalis (yellow sweet-clover)	2	0-3	50
Monarda fistulosa (horsemint)	1	0-1	25
Prunella vulgaris (self-heal)	1	0-1	25
Smilacina stellata (starry Solomon-plume)	12	0-20	50
Taraxacum officinale (common dandelion)	1	0-1	25
Trifolium repens (white clover)	1	0-1	25

Vicia americana (American vetch)	1	0-1	25
Ferns and Allies			
Equisetum arvense (field horsetail)	20	0-20	25

SUCCESSIONAL INFORMATION

Seral stands of this type may be dominated by the *Populus trichocarpa* (black cottonwood), *Populus angustifolia* (narrowleaf cottonwood), and *Betula occidentalis* (water birch) community types. In these seral stands, *Juniperus scopulorum* (Rocky Mountain juniper) will be present and successfully reproducing. In some stands of mature *Populus trichocarpa* (black cottonwood) and *Populus angustifolia* (narrowleaf cottonwood), *Juniperus scopulorum* (Rocky Mountain juniper) will dominate the understory.

SOILS

This habitat type occurs on a wide range of landforms, from rocky V-shaped canyons to fertile alluvium floodplains. This habitat type is intolerant of frequent and prolonged flooding. Soils of this habitat type are typically Mollisols, Entisols (Fluvents), or Inceptisols. Mineral soils are commonly up to 1 m (39 in) in depth overlying river gravel or cobbles. Soil texture varies from loam to coarse sand. Soils are generally well drained and have a low water holding capacity. Water tables generally drop below 1 m (39 in) in the summer, but surface horizons may remain moist due to capillary action. Coarse textured soils, moderate stream gradients, and high amounts of coarse fragments provide an environment that produces a rapid movement of highly aerated groundwater.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including *Salix exigua* (sandbar willow), *Typha latifolia* (common cattail), and *Eleocharis palustris* (common spikesedge) types. Adjacent upland types include habitat types from the *Pseudotsuga menziesii* (Douglas fir) and *Pinus ponderosa* (ponderosa pine) series, *Juniperus scopulorum* (Rocky Mountain juniper) communities, and a variety of grass or shrub habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production ranges from low in stands of steep sided canyons, to moderate on sandy floodplains. Stands are typically very droughty, thereby reducing forage production. *Juniperus scopulorum* (Rocky Mountain juniper) is not very palatable to livestock, but young plants can be eliminated by grazing.

Timber

Timber harvest activities on these sites is limited to cutting for round wood products such as fence posts. Regeneration is primarily accomplished by birds passing seeds.

Wildlife

Big game use this type for forage and cover. Stands of the *Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) habitat type provide good to excellent structural diversity for both thermal and hiding cover. The berry like cones of *Juniperus scopulorum* (Rocky Mountain juniper) are an excellent source of food for small mammals and birds. Birds often relish this species, especially in the winter (Arno and Hammerly 1984).

Fire

Fire potential is low to moderate in this type. Young juniper trees are easily killed by fire primarily because of their small size, thin bark, and compact crown (Fischer and Bradley 1987). As juniper ages, the bark thickens and the crown develops a

bushy, open form. A hot fire can kill or severely damage a tree, but the same tree may survive a cool fire. Low, spreading branches can provide a route for fire to enter the crown. Often large junipers have survived a number of fires.

Soil Management and Rehabilitation Opportunities

Typically, these soils have weak structures, low organic matter contents, and thus, low water holding capacities. However, these coarse textured soils are not susceptible to compaction problems. Other less drought resistant, more preferred, forage species associated with this habitat type can be easily disturbed with moderate animal use and can cause an increase of *Juniperus scopulorum* and invader species.

Recreational Uses and Considerations

Stands of this habitat type are generally too small or too inaccessible to be used as developed campgrounds. However, they do provide excellent opportunities for nature study areas because of the diversity of wildlife associated with them. In these cases, fires should be controlled because even a light fire will kill *Juniperus scopulorum* (Rocky Mountain juniper).

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 14-19 inch Precipitation Zone = overflow range site.

OTHER STUDIES

Similar riparian or wetland communities have not been described elsewhere.

Picea/Calamagrostis canadensis Community Type
(Spruce/Bluejoint Reedgrass Community Type)

PICEA/CALCAN (PICEA/CACA4)

Number Of Stands Sampled = 20

LOCATION AND ASSOCIATED LANDFORMS

The *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type is a minor type at low to high elevations throughout the mountains of Montana. Elevations of sampled sites range from 1,494 to 2,326 m (4,900 to 7,625 ft). This type occurs on cool, moist sites, such as gentle slopes or flat alluvial benches bordering streams or ponds.

FLORISTIC CHARACTERISTICS

The overstory is nearly all *Picea* (spruce). The dense understory is dominated by graminoids and forbs including *Calamagrostis canadensis* (bluejoint reedgrass), *Calamagrostis stricta* (narrow-spiked reedgrass), *Epilobium angustifolium* (fireweed) and *Equisetum arvense* (field horsetail). The shrub layer in this type has a high species richness but low constancy and coverage.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in

stands that are ***relatively undisturbed by livestock or wildlife.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Picea spp. (spruce)	30	20-80	100
Shrubs			
Lonicera involucrata (twin-berry)	2	0-3	30
Potentilla fruticosa (shrubby cinquefoil)	2	0-3	20
Ribes lacustre (swamp currant)	1	0-1	10
Ribes spp. (currant)	1	0-1	30
Rosa acicularis (prickly rose)	3	0-3	10
Rosa woodsii (woods rose)	7	0-20	40
Rubus parviflorus (thimbleberry)	1	0-1	10
Salix bebbiana (Bebb willow)	1	0-1	10
Salix boothii (Booth willow)	11	0-40	40
Salix drummondiana (Drummond willow)	6	0-20	40
Salix geyeriana (Geyer willow)	40	0-40	10
Salix wolfii (Wolf's willow)	1	0-1	10
Vaccinium globulare (globe huckleberry)	1	0-1	10
Graminoids			
Agropyron caninum (bearded wheatgrass)	2	0-3	20
Agropyron repens (quackgrass)	1	0-1	10
Agropyron spp. (wheatgrass)	3	0-3	20
Agrostis thurberiana (thurber bentgrass)	2	0-3	20
Bromus ciliatus (fringed brome)	2	0-3	70
Calamagrostis canadensis (bluejoint reedgrass)	43	0-80	70
Calamagrostis stricta (narrow-spiked reedgrass)	26	0-60	40
Cares disperma (soft-leaved sedge)	1	0-1	10
Carex microptera (small-winged sedge)	1	0-1	20
Carex rostrata (beaked sedge)	27	0-40	30
Cinna latifolia (drooping woodreed)	1	0-1	10
Luzula parviflora (small-flowered woodrush)	1	0-1	20
Phleum pratense (common timothy)	2	0-3	50
Poa pratensis (Kentucky bluegrass)	1	0-1	10
Poa spp. (bluegrass)	3	0-3	10
Forbs			
Achillea millefolium (common yarrow)	1	0-1	10
Actaea rubra (baneberry)	1	0-1	10
Allium brevistylum (short-style onion)	1	0-1	20
Allium spp. (onion)	1	0-1	10
Angelica arguta (sharptooth angelica)	1	0-1	10
Arnica cordifolia (heart-leaf arnica)	1	0-1	10
Arnica latifolia (broadleaf arnica)	10	0-10	10
Aster foliaceus (leafy aster)	1	0-1	20
Aster occidentalis (western aster)	17	0-40	50

Aster spp. (aster)	12	0-20	20
Astragalus spp. (milk-vetch)	3	0-3	10
Cicuta maculata (spotted water-hemlock)	1	0-1	10
Cirsium scariosum (elk thistle)	1	0-1	10
Epilobium angustifolium (fireweed)	6	0-40	80
Epilobium ciliatum (common willow-herb)	2	0-3	20
Epilobium spp. (willow-herb)	1	0-1	10
Fragaria vesca (woods strawberry)	1	0-1	10
Fragaria virginiana (Virginia strawberry)	6	0-20	40
Galium boreale (northern bedstraw)	1	0-1	20
Galium triflorum (sweetscented bedstraw)	3	0-3	20
Gentianella detonsa (small fringed gentian)	1	0-1	10
Geranium richardsonii (white geranium)	3	0-10	50
Geranium spp. (geranium)	1	0-1	10
Geum macrophyllum (large-leaved avens)	1	0-3	40
Heracleum lanatum (cow-parsnip)	2	0-3	40
Mertensia ciliata (mountain bluebell)	2	0-3	40
Osmorhiza chilensis (mountain sweet-cicely)	3	0-3	10
Pedicularis groenlandica (elephant's head)	3	0-3	10
Polemonium occidentale (western polemonium)	1	0-1	10
Rubus pubescens (dwarf red blackberry)	1	0-1	10
Saxifraga arguta (brook saxifrage)	2	0-3	20
Senecio triangularis (arrowleaf groundsel)	7	0-10	20
Smilacina stellata (starry Solomon-plume)	1	0-1	40
Solidago canadensis (Canada goldenrod)	20	0-40	20
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	10
Taraxacum ceratophorum (horned dandelion)	1	0-1	10
Taraxacum officinale (common dandelion)	1	0-1	50
Thalictrum fendleri (Fendler's meadowrue)	2	0-3	40
Thalictrum occidentale (western meadowrue)	3	0-3	10
Thalictrum spp. (meadowrue)	1	0-1	10
Urtica dioica (stinging nettle)	1	0-1	30
Viola spp. (violet)	3	0-3	10
Ferns and Allies			
Equisetum arvense (field horsetail)	12	0-20	70
Equisetum laevigatum (smooth scouring-rush)	1	0-1	10
Equisetum pratense (meadow horsetail)	50	0-50	10

SUCCESSIONAL INFORMATION

The *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type is considered a late seral stage of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type described by Pfister and others (1977), Steele and others (1981, 1983), and Mauk and Henderson (1984) in which overwintering moose has either severely restricted, or in some cases, totally eliminated seedlings of *Abies lasiocarpa* (subalpine fir).

The mid-seral stands sampled indicate that after a disturbance, *Salix drummondii* (Drummond willow), *Alnus sinuata* (Sitka alder), and/or *Alnus incana* (mountain alder) dominate the site. *Pinus contorta* (lodgepole pine) may be a major seral species. Herbaceous species lists and canopy coverages are variable with *Calamagrostis canadensis* (bluejoint reedgrass) or *Calamagrostis stricta* (narrow-spiked reedgrass) as the major seral dominants.

SOILS

Soils are typically noncalcareous. Soil texture varies from silt to sandy loam. Soils are usually poorly drained with some redox concentrations (mottles) present. Water tables are usually high, and standing water may be present into the summer. Duff accumulations vary; none on sites subject to flooding to 15 cm (6 in) on those near seeps. Soil reaction varies from slightly acid to strongly acid (pH 6.0 to 5.0).

ADJACENT COMMUNITIES

Wetter sites are often dominated by various species of *Carex* species (sedge) or *Juncus* species (rush). Adjacent drier, well drained sites support habitat types from the *Abies lasiocarpa* (subalpine fir) or *Pseudotsuga menziesii* (douglas fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage value is moderate to high. Palatability of *Calamagrostis canadensis* (bluejoint reedgrass) varies from moderate to high, depending upon season and availability of other species (USDA Forest Service 1937). Foliage is most palatable when young, but wet conditions early in the grazing season limits use by livestock, especially sheep. Continued close utilization results in decreased *Calamagrostis canadensis* (bluejoint reedgrass) production.

In addition, the adjacent streams may attract many animals. Grazing during wet periods, however, can churn the wet soil and destroy plant cover as well as limit conifer establishment.

Timber

Timber productivity is moderate to high. *Picea engelmannii* (Engelmann spruce) and *Pinus contorta* (lodgepole pine) are the most productive timber species on these sites. Clearcutting may be the preferred harvest method because of the shallow rooting and subsequent windthrow on these high water table sites. Narrow stands along streams can sometimes be selectively cut at light levels (less than 30 percent of the basal area) with minimal damage to the site. Regeneration difficulties may result from high water tables and competition from graminoids after harvest, especially where sites are clearcut. Site preparation should be restricted to a brief period in late summer when sites may be dry enough to support machinery. Plants of *Picea* species (spruce) in contour trenches has been successful where grazing was restricted.

Wildlife

Elk, deer, moose, and bear are common in the summer. Heavy moose use has had a direct impact on this community type. The *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type is a late seral stage of the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type in which the overwintering moose has either severely restricted, or in some cases, totally eliminated seedlings of *Abies lasiocarpa* (subalpine fir) (see the discussion in the seral stages section of this community type). In addition, reduction or elimination of the seral shrub species will limit the availability of food for big game. In this case, logging or burning the stand may renew production of the browse species.

Fire

Fire susceptibility is low. However, *Picea engelmannii* (Engelmann spruce), including hybrids with *Picea glauca* (white spruce), is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to the species' low resistance. The shallow root system is readily subject to injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage.

Calamagrostis canadensis (bluejoint reedgrass) propagates itself by both seeds and rhizomes, making this species an aggressive invader of moist, burned sites (Crane and Fischer 1986). These features also make it a valuable species for stabilizing or rehabilitating mountain streams.

Soil Management and Rehabilitation Opportunities

Wet and moist soils are easily damaged and degraded. Equipment should not be used on this type in spring and summer when water tables are high. Roads and trails should be located elsewhere.

Recreational Uses and Considerations

The streamside locations may attract recreationists, but these wet sites are poorly suited for roads, trails, and recreational developments.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Youngblood and others (1985) described the *Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) community type in eastern Idaho/western Wyoming as a late seral stage within the *Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) habitat type.

Picea/Cornus stolonifera Habitat Type
(Spruce/Red-Osier Dogwood Habitat Type)

PICEA/CORSTO (PICEA/COST4)

Number Of Stands Sampled =37

LOCATION AND ASSOCIATED LANDFORMS

The *Picea/Cornus stolonifera* (red-osier dogwood) habitat type is a major type at low to mid elevations. Elevations of sampled sites range from 823 to 1,628 m (2,700 to 5,340 ft). This type occurs on moist sites gently undulating or flat alluvial benches and terraces bordering streams. In some instances, it occurs on moist toeslopes.

FLORISTIC CHARACTERISTICS

The relatively closed overstory contains mature *Picea* (spruce) with *Larix occidentalis* (western larch), *Pinus contorta* (lodgepole pine), and *Pseudotsuga menziesii* (Douglas fir) occasionally forming a major component. *Abies lasiocarpa* (subalpine fir) is occasionally present in limited amounts, but shows low vigor. Some sites may have widely scattered

Populus trichocarpa (black cottonwood) present.

Shrub cover is typically abundant with the major species being *Cornus stolonifera* (red-osier dogwood), *Symphoricarpos albus* (common snowberry), and *Amelanchier alnifolia* (western serviceberry). Herbaceous cover ranges from sparse to high. Stand species' richness is high but constancy and cover for most species is low. Herbaceous species with high constancy include *Smilacina stellata* (starry Solomon-plume), *Fragaria virginiana* (Virginia strawberry), *Galium triflorum* (sweetscented bedstraw), *Osmorhiza chilensis* (mountain sweet-cicely), and *Thalictrum occidentale* (western meadowrue).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Picea spp. (spruce)	27	1-98	100
Shrubs			
Alnus incana (mountain alder)	23	0-60	27
Amelanchier alnifolia (western serviceberry)	2	0-10	54
Cornus stolonifera (red-osier dogwood)	12	0-60	86
Linnaea borealis (twinflower)	14	0-40	41
Salix bebbiana (Bebb willow)	9	0-20	8
Salix boothii (Booth willow)	8	0-20	19
Salix brachycarpa (short-fruited willow)	30	0-30	3
Salix candida (hoary willow)	1	0-3	8
Salix drummondiana (Drummond willow)	15	0-50	11
Salexi exigua (sandbar willow)	12	0-20	5
Salix geyeriana (Geyer willow)	20	0-20	3
Salix lasiandra (Pacific willow)	1	0-1	3
Salix lutea (yellow willow)	1	0-1	5
Salix nivalis (snow willow)	1	0-1	3
Salix planifolia (planeleaf willow)	30	0-30	3
Salix pseudomonticola (mountain willow)	1	0-1	3
Salix scouleriana (Scouler willow)	3	0-3	5
Salix spp. (willow)	1	0-1	8
Salix tweedyi (Tweedy's willow)	10	0-10	3
Symphoricarpos albus (common snowberry)	15	0-60	54
Forbs			
Fragaria virginiana (Virginia strawberry)	4	0-30	57
Galium boreale (northern bedstraw)	1	0-3	43
Galium triflorum (sweetscented bedstraw)	4	0-40	49
Osmorhiza chilensis (mountain sweet-cicely)	5	0-20	49
Smilacina stellata (starry Solomon-plume)	2	0-20	70
Thalictrum occidentale (western meadowrue)	8	0-60	43

SUCCESSIONAL INFORMATION

Picea (spruce) is usually present in seral stands, however its canopy cover may vary greatly. It reestablishes quickly on disturbed sites but assumes dominance slowly. *Betula papyrifera* (paper birch), *Pinus ponderosa* (ponderosa pine), and *Populus trichocarpa* (black cottonwood) may also form a major component of the overstory. Shrub cover is typically moderate with the major species being *Acer glabrum* (Rocky Mountain maple), *Amelanchier alnifolia* (western serviceberry), *Berberis repens* (creeping Oregongrape), *Cornus stolonifera* (red-osier dogwood), *Rhamnus alnifolia* (alder buckthorn), and *Symphoricarpos albus* (common snowberry). Herbaceous cover is moderate and includes *Elymus glaucus* (blue wildrye), *Osmorhiza chilensis* (mountain sweet-cicely), and *Smilacina stellata* (starry Solomon-plume).

SOILS

Parent material is usually alluvium and soils are generally Mollisols or Entisols often with Histic and Aquic characteristics (e.g. high organic matter accumulations, redox depletions [gleyed soil], redox concentrations [mottling] and high water tables). Soils textures vary little between clay loam and silt loam with coarse fragments common throughout. Water tables typically remain within 1 m (39 in) of the surface throughout the growing season.

ADJACENT COMMUNITIES

The *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type is the driest of the low elevation *Picea* (spruce) wetland habitat types. Adjacent wetter types may include the *Picea/Equisetum arvense* (spruce/common horsetail) habitat type or various *Salix* species (willow) and *Alnus incana* (mountain alder). Adjacent upland types are from the *Pseudotsuga menziesii* (Douglas fir), *Abies lasiocarpa* (subalpine fir), and *Abies grandis* (grand fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is low to moderate. The dense overstory tends to limit forage production and thereby limiting use by livestock.

Timber

Timber productivity ranges from moderate to high. However, streamside locations and high water tables may restrict timber harvest. Partial cutting will favor *Picea* (spruce) while complete stand removal will result in mixed stands of *Pseudotsuga menziesii* (Douglas fir) and *Pinus contorta* (lodgepole pine) along with *Picea engelmannii* (Engelmann spruce). Uneven aged management should be considered as a possible silvicultural system in this habitat type.

Wildlife

Deer and elk appear to use this type as winter range. Some of the broad, flat mountain valleys associated with this type may be prime year-long moose habitat. Some sites may show sustained heavy use by moose and elk.

Fisheries

Those stands of the *Picea/Cornus stolonifera* (spruce/red-osier dogwood) habitat type adjacent to streams provide hiding, thermal cover, debris recruitment, and streambank stability for fish. *Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

Fire susceptibility is low. However, *Picea engelmannii* (Engelmann spruce), including hybrids with *Picea glauca* (white spruce), is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to the species' low resistance. The shallow root system is readily subject to

injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Machinery and livestock easily compact or otherwise damage the soil during periods with high water tables. Poorly drained sites, stream side locations, or sites with organic soils should also warrant special concern. Roads and trails should be located on the adjacent uplands.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

Similar communities have been described for eastern Idaho and western Wyoming (Youngblood and others 1985b) and for Utah and southeastern Idaho (Padgett and others 1989).

Picea/Equisetum arvense Habitat Type
(Spruce/Field Horsetail Habitat Type)

PICEA/EQUARV (PICEA/EQAR)
Number Of Stands Sampled = 16

LOCATION AND ASSOCIATED LANDFORMS

The *Picea/Equisetum arvense* (spruce/field horsetail) habitat type is a minor type at low to mid elevations throughout the mountains and valleys of Montana. It may be locally abundant. Elevations of sampled sites range from 878 to 2,257 m (2,880 to 7,400 ft). This type characteristically occurs on flat sites with poor drainage. It also occurs on gentle toeslopes, seeps, stream terraces, and on high elevation basins adjacent to small lakes, fens, and wet meadows having low gradient meandering streams. Boundaries with adjacent types are often distinct.

FLORISTIC CHARACTERISTICS

Picea (spruce) is usually the only successful coniferous tree species, and typically forms a closed canopy. *Abies lasiocarpa* (subalpine fir) and *Pinus contorta* (lodgepole pine) are occasionally present on drier microsites such as windthrow hummocks. Shrub species richness is high but their coverage is low. Shrub species present include *Lonicera involucrata* (twin-berry). The canopy coverage of the herbaceous layer is high, dominated by *Equisetum arvense* (field horsetail) and *Smilacina stellata* (starry Solomon-plume). The sometimes extreme micro-relief generated by root crown hummocks and windthrow mounds accounts for a high species richness with a mixture of upland and wetland species.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Larix occidentalis (western larch)	1	0-1	13
Picea spp. (spruce)	66	40-80	100
Pinus contorta (lodgepole pine)	2	0-3	25
Populus tremuloides (quaking aspen)	2	0-3	25
Populus trichocarpa (black cottonwood)	1	0-1	13
Pseudotsuga menziesii (Douglas fir)	2	0-3	25
Shrubs			
Acer spp. (maple)	1	0-1	13
Amelanchier alnifolia (western serviceberry)	1	0-1	25
Berberis repens (creeping Oregongrape)	1	0-1	38
Cornus canadensis (bunchberry)	3	0-3	13
Cornus stolonifera (red-osier dogwood)	5	0-10	38
Linnaea borealis (twinflower)	2	0-3	25
Lonicera involucrata (twin-berry)	2	0-3	63
Rhamnus alnifolia (alder buckthorn)	3	0-3	13
Ribes lacustre (swamp currant)	1	0-1	13
Ribes spp. (currant)	1	0-1	13
Rosa acicularis (prickly rose)	2	0-3	38
Rosa woodsii (woods rose)	1	0-3	38
Rubus idaeus (red raspberry)	1	0-1	13
Salix drummondiana (Drummond willow)	50	0-50	13
Salix scouleriana (Scouler willow)	1	0-1	13
Salix spp. (willow)	1	0-1	25
Spiraea betulifolia (shiny-leaf spiraea)	3	0-3	13
Symphoricarpos albus (common snowberry)	1	0-3	38
Symphoricarpos occidentalis (western snowberry)	1	0-1	13
Graminoids			
Agropyron spp. (wheatgrass)	3	0-3	13
Agropyron exarata (spike bentgrass)	1	0-1	13
Agrostis scabra (tickle-grass)	1	0-1	13
Agrostis stolonifera (redtop)	1	0-1	13
Agrostis thurberiana (thurber bentgrass)	3	0-3	13
Bromus ciliatus (fringed brome)	1	0-1	38

Bromus vulgaris (Columbia brome)	1	0-1	25
Calamagrostis canadensis (bluejoint reedgrass)	27	0-40	38
Calamagrostis rubescens (pinegrass)	2	0-3	25
Carex canescens (gray sedge)	3	0-3	13
Carex pachystachya (thick-headed sedge)	1	0-1	13
Carex rossii (Ross sedge)	1	0-1	13
Carex rostrata (beaked sedge)	30	0-30	13
Cinna latifolia (drooping woodreed)	1	0-1	25
Elymus glaucus (blue wildrye)	5	0-10	25
Glyceria elata (tall mannagrass)	1	0-1	13
Glyceria striata (fowl mannagrass)	1	0-1	13
Luzula parviflora (small-flowered woodrush)	1	0-1	13
Forbs			
Actaea rubra (baneberry)	1	0-3	38
Allium spp. (onion)	1	0-1	13
Angelica arguta (sharptooth angelica)	1	0-1	13
Aralia nudicaulis (wild sarsaparilla)	20	0-20	13
Arenaria lateriflora (bluntleaf sandwort)	1	0-1	13
Arnica cordifolia (heart-leaf arnica)	1	0-1	25
Arnica latifolia (broadleaf arnica)	3	0-3	13
Aster foliaceus (leafy aster)	9	0-20	38
Aster occidentalis (western aster)	3	0-3	13
Aster perelegans (elegant aster)	1	0-1	13
Aster spp. (aster)	1	0-1	13
Cirsium arvense (Canada thistle)	1	0-1	25
Cirsium foliosum (elk thistle)	1	0-1	13
Cirsium undulatum (wavy-leaved thistle)	1	0-1	13
Epilobium alpinum (alpine willow-herb)	1	0-1	13
Epilobium angustifolium (fireweed)	1	0-3	63
Epilobium glaberrimum (smooth willow-herb)	1	0-1	13
Erigeron peregrinus (subalpine daisy)	1	0-1	13
Erigeron speciosus (showy fleabane)	1	0-1	13
Fragaria virginiana (Virginia strawberry)	1	0-1	25
Galium boreale (northern bedstraw)	1	0-1	38
Galium trifidum (small bedstraw)	1	0-1	13
Galium triflorum (sweetscented bedstraw)	2	0-3	50
Geranium richardsonii (white geranium)	1	0-3	38
Geum macrophyllum (large-leaved avens)	1	0-1	38
Geum triflorum (old man's whiskers)	1	0-1	13
Habenaria obtusata (blunt-leaf rein-orchid)	1	0-1	13
Heracleum lanatum (cow-parsnip)	1	0-1	25
Mertensia ciliata (mountain bluebell)	3	0-3	13
Mitella spp. (mitrewort)	1	0-1	13
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	25
Potentilla gracilis (slender cinquefoil)	1	0-1	13
Pyrola asarifolia (pink wintergreen)	1	0-1	38
Pyrola chlorantha (green wintergreen)	1	0-1	13
Pyrola secunda (one-sided wintergreen)	1	0-1	25
Pyrola spp. (wintergreen)	1	0-1	13

Pyrola uniflora (woodnymph)	1	0-1	25
Ranunculus uncinatus (little buttercup)	1	0-1	13
Rubus pubescens (dwarf red blackberry)	3	0-3	13
Senecio pseudaureus (streambank groundsel)	1	0-1	50
Smilacina racemosa (false spikenard)	1	0-1	13
Smilacina stellata (starry Solomon-plume)	4	0-20	63
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-1	38
Taraxacum officinale (common dandelion)	1	0-1	25
Thalictrum fendleri (Fendler's meadowrue)	3	0-3	13
Thalictrum occidentale (western meadowrue)	1	0-3	38
Veronica americana (American speedwell)	1	0-1	13
Vicia spp. (vetch)	1	0-1	13
Viola adunca (Hook violet)	1	0-1	38
Viola canadensis (Canada violet)	1	0-1	25
Viola orbiculata (round-leaved violet)	1	0-1	13
Viola spp. (violet)	1	0-1	25
Ferns and Allies			
Equisetum arvense (field horsetail)	50	30-80	100

SUCCESSIONAL INFORMATION

Following disturbance, *Betula occidentalis* (water birch), *Alnus incana* (mountain alder), *Salix bebbiana* (Bebb willow), and *Equisetum arvense* (field horsetail) tend to dominate the site. Seedling and sapling *Picea* (spruce) are also common. In addition, *Populus trichocarpa* (black cottonwood) and *Pinus contorta* (lodgepole pine) may also be abundant in seral stands.

The *Populus tremuloides/Equisetum arvense* (quaking aspen/field horsetail) community type described by Youngblood and Mueggler (1981) is considered a seral stage of this habitat type.

SOILS

Soils on older terraces commonly classify to Mollisols (Aquolls or Borolls), while more recent soils key to Entisols (Aquents and Fluvents). Parent material is often coarse textured alluvium with coarse fragment contents varying widely. These soils are usually wet throughout the year, often with standing water. Water tables are usually less than 50 cm (20 in) deep, duff layers average 7 cm (3 in) and exposed rock or mineral soil is rare in this habitat type.

ADJACENT COMMUNITIES

Adjacent wetter communities include sites dominated by *Salix* species (willow), *Carex* species (sedge), or the *Typha latifolia* (common cattail) habitat type. Adjacent drier sites include communities dominated by other *Picea* (spruce) habitat types and by *Abies lasiocarpa* (subalpine fir) or *Pseudotsuga menziesii* (Douglas fir) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is moderate to high. However, these sites have little or no value for livestock other than shading. Soils are relatively sensitive to disturbance and cattle can easily churn the wet soil and destroy plant cover as well as limit conifer establishment (Youngblood and others 1985).

Timber

Timber productivity is moderate (Pfister and others 1977; Steele and others 1983) but offers limited potential due to the extremely fragile sites. Due to high water tables, the trees are extremely susceptible to windthrow and soil loss may follow all forms of timber harvesting. Possible options for timber harvesting includes winter logging with at least 60 cm (around 24 in) of snow on the ground, designated skid trails, and winching (Pfister and Sherwood 1989). However, according to Steele and others (1983), even if logged when the ground is frozen to reduce equipment impacts, water tables can rise, creating additional problems in site management. High water tables resulting from harvesting activity may cause regeneration problems. *Picea* (spruce) is generally the only conifer to successfully occupy these sites, although other species may occasionally occupy drier raised hummocks.

Wildlife

Deer, elk, and moose show moderate winter use of this type. *Equisetum arvense* (field horsetail) is an important food source for grizzly bears (Knight and Blanchard 1983). During the summer months, black bear use these sites for wallows. Big game may use this habitat type, especially during the rutting season (Youngblood and others 1985). Other wildlife, especially small mammals and avian species, may make high use of these sites because of their structural diversity. Big game may use this habitat type, especially during the rutting season (Youngblood and others 1985). Great blue herons are known to nest in *Picea* (spruce) stands in Montana, if a high degree of isolation during nesting is possible (Parker 1980). In addition, osprey will nest in old growth *Picea* (spruce) (Snow 1973).

Fisheries

Those stands of the *Picea/Equisetum arvense* (spruce/field horsetail) habitat type adjacent to streams provide hiding, thermal cover, and streambank stability for fish.

Fire

Fire susceptibility is low. However, *Picea engelmannii* (Engelmann spruce), including hybrids with *Picea glauca* (white spruce), is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to the species low resistance. The shallow root system is readily subject to injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage.

Soil Management and Rehabilitation Opportunities

Road construction and development severely degrade sites along stream sides and sites with high water tables, poor drainage, or organic soils. Roads and trails should be located on the adjacent uplands.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site;

Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

This discussion is an expanded description of this habitat type as defined by Pfister and others (1977). Similar habitat types were described for central Idaho (Steele and others 1981), eastern Idaho and western Wyoming (Steele and others 1983), northern Utah (Mauk and Henderson 1984), and central and southern Idaho (Youngblood and Mauk 1985). Kovalchik (1987) described a similar type (*Picea engelmannii/Equisetum arvense-Streptopus* (Engelmann spruce/field horsetail clasping-leaved twisted stalk) association for central Oregon. In addition, a similar community type has been described for western Wyoming (Norton and others 1981), eastern Idaho and western Wyoming (Youngblood and others 1985b), and for Utah and southeastern Idaho (Padgett and others 1989).

Picea/Galium triflorum Habitat Type
(Spruce/Sweetscented Bedstraw Habitat Type)

PICEA/GALTRI (PICEA/GATR)
Number Of Stands Sampled = 18

LOCATION AND ASSOCIATED LANDFORMS

The *Picea/Galium triflorum* (spruce/sweetscented bedstraw) habitat type is a major type at mid to high elevations in the mountains of southwestern and central Montana. Sites range in elevation from 854 to 2,151 m (2,800 to 7,052 ft). This type occurs on cool, moist sites, such as gently undulating or flat alluvial benches and terraces bordering streams. In some instances, it occurs on moist toeslopes. The type is abundant in the Gallatin National Forest.

FLORISTIC CHARACTERISTICS

The relatively dense overstory contains mature *Picea* (spruce). *Abies lasiocarpa* (subalpine fir) is frequently present in limited amounts, but shows low vigor. Shrub species include: *Ribes lacustre* (swamp currant), *Rosa acicularis* (prickly rose), *Symphoricarpos albus* (common snowberry), and *Lonicera involucrata* (twin-berry). The normally diverse herbaceous layer may include a variety of species: *Geranium richardsonii* (white geranium), *Galium triflorum* (sweetscented bedstraw), *Heracleum lanatum* (cow-parsnip), *Osmorhiza chilensis* (mountain sweet-cicely), *Smilacina stellata* (starry Solomon-plume), *Actaea rubra* (baneberry), *Thalictrum occidentale* (western meadowrue), and *Pyrola minor* (snowline pyrola).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies lasiocarpa (subalpine fir)	1	0-3	38
Picea spp. (spruce)	65	20-80	100
Pinus albicaulis (white-bark pine)	1	0-1	25
Pinus contorta (lodgepole pine)	3	0-3	38
Populus tremuloides (quaking aspen)	1	0-1	13
Pseudotsuga menziesii (Douglas fir)	1	0-1	25

Shrubs			
Alnus incana (mountain alder)	2	0-3	25
Amelanchier alnifolia (western serviceberry)	1	0-1	38
Berberis repens (creeping Oregongrape)	1	0-1	50
Juniperus communis (common juniper)	1	0-1	25
Linnaea borealis (twinflower)	40	0-40	13
Lonicera involucrata (twin-berry)	6	0-20	50
Lonicera utahensis (Utah honeysuckle)	1	0-3	38
Potentilla fruticosa (shrubby cinquefoil)	1	0-1	13
Ribes hudsonianum (stinking currant)	3	0-3	13
Ribes lacustre (swamp currant)	1	0-3	88
Rosa acicularis (prickly rose)	2	0-3	63
Rubus idaeus (red raspberry)	1	0-1	13
Rubus parviflorus (thimbleberry)	1	0-1	25
Salix scouleriana (Scouler willow)	1	0-1	25
Shepherdia canadensis (Canada buffaloberry)	2	0-3	25
Sorbus scopulina (Cascade mountain-ash)	1	0-1	13
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	13
Symphoricarpos albus (common snowberry)	1	0-3	63
Vaccinium globulare (globe huckleberry)	1	0-1	13
Graminoids			
Agropyron caninum (bearded wheatgrass)	3	0-3	13
Agropyron repens (quackgrass)	1	0-1	13
Bromus anomalus (nodding brome)	3	0-3	25
Bromus carinatus (mountain brome)	1	0-1	13
Bromus ciliatus (fringed brome)	1	0-1	13
Bromus vulgaris (Columbia brome)	1	0-1	25
Calamagrostis canadensis (bluejoint reedgrass)	22	0-40	25
Calamagrostis rubescens (pinegrass)	12	0-20	25
Calamagrostis stricta (narrow-spiked reedgrass)	60	0-60	13
Cares disperma (soft-leaved sedge)	6	0-20	50
Carex geyeri (elk sedge)	1	0-1	13
Carex hoodii (Hood's sedge)	3	0-3	13
Carex microptera (small-winged sedge)	1	0-1	13
Cinna latifolia (drooping woodreed)	2	0-3	25
Deschampsia cespitosa (tufted hairgrass)	1	0-1	13
Elymus glaucus (blue wildrye)	1	0-1	25
Luzula parviflora (small-flowered woodrush)	1	0-1	38
Melica subulata (Alaska oniongrass)	3	0-3	13
Oryzopsis asperifolia (roughleaf ricegrass)	1	0-1	13
Phleum pratense (common timothy)	1	0-1	13
Poa grayana (Gray's bluegrass)	1	0-1	13
Poa interior (inland bluegrass)	1	0-1	13
Poa nervosa (Wheeler's bluegrass)	1	0-1	13
Poa spp. (bluegrass)	3	0-3	13
Forbs			
Achillea millefolium (common yarrow)	1	0-1	38
Actaea rubra (baneberry)	1	0-1	88

Allium brevistylum (short-style onion)	1	0-1	13
Angelica arguta (sharptooth angelica)	1	0-3	38
Angelica pinnata (pinnate-leaved angelica)	1	0-1	13
Antennaria racemosa (raceme pussy-toes)	1	0-1	13
Aquilegia flavescens (yellow columbine)	2	0-3	25
Arenaria lateriflora (bluntleaf sandwort)	1	0-1	13
Arnica latifolia (broadleaf arnica)	15	0-20	25
Aster conspicuus (showy aster)	1	0-3	38
Aster engelmannii (Engelmann's aster)	1	0-1	25
Aster foliaceus (leafy aster)	2	0-3	38
Aster occidentalis (western aster)	40	0-40	13
Astragalus alpinus (alpine milk-vetch)	1	0-1	13
Astragalus miser (weedy milk-vetch)	1	0-1	13
Campanula rotundifolia (lady's-thimble)	1	0-1	13
Castilleja miniata (scarlet paintbrush)	1	0-1	13
Cicuta maculata (spotted water-hemlock)	1	0-1	13
Cirsium arvense (Canada thistle)	1	0-1	13
Corallorhiza trifida (yellow coral-root)	1	0-1	13
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	13
Epilobium angustifolium (fireweed)	1	0-1	50
Epilobium glaberrimum (smooth willow-herb)	1	0-1	13
Epilobium spp. (willow-herb)	1	0-1	13
Erythronium grandiflorum (glacier-lily)	1	0-1	25
Fragaria vesca (woods strawberry)	1	0-1	38
Fragaria virginiana (Virginia strawberry)	1	0-3	75
Galium boreale (northern bedstraw)	1	0-1	38
Galium triflorum (sweetscented bedstraw)	1	0-3	88
Gentianella amarella (northern gentian)	1	0-1	13
Geranium richardsonii (white geranium)	8	0-40	88
Geum macrophyllum (large-leaved avens)	1	0-1	50
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	25
Habernaria obtusata (blunt-leaf rein-orchid)	1	0-1	13
Habenaria orbiculata (large round-leaved rein-orchid)	1	0-1	13
Heracleum lanatum (cow-parsnip)	1	0-3	88
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	13
Ligusticum tenuifolium (slender-leafed licorice-root)	1	0-1	13
Listera borealis (norther twayblade)	1	0-1	13
Listera cordata (heart-leaf twayblade)	1	0-1	25
Mertensia ciliata (mountain bluebell)	2	0-3	38
Osmorhiza chilensis (mountain sweet-cicely)	1	0-3	88
Pedicularis bracteosa (bracted lousewort)	1	0-1	13
Potentilla diversifolia (diverse-leaved cinquefoil)	1	0-1	13
Potentilla gracilis (slender cinquefoil)	1	0-1	25
Pyrola asarifolia (pink wintergreen)	2	0-3	25
Pyrola chlorantha (green wintergreen)	1	0-1	63
Pyrola minor (snowline pyrola)	1	0-1	13
Pyrola secunda (one-sided wintergreen)	2	0-3	75
Rubus pubescens (dwarf red blackberry)	1	0-1	13
Saxifraga arguta (brook saxifrage)	1	0-1	38

Senecio pseudaureus (streambank groundsel)	1	0-3	50
Senecio triangularis (arrowleaf groundsel)	5	0-10	38
Smilacina racemosa (false spikenard)	1	0-1	38
Smilacina stellata (starry Solomon-plume)	1	0-3	88
Streptopus amplexifolius (clasping-leaved twisted stalk)	1	0-3	50
Taraxacum ceratophorum (horned dandelion)	1	0-1	13
Taraxacum officinale (common dandelion)	1	0-3	75
Thalictrum fendleri (fendler's meadowrue)	1	0-1	13
Thalictrum occidentale (western meadowrue)	5	0-20	75
Trifolium longipes (long-stalked clover)	1	0-1	25
Urtica dioica (stinging nettle)	1	0-1	38
Valeriana dioica (northern valerian)	1	0-1	13
Veratrum viride (green false hellebore)	1	0-1	13
Viola macloskeyi (small white violet)	1	0-1	13
Ferns and Allies			
Equisetum arvense (field horsetail)	1	0-3	38
Equisetum pratense (meadow horsetail)	50	0-50	13

SUCCESSIONAL INFORMATION

Seral stands may contain *Pseudotsuga menziesii* (Douglas fir) or *Pinus contorta* (lodgepole pine) in the overstory, but *Picea* (spruce) reestablishes quickly on disturbed sites and soon dominates. Youngblood and others (1985) suggest that on extremely well drained sites supporting the *Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood) or *Populus angustifolia*/Herbaceous (narrowleaf cottonwood/Herbaceous) community types, the *Picea/Galium triflorum* (spruce/sweetscented bedstraw) habitat type may represent the site's potential.

SOILS

These soils commonly develop from noncalcareous parent alluvium. Most soils have mollic epipedons, those less developed are commonly Entisols. Some sites have histic characteristics, such as organic layers often exceeding 50 cm (20 in). Water tables are commonly within 1 m (39 in) of the surface throughout the growing season.

ADJACENT COMMUNITIES

Adjacent wetter sites may include those dominated by species of *Salix* (willow) or *Carex* (sedge). Adjacent drier sites are most frequently moist habitat types supporting *Abies lasiocarpa* (subalpine fir).

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Grazing by livestock is generally light.

Timber

Timber productivity ranges from moderate to very high. This type represents one of the most productive habitat types for *Picea* (spruce) and *Pinus contorta* (lodgepole pine) east of the Continental Divide in Montana. However, streamside locations and high water tables may restrict timber harvest. Partial cutting will favor *Picea* (spruce) while complete stand removal will result in mixed stands of *Pseudotsuga menziesii* (Douglas fir) and *Pinus contorta* (lodgepole pine) along with *Picea engelmannii* (Engelmann spruce). Uneven aged management should be considered as a possible silvicultural system in this habitat type.

Wildlife

Deer and elk use this type as winter range. Some of the broad, flat mountain valleys associated with this type may be prime year long moose habitat. Some sites may show sustained heavy use by moose and elk. Great blue herons are known to nest in *Picea* species (spruce) stands in Montana, if a high degree of isolation during nesting is possible (Parker 1980). In addition, osprey will nest in old growth *Picea* species (spruce) (Snow 1973).

Fisheries

The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability.

Fire

Fire susceptibility is low. However, *Picea engelmannii* (Engelmann spruce), including hybrids with *Picea glauca* (white spruce), is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to the species' low resistance. The shallow root system is readily subject to injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage.

Soil Management and Rehabilitation Opportunities

Machinery and livestock easily compact or otherwise damage the soil during periods with high water tables. Poorly drained sites, stream side locations, or sites with organic soils should also warrant special concern. Roads and trails should be located on the adjacent uplands.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

The *Picea/Galium triflorum* (spruce/sweetscented bedstraw) habitat type was first described by Pfister and others in their 1977 publication for Montana. A similar habitat type was described by Steele and others (1981) for central Idaho, Steele and others (1983). Somewhat similar community types were also described by Youngblood and others (1985b) for eastern Idaho and western Wyoming and by Padgett and others (1989) for Utah and southeastern Idaho.

Picea/Lysichiton americanum Habitat Type

PICEA/LYSAME (PICEA/LYSA3)
Number Of Stands Sampled = 5

LOCATION AND ASSOCIATED LANDFORMS

The *Picea/Lysichiton americanum* (spruce/skunk cabbage) habitat type is an incidental type at low elevations in the valleys of northwestern Montana. Elevations of sampled sites range from 878 to 900 m (2,880 to 2,900 ft). This type is located on level sites with high water tables adjacent to low gradient meandering streams and ponds.

FLORISTIC CHARACTERISTICS

The overstory is moderately open with *Picea* (spruce) usually the only successful coniferous tree species. Small depressions with standing water are often interspersed among the trees. *Lysichiton americanum* (skunk cabbage), the diagnostic undergrowth species, grows at the waters' edge and moist microsites. The shrub canopy is abundant and includes *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), and *Betula occidentalis* (water birch). Herbaceous species include: *Lysichiton americanum* (skunk cabbage), *Cinna latifolia* (drooping woodreed), and *Athyrium filix-femina* (ladyfern).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Betula papyrifera (paper birch)	7	0-10	40
Picea spp. (spruce)	27	1-50	100
Pseudotsuga menziesii (Douglas fir)	2	0-3	40
Shrubs			
Acer glabrum (Rocky Mountain maple)	2	0-3	60
Alnus incana (mountain alder)	30	0-40	60
Betula occidentalis (water birch)	5	0-10	60
Cornus canadensis (bunchberry)	5	0-10	40
Cornus stolonifera (red-osier dogwood)	3	1-3	100
Linnaea borealis (twinflower)	1	0-1	40
Rosa acicularis (prickly rose)	1	0-3	60
Rubus parviflorus (thimbleberry)	2	0-3	40
Solanum dulcamara (climbing nightshade)	2	0-3	40
Symphoricarpos albus (common snowberry)	1	0-3	60
Graminoids			
Cinna latifolia (drooping woodreed)	2	0-3	60
Forbs			
Galium aparine (goose-grass)	1	0-1	40
Galium triflorum (sweetscented bedstraw)	2	0-3	40
Geum macrophyllum (larged-leaved avens)	1	0-3	60
Lysichiton americanum (skunk cabbage)	35	1-80	100
Osmorhiza chilensis (mountain sweet-cicely)	2	0-3	40

Smilacina stellata (starry Solomon-plume)	2	0-3	40
Taraxacum officinale (common dandelion)	1	0-1	80
Ferns and Allies			
Athyrium filix-femina (ladyfern)	5	0-10	60
Equisetum arvense (field horsetail)	1	0-1	60
Equisetum fluviatile (water horsetail)	1	0-1	40

SUCCESSIONAL INFORMATION

Only one early seral stand was sampled. It had been logged and heavily grazed. *Picea* (spruce) was the only tree species present. *Alnus incana* (mountain alder) was very abundant and the dominant herbaceous species was *Poa pratensis* (Kentucky bluegrass). *Lysichiton americanum* (skunk cabbage) had very low coverage, probably due to the grazing pressure.

SOILS

Water tables are typically within 50 cm (20 in) of the soil surface throughout the year, with standing water in surface depressions. Surface horizons usually have high organic matter contents or redox depletions (segregated gleyed soil) are found in most subsoils.

ADJACENT COMMUNITIES

This habitat type is the wettest type in the *Picea* (spruce) series. Adjacent wetter communities include sites dominated by *Phalaris arundinacea* (reed canarygrass), *Salix* species (willow), *Carex* species (sedge), and *Typha latifolia* (common cattail). The *Picea/Equisetum arvense* (spruce/common horsetail) habitat type probably occupies the drier wetland sites. The *Abies lasiocarpa* (subalpine fir) series is located on cooler sites. Adjacent upland sites include habitat types from the *Pinus ponderosa* (ponderosa pine) or *Pseudotsuga menziesii* (Douglas fir) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Herbage production is high in early seral stands and moderate in late seral stands. Grazing can churn the wet soil and destroy plant cover as well as limit conifer establishment.

Timber

Timber productivity is probably moderate to high, but offers limited potential due to the extreme fragility of the sites. If these sites are harvested, clearcutting may be the preferred method because of the shallow rooting and subsequent windthrow problems. High water tables resulting from harvesting activity may cause regeneration problems. *Picea* (spruce) is generally the only conifer to successfully occupy these sites, although other species may occasionally occupy drier raised hummocks. High water tables preclude the use of heavy equipment in these sites.

Fire

Fire susceptibility is low. However, *Picea* (spruce) is easily killed by fire (Fischer and Bradley 1987). The dead, dry, flammable lower limbs, low growing canopy, thin bark, and lichen growth in the branches contribute to the species' low resistance. The shallow root system is readily subject to injury from fire burning through the duff. Large older trees may occasionally survive one or more light fires, but deep accumulations of resinous needle litter around their bases usually make them very susceptible to fire damage.

Soil Management and Rehabilitation Opportunities

Road construction and site development present extreme problems related to high water tables, poor drainage, stream side locations, and organic soils. Roads and trails should be located on adjacent uplands.

Recreational Uses and Considerations

Because of high water tables and the problems with road construction, campgrounds should not be located in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = subirrigated range site, wet meadow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = subirrigated range site, wet meadow range site.

OTHER STUDIES

This habitat type has not been previously described.

Pinus ponderosa/Cornus stolonifera Habitat Type
(Ponderosa Pine/Red-Osier Dogwood Habitat Type)

PINPON/CORSTO (PIPO/COST4)

Number Of Stands Sampled = 29

LOCATION AND ASSOCIATED LANDFORMS

The *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type is a major type at low elevations in the mountain valleys of Montana. Elevations of sampled sites range from 707 to 1,280 m (2,320 to 4,200 ft). The type occurs on alluvial benches or terraces of major streams and rivers. Stands vary from broad and extensive to narrow and long, depending on the landform. This type is locally common along the lower Flathead River, the Bitterroot River, the Clark Fork River, and the Upper Yellowstone River.

FLORISTIC CHARACTERISTICS

The *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type is characterized by an overstory of *Pinus ponderosa* (ponderosa pine). Scattered individuals of *Populus angustifolia* (narrowleaf cottonwood) and *Populus trichocarpa* (black cottonwood) may also be present. The understory consists of a dense layer of shrubs including *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), and *Symphoricarpos occidentalis* (western snowberry). A variety of graminoids and forbs are also present in this type.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover Average	Range	Constancy
Trees			
Pinus ponderosa (ponderosa pine)	22	1-80	100
Populus angustifolia (narrowleaf cottonwood)	3	0-60	60
Populus trichocarpa (black cottonwood)	38	0-98	79
Shrubs			
Amelanchier alnifolia (western serviceberry)	10	0-1	55
Cornus stolonifera (red-osier dogwood)	21	0-60	59
Symphoricarpos occidentalis (western snowberry)	18	0-60	45
Graminoids			
Poa pratensis (Kentucky bluegrass)	9	0-60	52
Forbs			
Smilacina stellata (starry Solomon-plume)	3	0-20	41

SUCCESSIONAL INFORMATION

Seral stands of this type are dominated by the *Populus trichocarpa* (black cottonwood) and *Populus angustifolia* (narrowleaf cottonwood) community types. In these seral stands, *Pinus ponderosa* (ponderosa pine) will be present and successfully reproducing.

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of this type will contain a rich, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood) and *Amelanchier alnifolia* (western serviceberry). With moderate disturbance, there will be an increase in *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood) and *Amelanchier alnifolia* (western serviceberry). If the disturbance continues, the more desirable shrubs will be eliminated leaving *Symphoricarpos occidentalis* (western snowberry) and *Rosa woodsii* (woods rose) which can form a nearly impenetrable understory. However, if the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common), and *Bromus inermis* (smooth brome). During the process of converting from a rich, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Once the stand has converted from a shrub-dominated understory to one that is dominated by introduced herbaceous species, we speculate the prospect of returning the site to its former state will be difficult and costly in terms of both manpower and money. Therefore, if a manager wants to maintain the stand in a shrub understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is degraded.

SOILS

Soils are usually Mollisols or Entisols, often more specifically Fluvents. Mineral soils are commonly found up to 1 m (39 in) in depth overlying river gravel or cobbles. Soils textures vary from loam to coarse sand. Water tables generally drop below 1 m in the summer, but surface horizons may remain moist due to capillary action. Coarse textured soils, moderate stream gradients, and high amounts of coarse fragments provide an environment in which the rapid movement of highly aerated water can occur. Reduced soil conditions are uncommon, but redox concentrations (mottles) have been noted in some soils.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including *Salix exigua* (sandbar willow), *Typha latifolia* (common cattail), and *Eleocharis palustris* (common spikesedge) types. Adjacent upland types include habitat

types from the *Pseudotsuga menziesii* (Douglas fir) and *Pinus ponderosa* (ponderosa pine) series, and a variety of upland grass or shrub habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to moderate. Most sites are subjected to heavy grazing pressures because of their topographic location and ease of access. With moderate to heavy grazing pressures, most shrubs will be eliminated leaving *Rosa woodsii* (woods rose), *Symphoricarpos occidentalis* (western snowberry), and *Poa pratensis* (Kentucky bluegrass) as the dominate understory. If disturbance is severe, the shrubs will also be eliminated (see the discussion under the Seral Stages section).

Timber

Limited information is available on this type. Limited information suggests that timber productivity is moderate to high. However, it probably represents one of the most productive sites for *Pinus ponderosa* (ponderosa pine) due to relatively high water tables. *Pinus ponderosa* (ponderosa pine) is the only conifer to occupy these sites and will be favored by partial cutting. Complete overwood removal is likely to set the sites back to a seral shrub stage resulting in slow regeneration by *Pinus ponderosa* (ponderosa pine).

Wildlife

The *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type provides valuable hiding cover and shade for a variety of species. Big game use may be high, depending upon the time of year. *Cornus stolonifera* (red-osier dogwood) is favored by moose (Costain 1989) and beaver (Allen 1983) when present. Canada geese occasionally use the nests previously built by bald eagles and osprey. Great blue herons are known to nest in *Pinus ponderosa* (ponderosa pine) stands in Montana, if a high degree of isolation during nesting is possible (Parker 1980). A variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in trunk cavities.

Fisheries

The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability.

Fire

Fire potential is moderate, especially in late summer. *Pinus ponderosa* (ponderosa pine) has many fire resistant characteristics. Seedlings and saplings are often able to withstand fire (Fischer and Bradley 1987). Seedlings and saplings can maintain themselves on sites with fire intervals as short as 6 years if fire severity is low. Development of insulative bark and the tendency for meristems to be shielded by enclosing needles and thick bud scales contribute to the temperature resistance of pole-sized and larger trees. However, on moist sites, *Pinus ponderosa* (ponderosa pine) forms dense understories which may act as fuel ladders that can carry surface to the overstory. In addition, understory *Pinus ponderosa* (ponderosa pine) may also be more susceptible to fire damage because crowded conditions can result in slower diameter growth. Such trees do not develop their protective layer of insulative bark as early as do faster growing trees.

Soil Management and Rehabilitation Opportunities

Coarse textured substrates are not susceptible to compaction, yet this type is subject to infrequent flooding. Soils are relatively stable due to the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer for streambank stabilization.

Where revegetation with woody species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers

of alluvial soil deposits.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and bird watching.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site.

OTHER STUDIES

This type has not been previously described. However, Kovalchik (1987) described a *Pinus ponderosa/Symphoricarpos albus* (ponderosa pine/common snowberry) floodplain association for central Oregon that is similar in composition.

Pinus ponderosa/Prunus virginiana Habitat Type
(Ponderosa Pine/Common Chokecherry Habitat Type)

PINPON/PRUVIR (PIPO/PRVI)

Number Of Stands Sampled = 32

LOCATION AND ASSOCIATED LANDFORMS

The *Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry) habitat type is a minor type in the mountains and foothills of the isolated mountain ranges of the northern Great Plains in eastern Montana. It occupies V-shaped ravines along streams and the lower portions of steep, north facing slopes. In most cases, the sites are narrow stringers bordering the streams. Sites range in elevation from 1,080 to 1,510 m (3,550 to 4,950 ft). Sites occurred in the Missouri River Breaks area in central Montana, and in the southeastern portion of the state in the Crow Indian Reservation, Northern Cheyenne Indian Reservation, and the Custer National Forest.

FLORISTIC CHARACTERISTICS

In relatively undisturbed sites of the *Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry) habitat type, *Pinus ponderosa* (ponderosa pine) forms a closed overstory with a two layer shrub understory. The tallest shrub layer is dominated by *Prunus virginiana* (common chokecherry), with scattered amounts of *Amelanchier alnifolia* (western serviceberry). The lower shrub layer is dominated by *Berberis repens* (creeping Oregongrape), *Symphoricarpos albus* (common snowberry), and *Rosa woodsii* (woods rose). In the more mesic sites, *Fraxinus pennsylvanica* (green ash) may be present. The herbaceous understory contains a rich assortment of species including *Galium boreale* (northern bedstraw), *Arnica cordifolia* (heart-leaf arnica), and *Disporum trachycarpum* (wartberry fairy-bell). The diversity of species reflects

the mesic conditions associated with this habitat type.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Fraxinus pennsylvanica (green ash)	4	0-20	19
Pinus ponderosa (ponderosa pine)	27	40-98	100
Shrubs			
Amelanchier alnifolia (western serviceberry)	11	1-40	100
Berberis repens (creeping Oregongrape)	20	0-40	97
Crataegus douglasii (black hawthorn)	10	0-40	47
Prunus virginiana (common chokecherry)	30	1-60	100
Rosa woodsii (woods rose)	10	0-60	78
Shepherdia canadensis (Canada buffaloberry)	10	0-60	41
Spiraea betulifolia (shiny-leaf spiraea)	22	0-60	47
Symphoricarpos albus (common snowberry)	12	0-40	97
Toxicodendron rydbergii (poison ivy)	8	0-40	53
Graminoids			
Agrostis scabra (tickle-grass)	4	0-20	41
Festuca idahoensis (Idaho fescue)	1	0-3	44
Forbs			
Achillea millefolium (common yarrow)	1	0-1	69
Apocynum androsaemifolium (spreading dogbane)	4	0-20	50
Arnica cordifolia (heart-leaf arnica)	14	0-40	72
Campanula rotundifolia (lady's thimble)	1	0-1	56
Disporum trachycarpum (wartberry fairy-bell)	2	0-20	69
Fragaria virginiana (Virginia strawberry)	2	0-20	59
Galium boreale (northern bedstraw)	2	0-20	91
Smilacina racemosa (false spikenard)	2	0-20	59
Smilacina stellata (starry Solomon-plume)	1	0-3	56

SUCCESSIONAL INFORMATION

With increased grazing/browsing pressures, *Fraxinus pennsylvanica* (green ash) is eliminated and *Prunus virginiana* (common chokecherry) and *Amelanchier alnifolia* (western serviceberry) become dwarf-like and produce more shoots. In addition, prolonged grazing/browsing pressures cause the stands to become dominated by *Crataegus succulenta* (succulent hawthorn), *Rosa woodsii* (woods rose), and *Poa pratensis* (Kentucky bluegrass).

SOILS

Parent materials vary widely, including sandstone, siltstone, and shale. Soil texture varies little, ranging from silt loam to sandy loam. Undisturbed sites have duff layers averaging 5 cm (2 in). Soil reaction range from neutral to slightly acid (pH 7.0 to 6.0).

ADJACENT COMMUNITIES

Adjacent wetter communities include *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type, *Populus trichocarpa* (black cottonwood) community types, *Salix exigua* (sandbar willow) community types, and *Salix drummondiana* (Drummond willow) community types. Adjacent drier sites are typically dominated by upland *Pinus ponderosa* (ponderosa pine) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Livestock make moderate to high use of the *Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry) habitat type for thermal cover and grazing. Sites showing high livestock use will frequently develop large clumps of *Crataegus succulenta* (succulent hawthorn) over a dense stand of *Poa pratensis* (Kentucky bluegrass). Land managers should avoid a hot season of use on these sites.

Over the years there has been some debate whether *Prunus virginiana* (common chokecherry) leaves are poisonous to livestock. The leaves and seeds do have sugars that contain cyanide. These cyanide sugars are not poisonous themselves, but when plant material is crushed, eaten or decomposed, enzymes cause hydrogen cyanide to be released (Ode 1987). In high concentrations hydrogen cyanide is a metabolic poison to most animals, including humans. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide if they consume small amounts of it over an extended period of time. Therefore, *Prunus virginiana* (common chokecherry) will poison livestock only if it is consumed in large amounts without prior exposure.

Timber

Timber productivity ranges from moderate to high. Hansen and Hoffman (1988) found basal areas ranging from 37 to 64 m^2/ha (159 to 277 ft/acre). Cooper (1985) found site index values ranging from 22 to 27 m (72 ft to 88 ft) at base age 100. Most sites show a high probability of successful natural regeneration which tends to favor clearcutting. However, land managers should consider the possibility of shrub competition and overstocking by *Pinus ponderosa* (ponderosa pine). The high incidence of overstocking indicates pre-commercial thinning will generally be required.

Wildlife

The diverse understory provides valuable forage and hiding cover to a number of wildlife species. Deer use may be quite high at times.

Fisheries

The value of these sites for fish are unknown at this time. However, they probably provide valuable thermal cover and streambank stability to many sites.

Fire

Most sites show evidence of past fire. *Pinus ponderosa* (ponderosa pine) has many fire resistant characteristics. Seedlings and saplings are often able to withstand fire (Fischer and Bradley 1987). Seedlings and saplings can maintain themselves on sites with fire intervals as short as 6 years if fire severity is low. Development of insulative bark and the tendency for meristems to be shielded by enclosing needles and thick bud scales contribute to the temperature resistance of pole-sized and larger trees. However, on moist sites, *Pinus ponderosa* (ponderosa pine) forms dense understories which may act as fuel ladders that can carry surface to the overstory. In addition, understory *Pinus ponderosa* (ponderosa pine) may also be more susceptible to fire damage because crowded conditions can result in slower diameter growth. Such trees do not develop their protective layer of insulative bark as early as do faster growing trees.

Many of the common undergrowth species of this habitat type regenerate from

subterranean organs following fire. Other species must recolonize the site from seeds; establishment is controlled, in part, by the distance from seed sources. Though aerial plant parts may be consumed during fire, *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and *Symphoricarpos alba* (common snowberry) sprout from surviving root crowns or rhizomes and usually increase their coverage following fire. *Berberis repens* (creeping Oregongrape) is moderately resistant and survives all but severe fires that both remove the duff and heat the upper soil for extended periods. The forb *Apocynum androsaemifolium* (spreading dogbane) also sprouts after fire. Following a cool to moderate fire, *Berberis repens* (creeping Oregongrape), *Apocynum androsaemifolium* (spreading dogbane), and *Symphoricarpos alba* (common snowberry) sprout quickly and increase their abundance. As succession advances, these species decrease in importance, usually adjusting to prefire conditions, while *Prunus virginiana* (common chokecherry) and, to a lesser extent, *Amelanchier alnifolia* (western serviceberry) slowly increase. In addition, scattered seedlings or saplings of *Fraxinus pennsylvanica* (green ash) and *Crataegus succulenta* (succulent hawthorn) may be found at this time. *Fraxinus pennsylvanica* (green ash) and *Crataegus succulenta* (succulent hawthorn) usually do not survive past saplings in the older stands. However, mature individuals of *Fraxinus pennsylvanica* (green ash) and *Crataegus succulenta* (succulent hawthorn) may occur close to streams in this habitat type.

Soil Management and Rehabilitation Opportunities

Sites adjacent to streams are vulnerable to streambank sloughing, particularly when soils are moist. Excessive livestock use will increase soil compaction and lower stability. Management should emphasize the importance of the understory shrub community for streambank stabilization.

Where revegetation with woody species is desired, *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and other shrub species are well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are moderate to rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits.

Recreational Uses and Considerations

Most sites provide excellent opportunities for viewing a variety of wildlife. In addition, these sites are good locations for campgrounds, provided the sites are large enough in size.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site.

OTHER STUDIES

This discussion is an expanded description of this habitat type as defined by Hansen and Hoffman (1988) and by Pfister and others (1977). This habitat type was also described by Cooper (1985) for the Crow and Northern Cheyenne Indian Reservations, and by Hoffman and Alexander (1987) for the northern edge of the Black Hills of South Dakota.

Pseudotsuga menziesii/Cornus stolonifera Habitat Type

PSEMEN/CORSTO (PSME/COST4)
Number Of Stands Sampled = 28

LOCATION AND ASSOCIATED LANDFORMS

The *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type is a minor type at low to mid elevations throughout the mountainous regions of Montana. Elevations of sampled sites range from 1,098 to 1,940 m (3,600 to 6,360 ft). The type occurs on well drained alluvial benches or terraces of major streams and rivers. It is typically located along the major rivers and streams in western and central Montana.

FLORISTIC CHARACTERISTICS

The *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type is characterized by an overstory of *Pseudotsuga menziesii* (Douglas fir) and a scattering of *Pinus ponderosa* (ponderosa pine). Scattered individuals of *Populus trichocarpa* (black cottonwood) and/or *Populus tremuloides* (quaking aspen) may also be present. The understory shrub layer consists of *Rosa woodsii* (woods rose), *Cornus stolonifera* (red-osier dogwood), and *Prunus virginiana* (common chokecherry). A variety of herbaceous species are also present.

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Populus angustifolia (narrowleaf cottonwood)	47	0-60	11
Populus trichocarpa (black cottonwood)	43	0-80	50
Pseudotsuga menziesii (Douglas fir)	21	1-98	100
Shrubs			
Cornus stolonifera (red-osier dogwood)	13	0-40	43
Prunus virginiana (common chokecherry)	9	0-50	43
Rosa woodsii (woods rose)	12	0-40	61
Salix bebbiana (Bebb willow)	4	0-20	25
Salix boothii (Booth willow)	5	0-10	7
Salexi exigua (sandbar willow)	1	0-3	11
Salix lutea (yellow willow)	3	0-3	7
Shepherdia canadensis (Canada buffaloberry)	3	0-10	43
Graminoids			
Phleum pratense (common timothy)	14	0-80	43
Poa pratensis (Kentucky bluegrass)	10	0-40	36
Forbs			
Actaea rubra (baneberry)	5	0-20	25
Smilacina stellata (starry Solomon-plume)	2	0-3	50
Ferns and Allies			
Equisetum arvense (field horsetail)	22	0-40	25

SUCCESSIONAL INFORMATION

Seral stands of this type are dominated by the *Populus trichocarpa* (black cottonwood) and/or *Populus tremuloides* (quaking aspen) community types. In these seral stands, *Pseudotsuga menziesii* (Douglas fir) will be present and successfully reproducing.

The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. On sites that are relatively undisturbed, the understory of this type will contain a rich, dense shrub layer dominated by *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), and *Prunus virginiana* (common chokecherry). With moderate disturbance, there will be an increase in *Symphoricarpos* species (snowberry) and *Rosa* species (rose), with a corresponding decrease in both the abundance and canopy cover of *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), and *Prunus virginiana* (common chokecherry). If the disturbance continues, the more desirable shrubs will be eliminated leaving *Rosa* species (rose) and *Symphoricarpos* species (snowberry) which can form a nearly impenetrable understory. However, if the disturbance is severe enough, ***ALL*** shrubs can be eliminated and the understory will be converted to a herbaceous one dominated by species such as *Poa pratensis* (Kentucky bluegrass), *Phleum pratensis* (common timothy), and *Bromus inermis* (smooth brome). During the process of converting from a rich, dense shrub understory to a herbaceous understory, the stand will open up resulting in a drier site. Once the stand has converted from a shrub-dominated understory to one that is dominated by introduced herbaceous species, we speculate that the prospect of returning the site to its former state will be difficult, and costly in terms of both manpower and money. Therefore, if a manager wants to maintain the stand in a shrub understory state, the most cost effective method is to change the management on the site ***BEFORE*** the site is degraded.

SOILS

Soils are usually Mollisols or Entisols, often more specifically Fluvents. Mineral soils are commonly found up to 1 m (39 in) in depth overlying river gravel and/or cobbles. Soils textures vary from loam to coarse sand. Water tables generally drop below 1 m in the summer, but surface horizons may remain moist due to capillary action. Coarse textured soils, moderate stream gradients, and high amounts of coarse fragments provide an environment in which the rapid movement of highly aerated water can occur. Reduced soil conditions are uncommon, but redox concentrations (mottles) have been noted in some soils.

ADJACENT COMMUNITIES

Adjacent wetter communities may be dominated by a variety of types including *Populus trichocarpa* (black cottonwood), *Salix exigua* (sandbar willow), *Salix drummondiana* (Drummond willow), *Typha latifolia* (common cattail), and *Eleocharis palustris* (common spikesedge) types. Adjacent upland types include habitat types from the *Pseudotsuga menziesii* (Douglas fir) and *Pinus ponderosa* (ponderosa pine) series, and a variety of upland grass or shrub habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage production is low to moderate. Most sites are subjected to heavy grazing pressures because of their topographic location and ease of access. With moderate to heavy grazing pressures, most shrubs will be eliminated leaving *Rosa woodsii* (woods rose) and *Poa pratensis* (Kentucky bluegrass) as the dominate understory. If disturbance is severe, *Rosa woodsii* (woods rose) will also be eliminated (see the discussion under the Seral Stages section).

Timber

Limited information is available on this type. Timber productivity is estimated to be moderate. Because of at least seasonally high water tables, these sites probably represent some of the better timber producing sites for *Pseudotsuga menziesii* (Douglas fir). *Pseudotsuga menziesii* (Douglas fir) is the conifer most likely to dominate these sites. Clearcutting will set the

site back to seral shrub stages and new regeneration of *Pseudotsuga menziesii* (Douglas fir) may be slow due to increased competition from forbs, graminoids, and shrubs. A three step shelterwood cut may be the best method to use in achieving harvest regeneration.

Wildlife

The *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type provides valuable hiding cover and shade for a variety of species. Big game use may be high, depending upon the time of year. Whitetail deer may use this type year round as cover, while other big game species may use this type as cover only in the winter.

Cornus stolonifera (red-osier dogwood) is favored by moose (Costain 1989) and beaver (Allen 1983) when present. Canada geese occasionally use the nests previously built in *Cornus stolonifera* by bald eagles and osprey. In Montana, if a high degree of isolation during nesting is possible, great blue herons nest in *Pseudotsuga menziesii* (Douglas fir) stands (Parker 1980). In addition, a variety of birds and mammals, such as woodpeckers, great horned owls, wood ducks, and raccoons, nest in the trunk cavities.

Fisheries

The stream side location of this type is important in providing thermal cover, debris recruitment, and streambank stability. *Cornus stolonifera* (red-osier dogwood) is an excellent shrub for controlling erosion along streams. This is particularly important on the higher gradient streams where scouring by seasonal flooding is possible.

Fire

Fire potential is moderate, especially in late summer or during open, dry winters. Mature *Pseudotsuga menziesii* (Douglas fir) is a relatively fire resistant tree (Fischer and Bradley 1987). However, seedlings and saplings are vulnerable to surface fires because of their thin, photosynthetically active bark, resin blisters, closely spaced flammable needles, and thin twigs and bud scales. The moderately low and dense branching characteristic of saplings allows surface fires to be carried into the crown layer. Older trees develop a relatively unburnable, thick layer of insulative corky bark that provides protection against cool to moderately severe fires. Fire resistant bark takes about 40 years to develop on moist sites. *Pseudotsuga menziesii* (Douglas fir) regeneration is favored by fire which eliminates competition and creates favorable seedbeds.

Cornus stolonifera (red-osier dogwood) and the associated shrub species can survive all but the most severe fires that remove duff and cause extended heating of the upper layer of soil. After a fire, the shrubs sprouts from the surviving rhizomes or stolons (runners) (Fischer and Bradley 1987).

Soil Management and Rehabilitation Opportunities

Coarse textured substrates are not susceptible to compaction, yet this type is subject to infrequent flooding. Soils are relatively stable due to the strong rooting action of the associated species. Management should emphasize the importance of the understory shrub layer for streambank stabilization.

Where revegetation with woody species is desired, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), and various species of *Salix* (willow) and *Ribes* (currants and gooseberries) may be well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits.

Recreational Uses and Considerations

Because of its proximity to streams and rivers and its flat topography, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and bird watching.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Foothills and Mountains, 10-14 inch Precipitation Zone = overflow range site; Foothills and Mountains, 15-19 inch Precipitation Zone = overflow range site; Foothills and Mountains, 20 inch Plus Precipitation Zone = overflow range site; Northern Rocky Mountain Valleys, West of the Continental Divide, 15-19 inch Precipitation Zone = overflow range site; Northern Rocky Mountain Parks, West of the Continental Divide, 20 inch Plus Precipitation Zone = overflow range site.

OTHER STUDIES

This type has not been previously described.

Thuja plicata/Athyrium filix-femina Habitat Type, *Athyrium filix-femina* Phase (Western Red Cedar/Lady Fern Habitat Type, Lady Fern Phase)

THUPLI/ATHFIL-ATHFIL (THPL/ATFI-ATFI)
Number Of Stands Sampled = 11

LOCATION AND ASSOCIATED LANDFORMS

The *Thuja plicata/Athyrium filix-femina* (western red cedar/lady fern) habitat type, *Athyrium filix-femina* (lady fern) phase is an incidental type at low to mid elevations in northwest Montana, and in the lower valley bottoms of the Bitterroot Mountains. Elevations of sampled sites range from 701 to 1,341 m (2,300 to 4,400 ft). It is located on stream terraces and toe slopes.

FLORISTIC CHARACTERISTICS

Thuja plicata (western red cedar), *Tsuga heterophylla* (western hemlock), and *Abies grandis* (grand fir) are the major tree species. This type often supports large old growth trees. The following species have a high constancy in this type: *Athyrium filix-femina* (ladyfern), *Tiarella trifoliata* (trefoil foamflower), *Smilacina stellata* (starry Solomon-plume), *Symphoricarpos albus* (common snowberry), and *Rubus parviflorus* (thimbleberry). High coverage of *Acer glabrum* (Rocky Mountain maple) or *Alnus sinuata* (Sitka alder) occurs on some sites. Sites with better soil drainage support nearly pure stands of *Tsuga heterophylla* (western hemlock), indicating a possible *Tsuga heterophylla/Athyrium filix-femina* (western hemlock/lady fern) habitat type.

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies grandis (grand fir)	11	0-20	71

Abies lasiocarpa (subalpine fir)	4	0-10	57
Larix occidentalis (western larch)	5	0-10	29
Picea engelmannii (Engelmann spruce)	1	0-3	43
Picea spp. (spruce)	12	0-20	29
Pinus monticola (western white pine)	1	0-3	43
Populus trichocarpa (black cottonwood)	3	0-3	29
Pseudotsuga menziesii (Douglas fir)	4	0-10	57
Thuja plicata (western red cedar)	71	0-98	86
Tsuga heterophylla (western hemlock)	31	0-80	71
Shrubs			
Acer glabrum (Rocky Mountain maple)	11	0-40	57
Cornus canadensis (bunchberry)	1	0-1	14
Cornus nuttallii (Pacific dogwood)	3	0-3	14
Linnaea borealis (twinflower)	5	0-10	29
Menziesia ferruginea (fool's huckleberry)	2	0-3	43
Oplopanax horridum (Devil's club)	1	0-1	14
Philadelphus lewisii (mockorange)	3	0-3	14
Ribes lacustre (swamp currant)	1	0-3	43
Rosa gymnocarpa (baldhip rose)	1	0-1	14
Rubus parviflorus (thimbleberry)	2	0-3	57
Sambucus racemosa (red elderberry)	1	0-1	14
Symphoricarpos albus (common snowberry)	5	0-20	57
Taxus brevifolia (Pacific yew)	15	0-20	29
Vaccinium globulare (globe huckleberry)	1	0-1	29
Vaccinium membranaceum (big huckleberry)	20	0-20	14
Graminoids			
Agrostis spp. (bentgrass)	1	0-1	14
Bromus vulgaris (Columbia brome)	1	0-1	29
Carex praegracilis (clustered field sedge)	1	0-1	14
Carex spp. (sedge)	1	0-1	14
Trisetum cernuum (nodding trisetum)	1	0-1	14
Forbs			
Aconitum columbianum (Columbian monkshood)	1	0-1	29
Actaea rubra (baneberry)	1	0-1	43
Adenocaulon bicolor (trail-plant)	1	0-1	29
Angelica arguta (sharptooth angelica)	1	0-1	14
Aquilegia flavescens (yellow columbine)	1	0-1	14
Aralia nudicaulis (wild sarsaparilla)	3	0-3	14
Asarum caudatum (wild ginger)	3	0-3	43
Aster campestris (meadow aster)	1	0-1	14
Circaea alpina (enchanter's nightshade)	1	0-1	29
Clintonia uniflora (queen's cup)	1	0-1	43
Coptis occidentalis (western goldthread)	20	0-20	14
Disporum hookeri (hooker fairy-bell)	2	0-3	29
Galium aparine (goose-grass)	1	0-1	14
Galium triflorum (sweetscented bedstraw)	2	0-3	29
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	29
Heracleum lanatum (cow-parsnip)	3	0-3	14
Listera convallarioides (broad-lipped twayblade)	1	0-1	14

Mitella nuda (bare-stemed mitrewort)	1	0-1	14
Mitella spp. (mitrewort)	1	0-1	14
Mitella stauropetala (side-flowered mitrewort)	1	0-1	14
Montia cordifolia (broad-leaved montia)	1	0-1	14
Montia sibirica (Siberian springbeauty)	3	0-3	14
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	43
Pyrola asarifolia (pink wintergreen)	1	0-1	14
Pyrola secunda (one-sided wintergreen)	1	0-1	14
Senecio spp. (groundsel)	1	0-1	14
Senecio triangularis (arrowleaf groundsel)	1	0-1	29
Smilacina stellata (starry Solomon-plume)	9	0-20	71
Stellaria spp. (starwort)	1	0-1	14
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-3	57
Thalictrum occidentale (western meadowrue)	1	0-1	14
Tiarella trifoliata(trefoil foamflower)	6	0-20	86
Trautvetteria caroliniensis (false bugbane)	8	0-20	43
Trillium ovatum (white trillium)	1	0-1	57
Urtica dioica (stinging nettle)	1	0-1	14
Veratrum viride (green false hellebore)	1	0-1	14
Viola glabella (pioneer violet)	1	0-1	14
Viola orbiculata (round-leaved violet)	1	0-1	14
Viola spp. (violet)	1	0-1	14
Ferns and Allies			
Athyrium filix-femina (ladyfern)	15	3-60	100
Equisetum sylvaticum (wood horsetail)	1	0-1	14
Gymnocarpium dryopteris (oak-fern)	19	0-60	71

SUCCESSIONAL INFORMATION

Populus trichocarpa (black cottonwood), *Abies grandis* (grand fir), *Pseudotsuga menziesii* (Douglas fir), *Larix occidentalis* (western larch), and *Tsuga heterophylla* (western hemlock) are sporadic associates with the dominant *Thuja plicata* (western red cedar). Undergrowth species may include: *Symphoricarpos albus* (common snowberry), *Phalaris arundinacea* (reed canarygrass), *Aralia nudicaulis* (wild sarsaparilla), *Galium triflorum* (sweetscented bedstraw), *Tiarella trifoliata* (trefoil foamflower), and *Athyrium filix-femina* (lady fern). The major climax indicator species, *Thuja plicata* (western red cedar) and *Athyrium filix-femina* (lady fern), are typically present in the earliest stages of succession.

SOILS

Parent material is mainly quartzite, sandstone, and granitics with some sites having metasediments, biotite, shale, and riverine or glacial alluvium. Soil texture range from silt loam to loamy sand. Water tables typically remain above 1 m (39 in) throughout the year. Depths to redox concentrations (mottling) average 24 cm (10 in). Bare soil and rock are occasionally found on these sites. Duff layers average 5 cm (2 in), while soil depths range from 40 to 80 cm (16 to 32 in). Soil reaction ranges from strongly acid to slightly acid (pH 5.0 to 6.0) (Cooper and others 1991).

ADJACENT COMMUNITIES

The *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type typically occupies wetter sites and the *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) or the *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat types are located on the drier wetland sites. The *Abies lasiocarpa* (subalpine fir) series is also located on wetter and/or cooler sites. Adjacent upland sites support habitat types from the *Abies grandis* (grand fir),

Tsuga heterophylla (western hemlock), or *Thuja plicata* (western red cedar) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage potential is moderate in early seral stages and low in late seral stages. It is very low in late seral or climax stands with closed canopies.

Timber

Timber productivity is high for *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock). High water tables during most of the season preclude the use of heavy equipment in these sites. If harvested, some dead and downed logs should be left because downed woody material serves as a seedbed for *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) (Parker 1979).

Wildlife

Early successional stages provide moderate amounts of browse and forage for elk and deer. Forage is low in old growth climax stands. This habitat type along with other moist old growth tree communities are rare in Montana. Many wildlife species, such as chestnut-backed chickadees and goshawks, are partially to strongly dependent on huge old growth trees for forage, cover, and nesting sites.

Fire

Fire frequency is low although when fires do occur, they are often intense. Riparian and wetland stringers of *Thuja plicata* (western red cedar) often act as natural firebreaks, because the moist duff does not readily burn. The thin bark, shallow root system, and low, dense branching habit of *Thuja plicata* (western red cedar) make it susceptible to fire damage. Despite its low to moderate fire resistance (Fischer and Bradley 1987), *Thuja plicata* (western red cedar) often survives because of its large size and its ability to live if any portion of the bole is not killed.

Soil Management and Rehabilitation Opportunities

High gravel contents common to soils of this habitat type make them unsusceptible to compaction. However, heavy equipment use can disrupt the stability of the site. All road construction and intensive site development should be located on adjacent uplands.

Recreational Uses and Considerations

Old growth stands of *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) have high recreational value due to their scarcity and attractiveness.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

This habitat type and phase is equivalent to that described by Cooper and others (1991) for northern Idaho. It represents a refinement of the type previously described by Daubenmire and Daubenmire (1968), Steele (1971), and Steele and others (1976).

Thuja plicata/Gymnocarpium dryopteris Habitat Type
(Western Red Cedar/Oak Fern Habitat Type)

THUPLI/GYMDRY (THPL/GYDR)
Number Of Stands Sampled = 7

LOCATION AND ASSOCIATED LANDFORMS

The *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type is a minor type at low to mid elevations in northwest Montana. It occurs on moderate slopes or benches along major mountain streams.

FLORISTIC CHARACTERISTICS

Thuja plicata (western red cedar) dominates the late seral and climax stands. *Abies grandis* (grand fir) is a major component of the overstory with *Picea* (spruce), *Pinus monticola* (western white pine), and *Pseudotsuga menziesii* (Douglas fir) represented by scattered individuals. Common undergrowth shrubs include *Linnaea borealis* (twinflower) and *Rubus parviflorus* (thimbleberry). Herbaceous species include *Gymnocarpium dryopteris* (oak-fern), *Clintonia uniflora* (queen's cup), and *Tiarella trifoliata* (trefoil foamflower).

Due to the limited number of late seral to climax stands sampled, the following table provides the average canopy cover, the range of canopy cover, and the constancy for indicator species and those species that occurred in 40 percent or more of the sampled stands. (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies grandis (grand fir)	28	0-60	86
Picea engelmannii (Engelmann spruce)	2	0-3	43
Pinus monticola (white pine)	1	0-3	43
Pseudotsuga menziesii (Douglas fir)	2	0-3	43
Thuja plicata (western red cedar)	53	3-90	100
Shrubs			
Acer glabrum (Rocky Mountain maple)	7	0-20	43
Amelanchier alnifolia (western serviceberry)	1	0-3	57
Linnaea borealis (twinflower)	12	0-20	57
Lonicera utahensis (Utah honeysuckle)	1	0-3	57
Rubus parviflorus (thimbleberry)	10	0-20	57
Symphoricarpos albus (common snowberry)	1	0-3	43
Taxus brevifolia (Pacific yew)	1	0-3	57
Forbs			
Aralia nudicaulis (wild sarsaparilla)	2	0-3	43
Clintonia uniflora (queen's cup)	7	1-20	100
Coptis occidentalis (western goldthread)	20	0-40	43

Disporum hookeri (hooker fairy-bell)	9	0-20	43
Galium triflorum (sweetscented bedstraw)	1	0-1	57
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	43
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	43
Pyrola asarifolia (pink wintergreen)	1	0-1	43
Senecio triangularis (arrowleaf groundsel)	1	0-1	43
Smilacina stellata (starry Solomon-plume)	7	0-20	57
Thalictrum occidentale (western meadowrue)	1	0-1	57
Tiarella trifoliata (trefoil foamflower)	10	0-20	71
Trillium ovatum (white trillium)	1	0-1	57
Viola canadensis (Canada violet)	1	0-1	43
Viola orbiculata (round-leaved violet)	2	0-3	57
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-3	57
Gymnocarpium dryopteris (oak-fern)	16	3-60	100

SUCCESSIONAL INFORMATION

Major components of seral stands may include *Abies grandis* (grand fir), *Pseudotsuga douglasii* (Douglas fir), *Larix occidentalis* (western larch), *Picea* (spruce), and *Abies lasiocarpa* (subalpine fir). In addition, *Abies grandis* (grand fir) is usually long-lived persistent seral species and occasionally appears to achieve co-climax status with *Thuja plicata* (western red cedar) (Pfister and others 1977).

SOILS

Parent materials are usually quartzite, sandstone, or schist, often mixed or overlain with volcanic ash. Soil texture varies widely from coarse to fine, but loams predominate. Drainage also varies from well drained to poorly drained (Pfister and Sherwood 1989). Exposed rock and bare soil rarely occur in this habitat type. Duff layers average 8 cm (3 in). Soil reaction ranges between medium acid and very slightly acid (pH 5.5 to 6.5).

ADJACENT COMMUNITIES

The *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type and the *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type are the driest wetland types in the *Tsuga heterophylla* (western hemlock) or the *Thuja plicata* (western red cedar) series. Adjacent wetter types are the *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type and *Thuja plicata/Athyrium filix-femina* (western red cedar/lady fern) habitat type, *Athyrium filix-femina* (lady fern) phase. Adjacent upland types include *Thuja plicata/Asarum caudatum* habitat type (Cooper and others 1991), the dry end of *Thuja plicata/Clintonia uniflora* (western red cedar/queen cup) habitat type (Pfister and others 1977), *Aralia nudicaulis* (wild sarsaparilla) phase, and sites supporting habitat types from the *Abies grandis* (grand fir), *Tsuga heterophylla* (western hemlock), and *Thuja plicata* (western red cedar) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage potential is good in early seral stands, and poor in the late seral or climax stands.

Timber

Timber productivity is high for *Abies grandis* (grand fir) and *Picea engelmannii* (Engelmann spruce), and moderately

productive for *Pseudotsuga menziesii* (Douglas fir), *Pinus monticola* (white pine), and *Thuja plicata* (western red cedar). The above species with the proper silvicultural treatment should do well on these sites. Intensive management, such as selecting the best species, minimizing disease and insect losses, and controlling the stocking may be required to realize the potential for high timber yields (Pfister and others 1977; Pfister and Sherwood 1989).

Potential for blowdown is high in this habitat type, making the role and function of the Streamside Management Zone (SMZ) particularly important. Although the Best Management Practices state a minimum of 8 m (25 ft) for SMZ layout, special precautions may be necessary. On the Flathead National Forest, sideslopes to streams are often gentle (<15 percent), but with little understory vegetation, possibly decreasing the filtering capability of the SMZ. Managers should objectively consider the nature and uses of the stream, existing stand (and understory) structure, as well as possible long and short term effects proposed treatments could have on water quality when deciding on the management scheme for the SMZ. Effects of timber harvesting adjacent to the designated SMZ must be evaluated relative to their effects on the SMZ, especially increasing the hazard of blowdown in the SMZ (Pfister and Sherwood 1989). For instance, a clearcut next to a 25 ft SMZ may result in blowdown of the entire SMZ (Froehlich 1989).

Tree regeneration should be scheduled immediately following logging because shrub and forb invasion can significantly impact reforestation through direct competition and/or attraction of large and small herbivores (Cooper 1987). The moist habitat types in valley bottom situations frequently have inclusions of wetter habitat types. If numerous, they may pose problems for equipment operations.

Wildlife

Forage for deer and elk is fair in climax stands. This habitat type along with other moist old growth tree communities are rare in Montana. Many wildlife species, such as chestnut-backed chickadees and goshawks, are partially to strongly dependent on huge old growth trees for forage, cover, and nesting sites.

Soil Management and Rehabilitation Opportunities

In the spring, when water tables are highest, soils in this habitat type are highly susceptible to compaction. Developmental activities should be planned with this problem in mind. The wide variety of soil textures and soil moisture conditions found with this habitat type may require special attention for specific management options.

Recreational Uses and Considerations

Old growth stands of *Thuja plicata* (western red cedar) have high recreational values due to their relative scarcity and aesthetic attractiveness. Construction and maintenance of campgrounds, roads, and trails may be difficult and may damage sites in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

The *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type is a further refinement of the *Thuja plicata/Clintonia uniflora* (western red cedar/queen cup) habitat type, *Aralia nudicaulis* (wild sarsaparilla) phase described

by Pfister and others (1977) and represents an expanded description of the same habitat type as defined by Cooper and others (1991). The wet stands of this habitat type will now fit into the *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type as described above. In addition, it would have been classified as the *Tsuga heterophylla/Pachistima myrsinites* (western hemlock/mountain box-wood) habitat type described by Daubenmire and Daubenmire (1968). Steele and others (1976) included *Gymnocarpium dryopteris* (oak fern) as a minor phase of their *Thuja plicata/Asarum caudatum* (western red cedar/wild ginger) habitat type on the Nez Perce National Forest.

Thuja plicata/Oplopanax horridum Habitat Type
(Western Redcedar/Devil's Club Habitat Type)

THUPLI/OPLHOR (THPL/OPHO)
Number Of Stands Sampled = 20

LOCATION AND ASSOCIATED LANDFORMS

The *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type is an incidental type at low to mid elevations in northwest Montana. Elevations of sampled sites range from 866 to 1,311 m (2,840 to 4,300 ft). This type is located in wet bottoms and toe slope seepage areas along streams. It also occupies lower benches, valleys, and lower stream terraces. These stream bottoms typically have high water tables and cold air drainage.

FLORISTIC CHARACTERISTICS

In late seral stands, *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock), either alone or as codominants, are the major tree species. The overstory canopy cover ranges from abundant to closed. Traces of *Abies grandis* (grand fir), *Abies lasiocarpa* (subalpine fir), and *Picea* (spruce) are found in most stands. This type often supports large old growth trees. The distribution of *Oplopanax horridum* (devil's club), the diagnostic undergrowth species, ranges from small isolated patches to dense thickets. Undergrowth canopy cover ranges from dense in open stands to sparse in closed stands. The major undergrowth species are *Oplopanax horridum* (devil's club), *Athyrium filix-femina* (ladyfern), *Clintonia uniflora* (queen's cup), *Gymnocarpium dryopteris* (oak-fern), and *Tiarella trifoliata* (trefoil foamflower).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		
	Average	Range	Constancy
Trees			
Abies grandis (grand fir)	1	0-3	50
Abies lasiocarpa (subalpine fir)	1	0-3	33
Betula papyrifera (paper birch)	2	0-3	17
Larix occidentalis (western larch)	1	0-1	8
Picea spp. (spruce)	2	0-3	33
Pinus monticola (western white pine)	1	0-1	17
Populus trichocarpa (black cottonwood)	1	0-1	8
Thuja plicata (western red cedar)	46	0-90	83
Tsuga heterophylla (western hemlock)	32	1-80	100
Shrubs			
Acer glabrum (Rocky Mountain maple)	1	0-3	42

Alnus sinuata (Sitka alder)	1	0-1	8
Amelanchier alnifolia (western serviceberry)	1	0-1	17
Arctostaphylos uva-ursi (kinnikinnick)	1	0-1	8
Betula occidentalis (water birch)	1	0-1	8
Chimaphila menziesii (little Prince's-pine)	1	0-1	8
Cornus canadensis (bunchberry)	1	0-1	8
Cornus stolonifera (red-osier dogwood)	9	0-20	25
Linnaea borealis (twinflower)	1	0-3	25
Lonicera tatarica (Tatarian honeysuckle)	10	0-10	8
Lonicera utahensis (Utah honeysuckle)	1	0-1	17
Menziesia ferruginea (fool's huckleberry)	1	0-1	17
Oplopanax horridum (devil's club)	24	10-60	100
Rhus spp. (sumac)	1	0-1	8
Ribes hudsonianum (stinking currant)	1	0-1	17
Ribes lacustre (swamp currant)	1	0-3	33
Rosa gymnocarpa (baldhip rose)	1	0-1	8
Rubus idaeus (red raspberry)	2	0-3	17
Rubus leucodermis (blackcap)	1	0-1	8
Rubus parviflorus (thimbleberry)	11	0-40	42
Sambucus racemosa (red elderberry)	1	0-1	8
Sorbus scopulina (Cascade mountain-ash)	1	0-1	8
Symphoricarpos albus (common snowberry)	1	0-3	25
Taxus brevifolia (Pacific yew)	15	0-40	33
Vaccinium globulare (globe huckleberry)	1	0-1	17
Vaccinium membranaceum (big huckleberry)	1	0-1	17
Graminoids			
Bromus commutatus (hairy brome)	1	0-1	8
Bromus vulgaris (Columbia brome)	1	0-1	33
Carex aquatilis (water sedge)	1	0-1	8
Carex deweyana (Dewey's sedge)	1	0-1	8
Carex laeviconica (smooth sedge)	3	0-3	8
Carex spp. (sedge)	1	0-1	8
Cinna latifolia (drooping woodreed)	3	0-3	8
Festuca subulata (crinkle-awn fescue)	1	0-1	8
Melica subulata (Alaska oniongrass)	1	0-1	17
Trisetum cernuum (nodding trisetum)	1	0-1	8
Forbs			
Aconitum columbianum (Columbian monkshood)	1	0-1	8
Actaea rubra (baneberry)	1	0-1	58
Adenocaulon bicolor (trail-plant)	5	0-20	58
Anaphalis margaritacea (common pearly-everlasting)	1	0-1	8
Anemone piperi (Piper's anemone)	1	0-1	8
Aquilegia spp. (columbine)	10	0-10	8
Aralia nudicaulis (wild sarsaparilla)	1	0-3	50
Asarum caudatum (wild ginger)	12	0-20	33
Circaea alpina (enchanter's nightshade)	9	0-20	42
Cirsium spp. (thistle)	1	0-1	8
Clintonia uniflora (queen's cup)	7	0-20	92
Coptis occidentalis (western goldthread)	8	0-20	25

Disporum hookeri (hooker fairy-bell)	7	0-20	25
Disporum spp. (fairy-bell)	1	0-1	17
Disporum trachycarpum (wartberry fairy-bell)	1	0-1	8
Epilobium angustifolium (fireweed)	1	0-1	8
Fragaria spp. (strawberry)	1	0-1	8
Fragaria virginiana (Virginia strawberry)	3	0-3	8
Galium triflorum (sweetscented bedstraw)	5	0-20	67
Geranium carolinianum (Carolina geranium)	1	0-1	8
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-1	8
Heracleum lanatum (cow-parsnip)	1	0-1	8
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	17
Montia spp. (montia)	3	0-3	8
Osmorhiza chilensis (mountain sweet-cicely)	1	0-1	67
Parnassia fimbriata (fringed grass-of-parnassus)	1	0-1	8
Pyrola asarifolia (pink wintergreen)	1	0-1	17
Pyrola secunda (one-sided wintergreen)	1	0-1	17
Ranunculus uncinatus (little buttercup)	1	0-1	8
Rubus pedatus (strawberry bramble)	20	0-20	8
Senecio triangularis (arrowleaf groundsel)	1	0-1	25
Smilacina racemosa (false spikenard)	1	0-1	8
Smilacina stellata (starry Solomon-plume)	16	0-80	75
Streptopus amplexifolius (clasping-leaved twisted-stalk)	1	0-3	25
Thalictrum occidentale (western meadowrue)	15	0-60	33
Tiarella trifoliata (trefoil foamflower)	21	0-40	83
Taraxacum ceratophorum (horned dandelion)	1	0-1	8
Trillium ovatum (white trillium)	1	0-3	58
Trollius laxus (American globeflower)	1	0-1	8
Urtica dioica (stinging nettle)	2	0-3	17
Valeriana spp. (valerian)	1	0-1	8
Veratrum viride (green false hellebore)	1	0-1	25
Viola glabella (pioneer violet)	10	0-20	33
Viola orbiculata (round-leaved violet)	2	0-3	42
Ferns and Allies			
Athyrium filix-femina (ladyfern)	24	1-40	100
Botrychium virginianum (Virginia grape-fern)	1	0-1	8
Cystopteris fragilis (brittle bladder-fern)	1	0-1	8
Dryopteris filix-mas (male fern)	1	0-1	17
Dryopteris spinulosa (spinulose wood-fern)	14	0-20	25
Equisetum arvense (field horsetail)	1	0-1	25
Equisetum spp. (horsetail)	1	0-1	8
Gymnocarpium dryopteris (oak-fern)	36	0-80	83
Lycopodium annotinum (stiff clubmoss)	1	0-1	17
Polystichum munitum (common Christmas-fern)	1	0-1	8
Pteridium aquilinum (brakenfern)	3	0-3	8

SUCCESSIONAL INFORMATION

Picea (spruce) and *Abies grandis* (grand fir) occur as sporadic seral species on colder or higher elevation sites and warmer,

lower elevation sites, respectively. Pfister and others (1977) found that following disturbances such as fire or logging, the *Thuja plicata* (western red cedar) sites are often invaded by *Epilobium angustifolium* (fireweed) and other forbs, or *Salix scouleriana* (Scouler willow), *Rubus parviflorus* (thimbleberry), *Amelanchier alnifolia* (western serviceberry), *Acer glabrum* (Rocky Mountain maple), *Vaccinium globulare* (globe huckleberry), *Ceanothus velutinus* (mountain balm), and *Ceanothus sanguineus* (redstem ceanothus). The dominant seral trees are usually *Pseudotsuga menziesii* (Douglas fir), *Larix occidentalis* (western larch), and to a lesser extent, *Picea engelmannii* (Engelmann spruce). In addition, Cooper and others (1991) found that severe disturbance can result in total site occupancy by tall shrubs such as *Acer glabrum* (Rocky Mountain maple), *Alnus incana* (mountain alder), and *Oplopanax horridum* (devil's club).

SOILS

Cooper and others (1991) found parent materials of this type to be quartzite and alluvial mixtures of metasediments, siltite, ash, and mica schist. Soil texture is fairly coarse, ranging from sandy loam to gravelly loamy sand with gravel contents between 40-40 percent by volume in most horizons. Water tables usually remain within 1 m (39 in) of the soil surface throughout most of the year. Redoximorphic features (mottling or gleyed soil) are found in some stands within 1 m (39 in) of the soil surface. Duff layers average 2 cm (1 in). Soil reaction ranges from very strongly acid to very slightly acid (pH 4.5 to 6.0).

ADJACENT COMMUNITIES

The *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type is the wettest type in the *Thuja plicata* (western red cedar) series. The *Thuja plicata/Athyrium filix-femina* (western red cedar/lady fern) habitat type, *Athyrium filix-femina* (lady fern) phase, and the *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type occupy the drier wetland sites. The *Abies lasiocarpa* (subalpine fir) series is located on wetter and/or cooler sites. At higher elevations, the *Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) habitat type occupies similar sites. Adjacent upland sites support habitat types from the *Abies grandis* (grand fir), *Tsuga heterophylla* (western hemlock), or *Thuja plicata* (western red cedar) series.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage potential is low in early seral stages and can be nonexistent in late seral or near climax stands with closed canopies (Pfister and Sherwood 1989).

Timber

Timber productivity is high for *Thuja plicata* (western red cedar), *Tsuga heterophylla* (western hemlock), and *Picea* (spruce). Site index is typically difficult to measure accurately due to the high percentage of suppressed and over mature trees in the late seral stands. Extreme care must be exercised in logging these sites due to the water table's proximity to the soil surface. Bottomland sites should not be disturbed other than to salvage high value trees or to remove high risk trees. If harvested, some dead and down logs should be left because downed woody material serves as a seedbed for *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) (Parker 1979). Natural regeneration by *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) is probably sufficient to revegetate the sites. If planting is required, *Picea* (spruce) and *Thuja plicata* (western red cedar) are the species best suited for reforestation (Cooper and others 1991). Once again, extreme care should be used if this habitat type is to be harvested because extensive disturbance could cause irreparable damage.

Wildlife

The *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type has high value as wildlife habitat, offering high quantities of food, cover, and water. Forage production for deer and elk is moderate in mid-seral stands and moderate to low in old growth climax stands. This habitat type along with other moist old growth tree communities is rare in

Montana. Many wildlife species, such as chestnut-backed chickadees and goshawks, are partially to strongly dependent on huge old growth trees for forage, cover, and nesting sites.

Fire

Fire frequency is low in this habitat type although when fires do occur, they are often intense. Riparian or wetland stringers of *Thuja plicata* (western red cedar) often act as natural firebreaks because the moist duff does not readily burn. The thin bark, shallow root system, and low, dense branching habit of *Thuja plicata* (western red cedar) make it susceptible to fire damage. Despite its low to moderate fire resistance (Fischer and Bradley 1987), *Thuja plicata* (western red cedar) often survives because of its large size and its ability to live if any portion of the bole is not killed.

Soil Management and Rehabilitation Opportunities

High gravel contents common to soils of this habitat type make them highly resistant to compaction. However, heavy equipment use can disrupt the stability of the site. All road construction and intensive site development should be located on adjacent upland communities.

Recreational Uses and Considerations

Old growth stands of *Thuja plicata* (western red cedar) and *Tsuga heterophylla* (western hemlock) have high recreational value due to their scarcity and attractiveness.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = seasonally flooded to saturated.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)

Comparable range site(s) could not be determined.

OTHER STUDIES

This habitat type is equivalent to that described by Cooper and others (1991) for northern Idaho. It represents a refinement of the type previously described by Daubenmire and Daubenmire (1968) and similar to types described by Bell (1965), Utzig and others (1983), and Pfister and others (1977).

Tsuga heterophylla/Gymnocarpium dryopteris Habitat Type
(Western Hemlock/Oak Fern Habitat Type)

TSUHET/GYMDRY (TSHE/GYDR)

Number Of Stands Sampled = 10

LOCATION AND ASSOCIATED LANDFORMS

The *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type is a minor type at low to mid elevations in northwest Montana. Elevations of sampled sites range from 555 to nearly 1,220 m (1,822 to nearly 4,000 ft). It occurs on moderate slopes or benches along major mountain streams and rivers.

FLORISTIC CHARACTERISTICS

Tsuga heterophylla (western hemlock) dominates the late seral stands. *Thuja plicata* (western red cedar) is a major component of the overstory. *Larix occidentalis* (western larch) and *Abies lasiocarpa* (subalpine fir) are occasionally present as scattered individuals. Climax stands are often open due to windthrow and root rot pockets. Undergrowth shrubs include *Linnaea borealis* (twinflower) and *Acer glabrum* (Rocky Mountain maple). Herbaceous species include *Gymnocarpium dryopteris* (oak-fern) and *Clintonia uniflora* (queen's cup).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			
Abies grandis (grand fir)	1	0-1	20
Abies lasiocarpa (subalpine fir)	3	0-3	20
Betula papyrifera (paper birch)	3	0-3	20
Larix occidentalis (western larch)	2	0-3	40
Picea engelmannii (Engelmann spruce)	1	0-1	20
Pinus monticola (western white pine)	1	0-1	20
Populus trichocarpa (black cottonwood)	3	0-3	20
Pseudotsuga menziesii (Douglas fir)	3	0-3	20
Thuja plicata (western red cedar)	49	0-98	80
Tsuga heterophylla (western hemlock)	60	20-98	100
Shrubs			
Acer glabrum (Rocky Mountain maple)	7	0-20	80
Amelanchier alnifolia (western serviceberry)	1	0-1	40
Berberis repens (creeping Oregongrape)	1	0-1	20
Chimaphila umbellata (common Prince's pine)	1	0-1	20
Cornus canadensis (bunchberry)	1	0-1	20
Cornus stolonifera (red-osier dogwood)	1	0-1	20
Linnaea borealis (twinflower)	5	1-20	100
Lonicera ciliosa (orange honeysuckle)	1	0-1	20
Lonicera utahensis (Utah honeysuckle)	1	0-1	60
Oplopanax horridum (Devil's club)	3	0-3	40
Pachistima myrsinites (mountain-boxwood)	2	0-3	40
Rosa gymnocarpa (baldhip rose)	1	0-1	20
Rubus parviflorus (thimbleberry)	1	0-3	60
Spiraea betulifolia (shiny-leaf spiraea)	1	0-1	20
Symphoricarpos albus (common snowberry)	10	0-20	40
Taxus brevifolia (Pacific yew)	10	0-20	40
Vaccinium globulare (globe huckleberry)	1	0-1	20
Vaccinium membranaceum (big huckleberry)	12	0-20	40
Vaccinium scoparium (whortleberry)	1	0-1	20
Graminoids			
Bromus vulgaris (Columbia brome)	3	0-3	20
Luzula campestris (field woodrush)	1	0-1	20
Melica subulata (Alaska oniongrass)	1	0-1	20

Forbs			
Actaea rubra (baneberry)	1	0-1	20
Adenocaulon bicolor (trail-plant)	20	0-20	40
Aralia nudicaulis (wild sarsaparilla)	10	0-20	40
Circaea alpina (enchanter's nightshade)	10	0-20	40
Clintonia uniflora (queen's cup)	7	0-20	80
Coptis occidentalis (western goldthread)	40	0-40	20
Disporum hookeri (hooker fairy-bell)	2	0-3	40
Disporum spp. (fairy-bell)	1	0-1	20
Fragaria spp. (strawberry)	1	0-1	20
Galium triflorum (sweetscented bedstraw)	1	0-3	60
Goodyera oblongifolia (western rattlesnake-plantain)	1	0-3	60
Habenaria orbiculata (large round-leaved rein-orchid)	1	0-1	20
Hieracium albiflorum (white-flowered hawkweed)	1	0-1	40
Listera borealis (northern twayblade)	1	0-1	20
Montia perfoliata (miner's lettuce)	1	0-1	20
Osmorhiza chilensis (mountain sweet-cicely)	1	0-3	60
Pyrola asarifolia (pink wintergreen)	1	0-1	60
Pyrola chlorantha (green wintergreen)	1	0-1	20
Pyrola secunda (one-sided wintergreen)	1	0-1	20
Pyrola uniflora (woodnymph)	1	0-1	20
Rubus pedatus (strawberry bramble)	40	0-40	20
Smilacina stellata (starry Solomon-plume)	3	0-3	40
Thalictrum occidentale (western Meadowrue)	1	0-1	40
Tiarella trifoliata (trefoil foamflower)	12	0-20	40
Trillium ovatum (white trillium)	1	0-1	60
Urtica dioica (stinging nettle)	1	0-1	20
Viola glabella (pioneer violet)	2	0-3	40
Viola orbiculata (round-leaved violet)	2	0-3	60
Ferns and Allies			
Athyrium filix-femina (ladyfern)	1	0-3	60
Botrychium virginianum (Virginia grape-fern)	1	0-1	20
Cystopteris fragilis (brittle bladder-fern)	1	0-1	20
Dryopteris spinulosa (spinulose wood-fern)	1	0-1	20
Gymnocarpium dryopteris (oak-fern)	18	3-60	100
Polystichum munitum (common Christmas-fern)	1	0-1	20
Pteridium aquilinum (brakenfern)	1	0-1	40

SUCCESSIONAL INFORMATION

Thuja plicata (western red cedar) is a mid to late seral species in many stands and tends to persist with much reduced numbers in climax stands. *Abies grandis* (grand fir) and *Picea engelmannii* (Engelmann spruce) are the other major seral species.

SOILS

Parent material of this type is commonly ash over quartzite. However, stands have been sampled with soils developing from siltite, metasediments, and glacial till. Soil texture varies little from loam to sandy loam. High water tables were not recorded. Soil depths range from 40 to 70 cm (15 to 28 in) and duff layers average 5 cm (2 in). Exposed rock and bare soil are rare on these sites. Soil reaction ranges from slightly to strongly acid (pH 4.9 to 6.0)

ADJACENT COMMUNITIES

The *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type and the *Thuja plicata/Gymnocarpium dryopteris* (western red cedar/oak fern) habitat type are the driest wetland types in the *Tsuga heterophylla* or *Thuja plicata* series. Adjacent wetter types are the *Thuja plicata/Oplopanax horridum* (western red cedar/devil's club) habitat type and the *Thuja plicata/Athyrium filix-femina* (western red cedar/lady fern) habitat type, *Athyrium filix-femina* (lady fern) phase. Adjacent upland types are Cooper and others (1991) *Thuja plicata/Asarum caudatum* (western red cedar/wild ginger) habitat type and the dry end of Pfister and others (1977) *Thuja plicata/Clintonia uniflora* (western red cedar/queen's cup) habitat type, *Aralia nudicaulis* (wild sarsaparilla) phase.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

Forage potential is good in early seral stages, and poor in the late seral or climax stands.

Timber

Timber productivity is high for *Tsuga heterophylla* (western hemlock), *Abies grandis* (grand fir), *Larix occidentalis* (western larch), *Thuja plicata* (western red cedar), and *Picea engelmannii* (Engelmann spruce). Short rotation, even aged management of *Larix occidentalis* (western larch) and *Picea engelmannii* (Engelmann spruce) is currently the preferred management regime. Mature stands within this type have a high percentage of trees with extensive heart rot. The moist habitat types in valley bottom situations frequently have inclusions of wetter habitat types. If numerous, they may pose problems for equipment operations. Potential for blowdown is high. Timber harvesting by clear cutting adjacent to this habitat type may increase the hazard of blow down.

Wildlife

Forage for deer and elk is fair in climax stands, poor in mid to late seral stages, and good in early seral stages. The *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type along with other moist old growth tree communities are rare in Montana. Many wildlife species, such as chestnut-backed chickadees and goshawks, are partially to strongly dependent on huge old growth trees for forage, cover, and nesting sites.

Soil Management and Rehabilitation Opportunities

Low gravel contents and loamy textures make these sites highly susceptible to compaction; particularly in spring when soil moisture contents are highest. Developmental and management activities should include consideration of seasonally high water tables.

Recreational Uses and Considerations

Old growth stands of *Tsuga heterophylla* (western hemlock) have high recreational value due to their scarcity and attractiveness. Construction and maintenance of campgrounds, roads, and trails may be difficult and may damage sites in this type.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)

System = palustrine; Class = forested wetland; Subclass = needle-leaved evergreen; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Comparable range site(s) could not be determined.

OTHER STUDIES

The *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type was first described by Cooper and others (1991) for northern Idaho. The habitat type is a further refinement of the *Tsuga heterophylla/Pachistima myrsinites* (western hemlock/mountain box-wood) habitat type described by Daubenmire and Daubenmire (1968) and the *Tsuga heterophylla/Clintonia uniflora* (western hemlock/queen cup) habitat type, *Aralia nudicaulis* (wild sarsaparilla) phase described by Pfister and others (1977). In each case, the wet stands from these two habitat types will now fit into the *Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak fern) habitat type as described above.

Acer negundo/Prunus virginiana Habitat Type
(Box-Elder/Common Chokecherry Habitat Type)

ACENEG/PRUVIR (ACNE2/PRVI)
Number Of Stands Sampled = 17

LOCATION AND ASSOCIATED LANDFORMS

The *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type occupies similar landforms as the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type. It is a minor type in the Great Plains region of central and eastern Montana. It occurs along streams, rivers, lakes, springs, and ponds throughout the region, occupying either terraces, fans, or floodplain positions. In addition, it occupies V-shaped ravines (locally called woody draws) where sites may be occasionally flooded by overland flows. Sites range in elevation from 640 to 1,219 m (2,100 to 4,000 ft).

In the northern Great Plains where the soil orders of Mollisols and Aridisols usually support grassland or shrubland vegetation, woodland vegetation is confined to stream courses or to other positions on the landscape where combinations of soil and topography permit greater than average accumulation of moisture (Hansen and Hoffman 1988). Sites can be found on higher (older) terraces of the Missouri and middle to lower segments of the Yellowstone River, Powder River, Tongue River, Milk River, and the Little Missouri River. On sites released from grazing, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type will reestablish in areas dominated by *Symphoricarpos occidentalis* (western snowberry), *Glycyrrhiza lepidota* (American licorice), *Agropyron smithii* (western wheatgrass), and some wetter areas of the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type.

FLORISTIC CHARACTERISTICS

The *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type is floristically similar to the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type with the difference being the absence of *Fraxinus pennsylvanica* (green ash) in the former.

The tree layer of the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type is dominated by *Acer negundo* (box-elder). *Populus deltoides* (Great Plains cottonwood) and/or *Salix amygdaloides* (peach-leaf willow) may dominate seral stands of this type. In sharply cut, V-shaped ravines, the largest trees are near the center or bottom of the ravines where there is greater soil moisture.

In relatively undisturbed stands, the undergrowth is comprised of two layers. The taller and more conspicuous shrub layer (2 to 3 m [6.5-9.8 ft] in height) is dominated by *Prunus virginiana* (common chokecherry). Associated shrubs may include *Amelanchier alnifolia* (western serviceberry) and *Ribes odoratum* (buffalo currant). The second layer is dominated by herbaceous species such as *Carex sprengelii* (Sprengel's sedge), *Elymus virginicus* (Virginia wildrye), *Thalictrum dasycarpum* (purple meadowrue), and *Smilacina stellata* (starry Solomon-plume).

The following table provides the average canopy cover, the range of canopy cover, and the constancy for species that occur in ***late seral to climax stands.*** (Constancy is defined as the percentage of sampled stands occupied by a species.)

Species	% Canopy Cover		Constancy
	Average	Range	
Trees			

Acer negundo (box-elder)	60	60-60	100
Shrubs			
Amelanchier alnifolia (western serviceberry)	1	0-1	50
Berberis repens (creeping Oregongrape)	20	0-20	50
Cornus stolonifera (red-osier dogwood)	20	0-20	50
Crataegus succulenta (succulent hawthorn)	3	0-3	50
Prunus americana (wild plum)	20	0-20	50
Prunus virginiana (common chokecherry)	50	40-60	100
Ribes missouriense (Missouri gooseberry)	3	0-3	50
Ribes odoratum (buffalo currant)	20	20-20	100
Rosa woodsii (woods rose)	3	3-3	100
Symphoricarpos occidentalis (western snowberry)	3	0-3	50
Graminoids			
Bromus japonicus (Japanese brome)	20	20-20	100
Carex sprengelii (Sprengel's sedge)	70	60-80	100
Elymus virginicus (Virginia wildrye)	40	40-40	100
Poa pratensis (Kentucky bluegrass)	20	0-20	50
Forbs			
Achillea millefolium (common yarrow)	3	3-3	100
Arctium minus (common burdock)	40	0-40	50
Cirsium arvense (Canada thistle)	12	3-20	100
Galium aparine (goose-grass)	3	0-3	50
Monarda fistulosa (horsemint)	3	0-3	50
Parietaria pensylvanica (Pennsylvania pellitory)	3	0-3	50
Smilacina stellata (starry Solomon-plume)	20	0-20	50
Smilax herbacea (carrion-flower)	3	0-3	50
Thalictrum dasycarpum (purple meadowrue)	40	0-40	50
Thalictrum occidentale (western meadowrue)	3	0-3	50
Urtica dioica (stinging nettle)	3	0-3	50

SUCCESSIONAL INFORMATION

Primary Successional Stages

Primary successional stages of the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type may be dominated by a variety of types including cottonwoods, *Salix exigua* (sandbar willow), or *Salix amygdaloides* (peach-leaf willow) community types.

Early Seral Stage — An early seral stage on a primary successional site, such as a recently deposited alluvial bar, may contain the *Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/Recent Alluvial Bar) community type.

Mid-Seral Stage — Through time under limited disturbance, the stand progresses to a mature stand of *Populus deltoides* (Great Plains cottonwood) representing the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type. Normally, the understory of a pole to mature *Populus deltoides* (Great Plains cottonwood) stand is dominated by *Acer negundo* (box-elder). As the *Populus deltoides* (Great Plains cottonwood) overstory matures, becomes more open, and finally, becomes decadent, *Acer negundo* (box-elder) is ready to replace them.

Late Seral to Climax (PNC) Stage — As the cottonwood stand dies, primary succession toward other communities will

occur unless flooding deposits new sediments suitable for cottonwood seedlings. In the absence of sediment deposition, primary succession will continue from the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type to the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type.

Secondary Successional Stages

Late Seral to Climax (PNC) Stage — The presence or absence of a particular understory community may aid in determining the degree of disturbance (both present and historical disturbance) on a particular site. In relatively undisturbed stands (e.g., climax plant community), the undergrowth of the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type is comprised of two layers. *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and *Ribes odoratum* (buffalo currant) dominate the taller and more conspicuous shrub layer (2-3 m [6.5-9.8 ft] in height). Herbaceous species such as *Carex sprengelii* (Sprengel's sedge), *Galium boreale* (northern bedstraw), *Smilacina stellata* (starry Solomon-plume), and *Thalictrum dasycarpum* (purple meadowrue) dominate the second layer. In addition, relatively undisturbed stands will have all age groups of tree species present (seedlings, saplings, pole, and mature).

Mid-Seral Stage — Maintaining moderate levels of grazing sharply reduces reproduction of tree species. In addition, many of the sapling and pole size trees begin to show signs of damage. Reducing the seedling and sapling stages of the overstory tree species will eventually result in a decline of the tree population. If the degree of disturbance continues over an extended period of time, the trees will eventually be eliminated from the site.

In addition to its impact on the tree layer, grazing greatly reduces both the abundance and canopy cover of the understory layer of the desirable shrub and herbaceous species. Less desirable species such as *Symphoricarpos occidentalis* (western snowberry), *Rosa woodsii* (woods rose), *Crataegus succulenta* (succulent hawthorn), and *Poa pratensis* (Kentucky bluegrass) begin to invade the stand.

Under heavy grazing pressures, tree reproduction is either severely restricted or completely eliminated. At this stage, most of the saplings and pole sized trees have either been eliminated by trampling and/or rubbing, or browsed back until they are dead. High levels of grazing cause the stand to open up allowing the more sun tolerant, less desirable species (*Symphoricarpos occidentalis* [western snowberry], *Rosa woodsii* [woods rose], *Crataegus succulenta* [succulent hawthorn], and *Poa pratensis* [Kentucky bluegrass]) to dominate. In fact, many of the sites that support the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type in the northern Great Plains are in this state or in the severe overgrazed state (discussed in the following paragraph).

Early Seral Stage — Prolonged periods of severe overgrazing result in a stand of only older, decadent trees and a very open understory. The understory may be so severely impacted that most of the less desirable species (*Symphoricarpos occidentalis* (western snowberry), *Rosa woodsii* (woods rose), *Crataegus succulenta* (succulent hawthorn), and *Poa pratensis* (Kentucky bluegrass) are also eliminated resulting in large amounts of exposed soil. When a stand is at this stage, the prospect of returning the site to its former state is very difficult if not impossible. (Restoration would be extremely expensive in terms of both manpower and money.) Therefore, if a manager wants to maintain the stand of trees, the most cost effective method is to change the management on the site ***BEFORE*** the site is too degraded.

Severely disturbed *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) sites may be dominated by either the *Shepherdia argentea* (thorny buffaloberry), *Crataegus succulenta* (succulent hawthorn), *Rosa woodsii* (woods rose), or the *Symphoricarpos occidentalis* (western snowberry) community types. Close observation of remnant species, such as *Acer negundo* (box-elder), will aid in determination of the site potential.

SOILS

Flooding frequency is generally infrequent but *Acer negundo* (box-elder) is very tolerant to prolonged flooding. Soils are typically Entisols (Torrifluvents) or Mollisols (Haploborolls and Argiborolls). Soil textures range from clay loam to sandy

loam. Water tables are generally near the soil surface in spring or after storm events but commonly fall below 1 m (39 in) during dry periods.

ADJACENT COMMUNITIES

Adjacent drier sites are dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or by a variety of upland species. Wetter sites may be dominated by *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), *Eleocharis* species (spike rushes), or *Phragmites australis* (common reed) habitat types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

If the long term management objective is the maintenance of the tree stand on the site, then managers needs to key in on the seedling reproduction by *Acer negundo* (box-elder) or the stand will eventually be eliminated.

On relatively undisturbed sites, dense stands of the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type limit access by livestock. As the stands open up, livestock use may go up proportionally. This habitat type is valuable to livestock managers because of the following benefits they provide: 1) thermal cover (shade), 2) water source, 3) palatable forage, 4) protection from seasonal storms, and 5) calving grounds. Because the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type covers a small portion of the landscape and because of their high wildlife values (see the Wildlife section), these sites are becoming focal points for livestock and wildlife management conflicts in this region.

Livestock managers should reduce or eliminate hot season of use in this type. This can be accomplished by placing salt blocks on the uplands away from the woody draws, moving water sources out of the draws, and in some instances, by using cross fences (or drift fences) that are placed perpendicular to the linear stand at appropriate intervals. This method is most appropriate for those stands located in V-shaped draws or ravines. These short fences will discourage livestock from trailing down the center of the stand. In disturbed sites, it may be necessarily to fence out a portion of the stand for a period of five or more years in order to allow regeneration by the tree and shrub species. After the appropriate time frame, the fence could be moved to a different portion of the stand.

The use of these sites as winter feeding grounds can have a variety of results. In many instance, proper winter use will have minimal impacts on the stand. However, if livestock numbers are high, trampling and rubbing can have a detrimental impact on the woody species. In addition, if livestock use is high when the frost is going out of the ground, a great deal of soil churning and compaction can occur.

Over the years there has been some debate whether *Prunus virginiana* (common chokecherry) leaves are poisonous to livestock. The leaves and seeds do have sugars that contain cyanide. These cyanide sugars are not poisonous themselves, but when plant material is crushed, eaten or decomposed, enzymes cause hydrogen cyanide to be released (Ode 1987). In high concentrations hydrogen cyanide is a metabolic poison to most animals, including humans. It has recently been shown that livestock can acquire the ability to detoxify hydrogen cyanide if they consume small amounts of it over an extended period of time. Therefore, *Prunus virginiana* (common chokecherry) will poison livestock only if it is consumed in large amounts without prior exposure.

The high values associated with the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type should elicit special consideration by livestock operators.

Wildlife

(The wildlife discussion of this type is the same as for the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type.) In the northern Great Plains, woody draws are very important to wildlife even though they represent a very small fraction of the total area (around 1-2 percent of the total landscape). Located in areas of greater than normal moisture, they are more productive than the surrounding upland vegetation (Thomas and others 1979). Woody draws attract wildlife for thermal cover, nesting habitat, water source, late summer and winter forage, travel corridors, and hiding cover (Ames 1977; Hansen and others 1984; Hansen and Hoffman 1988; Severson and Boldt 1978). Woody draws are an important year round habitat for mule deer, provides critical winter habitat for whitetail deer (Severson and Carter 1978; Swenson 1981), and is an important fawning area for both whitetail and mule deer. During fall and winter, woody draws provides critical habitat for sharptailed grouse.

In addition, woody draws provides essential habitat for a large number of nongame species. Grosz and others (1981) found that this habitat type is the center of activity for most species and are critical importance to many species during the stressful winter months. They also found that these sites support a greater diversity and density of birds when compared to adjacent uplands. In northwestern North Dakota, Hopkins (1984) censused species of birds nesting in woody draws and found that although it had lower species diversity than cottonwood forests, the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type supported a much higher density of breeding pairs. Finally, this woody draws provides important habitat for such nongame mammals as coyote, weasel, bobcat, and red fox (Swenson 1981; Sieg and others 1984).

If the long term management objective is the maintenance of the tree stand on the site, then managers needs to key in on the seedling reproduction by *Acer negundo* (box-elder) or the stand will eventually be eliminated.

Fisheries

The woody species associated with the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type provide valuable streambank stability and thermal cover.

Fire

Acer negundo (box-elder) and most of the important shrub species in the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type produce sprouts from the root crown when the main trunk is damaged. The ability of the woody species to sprout prolifically suggests that this habitat type is adapted to fire and perhaps to periodic stand regeneration by fire. However, the role of fire in this habitat type is not well known.

Soil Management and Rehabilitation Opportunities

Sites adjacent to streams are extremely vulnerable to streambank sloughing, particularly when soils are moist. Excessive livestock use will increase levels of soil compaction and decrease stability. Management should emphasize the importance of the understory shrub communities for streambank stabilization.

Where revegetation with woody species is desired, *Acer negundo* (box-elder), *Prunus virginiana* (common chokecherry), *Amelanchier alnifolia* (western serviceberry), and *Ribes odoratum* (buffalo currant) are well adapted to planting on disturbed sites. Rooted cuttings or nursery grown seedlings are easily established on moist, well drained soils. Growth rates are moderate to rapid and the roots of established seedlings are effective stabilizers of alluvial soil deposits.

Recreational Uses and Considerations

Because of its proximity to streams, recreational developments and transportation corridors are common within this type. Recreational opportunities are excellent for fishing, big game and waterfowl hunting, and observing a variety of bird species.

The fruit of *Prunus virginiana* (common chokecherry) is highly regarded for making wine and tasty jelly, but one must harvest ahead of the birds (Johnson and Nichols 1982). Indians ate the fruit fresh or preserved it by drying. In addition they combined it with venison and buffalo meat to make mincemeat. They also used the berries for medicinal purposes.

Care must be taken when locating structures within this type. For example, some campgrounds in Montana have been seriously damaged by floods or lost altogether.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

Two additional classification systems that are being used to describe/define riparian and wetland ecosystems are listed below along with the appropriate "type(s)" that best describes this particular habitat type or community type.

USDI Fish and Wildlife Service Wetland Classification (Cowardin and others 1979)
System = palustrine; Class = forested wetland; Subclass = broad-leaved deciduous; Water Regime (nontidal) = temporarily flooded to intermittently flooded.

USDA Soil Conservation Service Range Site Classification (USDA Soil Conservation Service 1983)
Eastern Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Western Glaciated Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site; Eastern Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, thin clayey range site, thin sandy range site, thin silty range site, subirrigated range site; Eastern Sedimentary Plains, 15-19 inch Precipitation Zone = overflow range site, subirrigated range site; Western Sedimentary Plains, 10-14 inch Precipitation Zone = overflow range site, subirrigated range site.

OTHER STUDIES

A somewhat similar community type was described by Szaro (1989) for riparian or wetland sites in Arizona and New Mexico.

Elaeagnus angustifolia Community Type
(Russian Olive Community Type)

ELAANG (ELAN)
Number Of Stands Sampled = 4

LOCATION AND ASSOCIATED LANDFORMS

The *Elaeagnus angustifolia* (Russian olive) community type is an incidental type at low elevations on floodplains of the major rivers and streams in central and eastern Montana; isolated stands are found in western Montana, such as near Dillon and in the Flathead valley (near the National Bison Range). Relatively large stands of this community type are located along the Yellowstone River and its major tributaries (Little Bighorn River, Bighorn River, Tongue River, Clarks Fork Yellowstone River), along the Musselshell River near Roundup, irrigated valleys around the Bowdoin National Wildlife Refuge near Malta, along the Milk River from Glacier National Park to Glasgow, along the Missouri and Sun Rivers near Great Falls, and on the Charles M. Russell National Wildlife Refuge north of Lewistown. The *Elaeagnus angustifolia* (Russian olive) community type typically forms bands adjacent to waterways. Sites range in elevation from 640 to 1,036 m (2,100 to 3,400 ft). Extensive stands can be seen near Billings, Miles City, and Hardin.

GENERAL CHARACTERISTICS

Elaeagnus angustifolia (Russian olive), a tree native to southern Europe and western Asia, was introduced into North America during colonial times (Elias 1980). *Elaeagnus angustifolia* (Russian olive) was planted in shelterbelts throughout the prairie states and provinces due to its dense growth form, hardiness, and adaptability to a wide range of soil and moisture conditions (Olson and Knopf 1986). It has also been used for ornamental and wildlife habitat plantings, erosion control, and highway beautification (Christensen 1963). Currently, *Elaeagnus angustifolia* (Russian olive) has naturalized throughout the 17 western states bounded on the east by North and South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Personal

observations and a review of the literature indicates that *Elaeagnus angustifolia* (Russian olive) naturalization is rapidly increasing, especially in the riparian zone. The potential impacts of the spread of *Elaeagnus angustifolia* (Russian olive) to floodplain forests are substantial. Even though *Elaeagnus angustifolia* (Russian olive) has a high value for wildlife, it can interfere with agricultural practices and has the potential to displace native riparian or wetland vegetation. In fact, the displacement of native floodplain forests by *Elaeagnus angustifolia* (Russian olive) can result in a 30 percent reduction of breeding bird species (Knopf 1991).

Elaeagnus angustifolia (Russian olive) spreads from introduced plantings with the help of birds, and to a lesser degree, small mammals (Olson and Knopf 1986). The seeds, ingested with the fruits, pass through the digestive tract of birds and may be deposited in new locations. Small mammals help spread the seeds by building food caches, sometimes up to 150 m (ca. 450 ft) from the original sources.

Two conditions that tend to favor the establishment of *Elaeagnus angustifolia* (Russian olive) are spring moisture and slightly alkaline soil (Olson and Knopf 1986). Carmen and Brotherson (1982) reported that *Elaeagnus angustifolia* (Russian olive) preferred sites with low to medium concentrations (100-3,500 ppm) of soluble salts, whereas *Tamarix chinensis* (salt cedar) occurred on sites of higher (700-15,000 ppm) salt concentrations.

FLORISTIC CHARACTERISTICS

Elaeagnus angustifolia (Russian olive) has a dense growth form and tolerates a wide range of temperature, soil, and moisture conditions (Borell 1976; Elias 1980). In most instances, *Elaeagnus angustifolia* (Russian olive) forms such thickets that it excludes most other species. In stands that are somewhat open, associated species may include widely scattered *Populus deltoides* (Great Plains cottonwood), *Fraxinus pennsylvanica* (green ash), *Acer negundo* (box-elder), *Salix amygdaloides* (peach-leaf willow), *Populus angustifolia* (narrowleaf cottonwood), or an assortment of grasses and forbs (Appendix 00).

SUCCESSIONAL INFORMATION

In the northern Great Plains, the *Elaeagnus angustifolia* (Russian olive) community type seems to represent a seral stage of the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type or the *Acer negundo/Prunus virginiana* (box-elder/common chokecherry) habitat type. In the Rocky Mountains, foothills, and intermountain valleys, the *Elaeagnus angustifolia* (Russian olive) community type represents seral stages of many different types including the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type or the *Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) habitat type.

Disturbance Stages

Dense stands tend to limit access by livestock, thereby reducing most forms of disturbance. However, severe grazing can cause the understory to be dominated by non-native herbaceous species such as *Poa pratensis* (Kentucky bluegrass) and *Phleum pratense* (timothy).

SOILS

Soils are generally Entisols (Torrifluvents) or Mollisols (Haploborolls and Argiborolls). Soil texture ranges from clay loam to sandy loam. Water tables are generally near the soil surface during spring runoff or after storm events, but may fall below 1 m (39 in) during dry periods. These sites experience periodic flooding but duration is usually brief.

As discussed earlier, two situations that appear to favor the establishment of *Elaeagnus angustifolia* (Russian olive) seedlings are favorable spring moisture and slightly alkaline soils (Olson and Knopf 1986). Carmen and Brotherson (1982) reported that *Elaeagnus angustifolia* (Russian olive) preferred sites with low to medium concentrations (100-3,500 ppm) of soluble salts, whereas *Tamarix chinensis* (salt cedar) occurred on sites of higher (700-15,000 ppm) salt concentrations.

ADJACENT COMMUNITIES

Adjacent drier sites may be dominated by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass)

habitat type or by a variety of upland species. Wetter sites may be dominated by *Typha latifolia* (common cattail), *Scirpus* species (bulrushes), *Eleocharis* species (spike rushes), or *Phragmites australis* (common reed) habitat types, or by the *Salix amygdaloides* (peach-leaf willow) or *Salix exigua* (sandbar willow) community types.

MANAGEMENT INFORMATION

Additional management information can be found in Appendices 1-7.

Livestock

The limited size and extent of most stands generally limits livestock impacts. In dense stands the forage production is rated as low. In addition, the spine tipped branches restrict livestock use. As the stands open up, the utilization by livestock increases proportionally.

Wildlife

The high structural diversity of the *Elaeagnus angustifolia* (Russian olive) community type provides excellent thermal and hiding cover, and provides limited forage for wildlife species. The fruits of *Elaeagnus angustifolia* (Russian olive) are eaten by pheasants, squirrels, sharp-tailed grouse, squirrels, raccoons, whitetail deer, and a variety of nongame birds such as flickers, grosbeaks, warblers, and flycatchers. In southeastern Oregon, beaver have used *Elaeagnus angustifolia* (Russian olive) for dam material (Olson and Knopf 1986). However, the displacement of native floodplain forests by *Elaeagnus angustifolia* (Russian olive) can result in a 30 percent reduction of breeding bird species (Knopf 1991).

Elaeagnus angustifolia (Russian olive) stands can interfere with farming operations. They also hinder management activities on national wildlife refuges and occasionally block irrigation canals (Olson and Knopf 1986). Once established, *Elaeagnus angustifolia* (Russian olive) is difficult to control and nearly impossible to eradicate. Efforts to control unwanted stands have included mowing seedlings, cutting, burning, spraying, girdling, and bulldozing. Considering its adaptability and resistance to control efforts, *Elaeagnus angustifolia* (Russian olive) has become a management concern for both public agencies and private landowners.

Fisheries

The *Elaeagnus angustifolia* (Russian olive) community type is an effective stabilizer of streambanks.

Soil Management and Rehabilitation Opportunities

During spring runoff or after storm events when water tables are high, these soils are most susceptible to compaction by vehicular traffic or livestock. Sites with well drained soils and coarse textures are less susceptible to compaction, yet activities should be scheduled to avoid high water periods.

Considering its adaptability and resistance to control efforts, *Elaeagnus angustifolia* (Russian olive) has become a major management concern for both public agencies and private landowners. As indicated earlier, once established *Elaeagnus angustifolia* (Russian olive) is difficult to control and nearly impossible to eradicate. Efforts to control unwanted stands have included mowing seedlings, cutting, burning, spraying, girdling, and bulldozing. Therefore the planting of *Elaeagnus angustifolia* (Russian olive) should be eliminated due to the aggressive nature of *Elaeagnus angustifolia* (Russian olive) and the inevitable costs that will be associated with the long term control of this species.

Recreational Uses and Considerations

The *Elaeagnus angustifolia* (Russian olive) community type provides excellent opportunities for seeing a variety of wildlife including big game, small mammals, songbirds and upland game birds. In the spring, the flowers of *Elaeagnus angustifolia* (Russian olive) are quite fragrant.

RELATIONSHIP TO OTHER CLASSIFICATION SYSTEMS

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TABLE 2: FORMATIVE ELEMENTS OF HYDRIC SOILS 00

INTRODUCTION

Although the land area is small, riparian and wetland areas occupy a unique position in the landscape and life of the West with their importance far exceeding their total area. Riparian or wetland areas are defined as the green zones associated with lakes, reservoirs, estuaries, potholes, springs, bogs, fens, wet meadows, and ephemeral, intermittent, or perennial streams. The riparian or wetland zone occurs between the upland or terrestrial zone and the aquatic or deep water zone. Riparian and wetland areas are important islands of diversity within extensive upland ecosystems. Abundant water, forage, and habitat attract a proportionately greater amount of use and conflict than their small area would indicate. They are of prime importance to water quality, water quantity, stream stability, and fisheries habitat. They are vital to the livestock grazing industry and many are also well suited for development as high quality agricultural farmland. In addition, many riparian or wetland sites are excellent timber producing sites. Most sites provide critical habitat needs for many species and they support a greater concentration of wildlife species and activities than any other type of location on the landscape. In addition, riparian or wetland areas can be considered the "threads" that tie together all the other ecosystems. The importance of these areas as wildlife corridors can not be emphasized enough.

Riparian and wetland areas in western North America tend to have the following characteristics (Thomas and others 1979): 1) they create well-defined habitat zones within the much drier surrounding areas, 2) they make up a minor proportion of the overall area (between 1-5 percent), 3) they are generally more productive in terms of biomass—plant and animal—than the remainder of the area, and 4) they are a critical source of diversity. Both density and diversity of species tends to be higher at the land/water ecotones than in adjacent uplands, especially in the arid West.

In contrast to their importance, riparian and wetland communities are among the least studied and least understood areas in terms of structure, function, and management. The riparian or wetland zone has often been overlooked, ignored, or considered a minor inclusion of the larger terrestrial or aquatic systems. Impacts from excessive grazing, timber harvesting, road construction, and agriculture may drastically affect these communities. Management of riparian and wetland areas has become a major issue during the past decade and will continue to be a major issue during the 1990's. Multi-resource opportunities, multi-disciplinary concerns, and multi-ownership patterns call for a high level of coordination and cooperation to meet social needs.

With this in mind, a Riparian Program Team prepared reports in 1980 and 1981 for the Wildlife Subcommittee of the Montana Rural Area Development Committee (RAD) stressing the need for a statewide classification system that incorporated recommended management practices. A cooperative effort was suggested as the most effective method of meeting this goal.

In 1985, the Montana Department of Natural Resources and Conservation funded a proposal by the University of Montana School of Forestry to develop a riparian and wetland dominance type classification and pursue the formation of a cooperative. This led to a meeting of potential participants in July 1985 at the University of Montana's Lubrecht Experimental Forest. In March 1986, a formal proposal was sent to potential cooperators. In April 1986, the first organizational meeting of the Montana Riparian and Wetland Association (MRWA) was held in Helena, followed by the first annual technical Riparian Workshop on June 3, 1986. The MRWA Charter was formally signed on June 4, 1986.

The objectives of the Montana Riparian and Wetland Association are to:

1) Develop a riparian and wetland dominance type (cover type) classification for Montana.
2) Develop a riparian and wetland vegetation based ecological site classification for Montana to assist in the identification, description, communication, and management of riparian and wetland communities by resource managers.
3) Develop and maintain an interagency data base on classification and management guidelines of riparian and wetland areas for members of the MRWA.
4) Promote communication and sharing of information for managing riparian and wetland sites in order to achieve multiple-use objectives.

5) Provide training and continuing education in identification, function, and proper management of riparian and wetland ecosystems.

OBJECTIVES

The ideal riparian and wetland classification requires detailed knowledge of the interactions between vegetation, site, and management (vegetation based ecological site classification).

The objectives of this study are to:

1) Develop a riparian and wetland vegetation based ecological site classification for Montana to assist in the identification, description, communication, and management of riparian and wetland areas by resource managers.
2) Describe the general geographic, topographic, edaphic, functional, and floristic features of riparian and wetland ecosystems.
3) Describe successional trends and predict vegetative potential on disturbed riparian and wetland sites.
4) Present information on resource values and management opportunities.

PHYSICAL SETTING

Montana can be divided into two broad geographic zones: the Northern Great Plains and the Northern Rocky Mountains (Figure 00).

Northern Great Plains

The Northern Great Plains comprises approximately the eastern two thirds of the state, and includes scattered outlier mountains within the western plains. The Northern Great Plains are bounded along the western edge by the foothills of the Northern Rocky Mountains. From the western limit, the Northern Great Plains tilt to the east and slightly to the north. This tilting can be seen in the flow of the Missouri and Yellowstone Rivers, which drop from an elevation of approximately 1,500 to 600 m (5,000 to 2,000 ft), as they flow northeastward across the state.

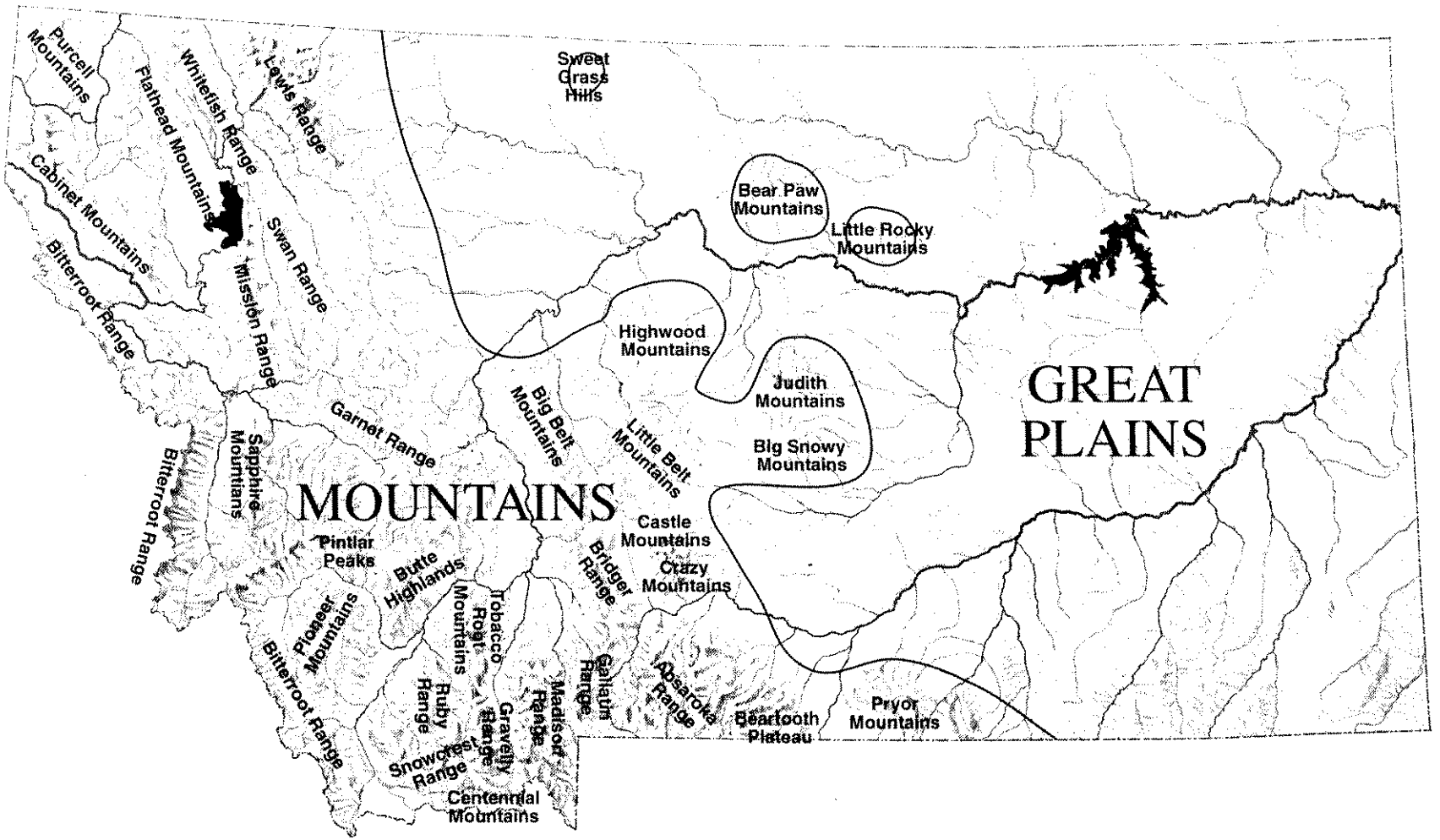
The Missouri River and its tributaries drain all but two small sections of the state east of the Continental Divide. It is dammed at Fort Peck and the resulting reservoir is 216 km (134 miles) long with more than 2,575 km (1,600 miles) of shoreline. The Yellowstone River, with its headwaters in Yellowstone Park, drains most of the southern half of this region, emptying into the Missouri River a few miles across the border into North Dakota. With headwaters in Glacier National Park, the St. Mary's River drains the northwestern extreme of the Northern Great Plains, and eventually flows into Hudson Bay. Located between the Musselshell and Yellowstone Rivers, northwest of Billings are Lake Basin and Comanche Basin. These very small adjacent areas have no external drainage. Here, intermittent streams flow into lakes and the water eventually evaporates.

Only sedimentary rocks, formed by past inland seas, are exposed in the eastern third of the state. Rolling hills and broad, flat divides separate wide, shallow valleys. Ridges and buttes are common, with badland topography occupying the southeastern part of the state. The northern half of the region is topographically dissimilar from the southern half due to the continental ice sheet that covered the area during the Pleistocene. Valleys full of glacial till, rock outcrops worn by the ice, prairie potholes, moraines and shore lines of ice-dammed lakes are common. In contrast, the southern landforms are the results of weathering and erosional forces other than those of moving ice masses.

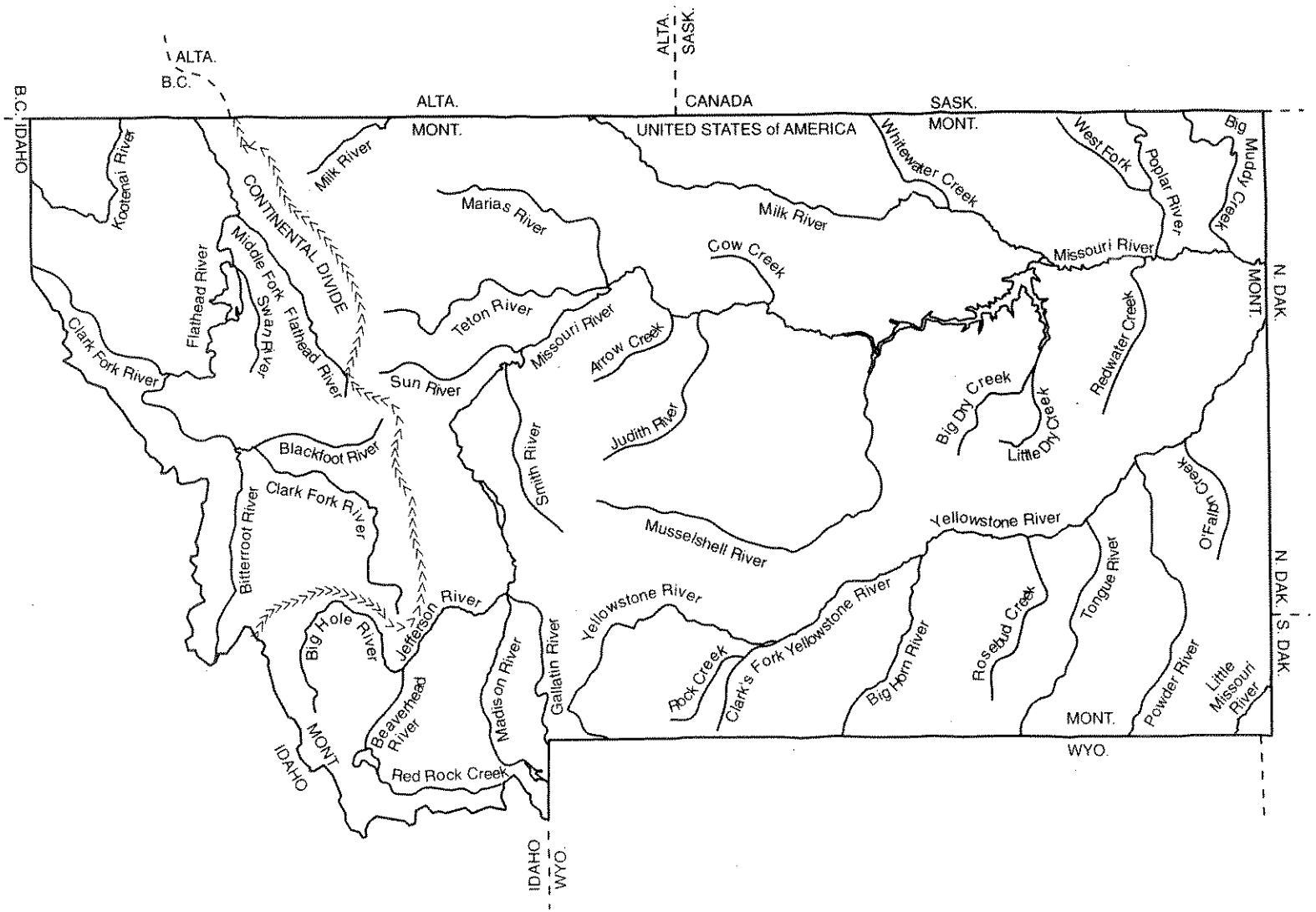
In the western portion of this region are scattered outlier mountain ranges. These isolated ranges rise out of the rolling plains and include the Crazy, Little Belt, Big Belt, Little Rocky, Judith, Highwood, Moccasin, Bull, Snowy, and Bears Paw Mountains. Most of these outlying ranges contain at least some igneous rocks, in contrast to the sedimentary rocks of the surrounding plains. This igneous rock could indicate geological origins with the main Rocky Mountain ranges, but Dating methods indicate that these outliers were formed later than the northern Rockies (Alt and Hyndman 1986).

The native vegetation of the Northern Great Plains is largely short grass prairie. Trees, shrubs, and other vegetation types

PHYSIOGRAPHIC FEATURES OF MONTANA



MAJOR WATER COURSES OF MONTANA



occur where topography, elevation, or local water sources act in concert or individually to provide the greater moisture needed for survival. Open coniferous forests, typically *Pinus ponderosa* (ponderosa pine) or *Juniperus scopulorum* (Rocky Mountain juniper), occur on higher elevations and northern aspects where the needed moisture is provided by rainfall and lower evapotranspiration rates. Hardwood forests, typically *Populus* spp. (cottonwoods), *Fraxinus pennsylvanica* (green ash) or *Acer negundo* (box elder), are confined to stream courses.

The cottonwood stands along the Missouri and Yellowstone Rivers were the source of firewood, lumber and steamship fuel for many of Montana's settlers. In the past trees were cut for firewood, fence posts, building of homesteads, and for powering the steamboats that transported the settlers to the West. Along the Upper Missouri River in Montana between the years 1860 to 1890, the wood hungry steamboats consumed stands of cottonwoods that appeared to be unlimited. Each steamboat could use 30 cords of wood in a normal day's operation. It is estimated that over 300,000 cords of wood were removed from the river corridor during the steamboat era (Damone 1987). By the turn of the century the river bottoms were completely denuded of any trees that could be utilized.

Northern Rocky Mountains

The Northern Rocky Mountains occupy the western one-third of Montana. This area is comprised of more than twenty-five mountain ranges. Many of these ranges run north and south, yet there is no overriding orientation of the mountains and valleys. Summit elevations are generally under 3,050 m (10,000 ft), yet a few are over 3,350 m (11,000 ft). Montana's highest peaks are found in the Absaroka and Beartooth Ranges; Granite Peak at 3,890 m (12,799 ft) is highest. Basin and valley elevations range from 555 m (1,820 ft) where the Kootenai River leaves Montana in the north, to 2,050 m (6,700 ft) at Lakeview (adjacent to Red Rock Lakes National Wildlife Refuge) in the south. The The Rocky Mountain Trench is the longest valley and extends from St. Ignatius northward into the Yukon forming the Mission, Flathead, and Tobacco valleys. Valleys in the northwest are usually narrow, and valleys in the central and southern portions of the region are commonly very broad.

The Continental Divide splits the region into two major drainage systems. The Flathead, Yaak, Kootenai, Clark Fork, Bitterroot and Blackfoot Rivers drain the western side of the Continental Divide. Both the Clark Fork River and Kootenai River flow into Idaho and eventually drain into the Columbia River basin. The Missouri River, which forms at the confluence of the Jefferson, Madison, and Gallatin Rivers, along with the Yellowstone River drains the eastern side of the Continental Divide.

Within the major mountain ranges the geology is quite complicated, involving all three major rock types (igneous, sedimentary and metamorphic). The granitic rocks of the Bitterroot Range and the Boulder batholith in the Butte and Helena area are the result of an igneous intrusion which occurred 70 to 90 million years ago. Along with this volcanic activity, movement of large crustal pieces took place resulting in massive folding and faulting to the form the Rocky Mountains. Approximately 50 million years ago, volcanic eruptions in the south and central parts of the region again deposited new materials. Since that time, weathering and erosion have altered the landscape to its present condition, with the geologically recent ice ages having profound effects (Alt and Hyndman 1986).

Between 140,000 and 10,000 years before present, two glaciations drastically altered the northern portion of the region; north of the Clark Fork River. During both glaciations, lobes of the Cordilleran ice sheet moved southward down the Rocky Mountain Trench and split at the northern end of the Mission Range. One lobe went east down the Swan Valley, while another moved down the Mission Valley. Ice of the earlier glaciation advanced as far south as Ronan, while ice of the latter glaciation extended to the southern end of Flathead Lake; as evidenced by the terminal moraine near Polson. Another lobe of Cordilleran ice sheet came down the Purcell Trench in Idaho to Pend Oreille Lake. The ice blocked the flow of the Clark Fork River to create Glacial Lake Missoula. The lake reached an elevation of 1,326 m (4,350 ft). At its maximum the lake had a volume of 500 cubic miles. Glacial Lake Missoula filled and drained 39-41 times over a period of 1,000 years, and was responsible for the largest floods known in the geologic record (Alt and Hyndman 1986). Thick lacustrine deposits from Glacial Lake Missoula are common throughout the valleys of northwest Montana.

Apart from continental glaciation, the entire region was also sculpted by alpine and valley glaciers during both these glaciations and other temporary local readvancements. Evidence of glacial action abounds throughout the region and includes cirques, long, straight U-shaped valleys, outwash plains, hanging valleys, and terminal and lateral moraines.

About 80 percent of the northern section of the region is forested. This falls to approximately 25 percent in the south. Most of the differences in forest coverage results from a drier climate and shortened growing season in higher valleys (Arno 1979). Nonforested areas in both sections are usually semiarid grasslands, shrublands, or alpine tundra. The region's location and variety of environments allows the growth of vegetation from many outside sources. Plants of the Great Plains and Intermountain region are common, and many Pacific coastal species can be found in milder locations in northwest Montana.

CLIMATE

No single climatic influence dominates Montana. Pacific maritime air masses strongly influence the climate west of the continental divide; continental conditions dominate east of the divide. Orographic effects have a strong influence on local microclimates in the mountainous regions, including outlier ranges on the Northern Great Plains.

Northern Great Plains

The Northern Great Plains climate is strongly continental and seasonal. The summers are warm, with precipitation from May through August being half or more of the annual amount. Winters are cold and relatively dry due to Canadian and arctic air masses entering from the north. Thunderstorms, generated by a convectional lift of moist air, result in much of the summer precipitation.

On the western edge of the Northern Great Plains the climate is cold and moist. Moving east the climate gradually becomes warmer and drier. The western edge of the Northern Great Plains region has a short growing season of approximately 50 to 110 frost free days (Taylor and others 1974). Variations result from local conditions. The Rocky Mountain Front commonly has dramatic temperature fluctuations. The world-record 24 hour temperature drop of 100°F occurred in Browning near Glacier Park (McWhirter and McWhirter 1972). These fluctuations result when warm chinook winds are replaced by rapidly advancing arctic cold fronts. The eastern part of the Great Plains has a relatively long frost-free growing period of 90 to 130+ days (Taylor and others 1974).

Increased elevations in the path of moving moist air results in increased rainfall at higher elevations (orographic lifting) as the rising, cooling air holds less moisture. Consequently, highlands such as the outlier ranges and the Absaroka and Beartooth Ranges receive higher amounts of precipitation than the surrounding plains. Due to the rainshadow effect, this precipitation is greatest on the west side of the mountain and lower in the foothills and plains of the east side.

Northern Rocky Mountains

The climate of the mountainous western one-third of the state is strongly influenced by Pacific maritime weather during the winter and spring. Moisture laden air masses from the north Pacific Ocean provide abundant snow and rain in northwest Montana. The Pacific maritime influence diminishes as it moves south and east due to successive mountain ranges continually depleting the moisture from the air masses. The continental divide is the eastern most boundary of Pacific maritime weather influence. The adjoining continental weather often spills over from the Northern Great Plains bringing extremely cold weather in the winter.

Summers are typically warm and dry. Subtropical high pressure systems on the west coast shift northward in late June causing the prevailing westerlies to carry dry air masses across western Montana. Warm temperatures in early summer often cause a convectional lift of moist air, resulting in thunderstorms that provide much of the summer precipitation.

General patterns exists of colder temperatures from north to south due to a corresponding gradual increase in elevation, and

from west to east due to the increased influence of the continental cold air masses. Local average temperature differences are also common; explainable by elevation differences. Valley locations are commonly warmer than adjacent mountainous areas.

The mountain and valley topography of the Northern Rocky Mountains produces great variations in precipitation distribution. Pacific storm fronts from the west, consequently produce a rainshadow effect; depositing greater amounts of precipitation on the west side of mountain ranges than on the east. In the Tobacco Valley and the western half of the Flathead Valley, the average annual precipitation is less than 36 cm (15 in) while adjacent mountain ranges less than twenty miles to the west receive as much as 240 cm (100 in) annually.

Temperature differentiations between high mountain and adjacent valley settings have a strong affect on daily temperature fluctuation. During the evening, warm valley air rises and is replaced by cooler mountain air flowing into the valley. Temperature inversions (cold air trapped in the valley bottoms by warmer air above) are common during the winter in all the valleys. These inversions can enable subalpine vegetation to survive in lower elevation canyon floors.

FIELD METHODS

The data base for the development of the classification consists of 2,681 sample plots. The following data sets were analyzed:

1) Data collection by the Montana Riparian and Wetland Association in Montana, the eastern edge of North Dakota and South Dakota, and the western edge of Idaho (1986, 1987, 1988, 1989, 1990, and 1991).
2) Data collection by the Montana Riparian and Wetland Association for the National Park Service, on the northern range of Yellowstone National Park (1986).
3) Data collection by Paul Hansen for his M.A. thesis (1980) on Theodore Roosevelt National Park, and his Ph.D. dissertation (1985) in northwest South Dakota, southwest North Dakota, and southeast Montana.
4) Data collection by Keith Boggs for the Montana Department of Fish, Wildlife and Parks, on the lower Yellowstone River (1984).
5) Data collection by Pfister and others for the USFS Region 1, on Forest Service lands in Montana; the data were used for *Forest Habitat Types Of Montana* (1977).
6) Data collection by John Pierce for the Helena National Forest (1984), Lewis and Clark National Forest (1984), and Lolo National Forest (1985).
8) Data collection by Steve Cooper and John Pierce for the USFS Region 1 grizzly bear habitat inventory on the Rocky Mountain Front (1986).
9) Data collection by Steve Cooper and others for the USFS Region 1, on Forest Service lands in northern Idaho; the data were used for *Forest Habitat Types Of Northern Idaho: A Second Approximation* (1991).
10) Data collection by Steve Cooper for the Lewis and Clark National Forest, and the Bureau of Indian Affairs on the Fort Belknap and Rocky Boys Indian Reservations (1988).
11) Data collection by Steve Cooper for the Bureau of Indian Affairs on the Blackfeet (1981), Crow (1985), and Northern Cheyenne (1985) Indian Reservations.
12) Data collection by Janet Johnson, John Joy, John Pierce, and Dan Svoboda for the Beaverhead and Deerlodge National Forests (1986, 1987).
13) Data collection by Peter Lesica for The Nature Conservancy in central and eastern Montana (1988), and southwest Montana (1990).
14) Data collection by Shari Gregory for the Confederated Salish and Kootenai tribes (1987).
15) Data collection by Dave McAllister for The Nature Conservancy at Pine Butte (1990).
16) Data collected from riparian and wetland sites throughout Montana during the development of an inventory and mapping procedure for various agencies and organizations including Bureau of Land Management, Bureau of Indian Affairs, Bureau of Reclamation, Ft. Peck Tribes, Confederated Salish and Kootenai Tribes, Montana Department of Fish, Wildlife, and Parks, and the Atlantic Richfield Company. The data and knowledge gained was especially useful in the development and refinement of the taxonomic key to the habitat types and community types of Montana and to the development of management information.

Stand selection based on "subjective sampling without preconceived bias" is described by Mueller-Dombois and Ellenberg (1974). Plots selected reflect the apparent range of environmental and successional conditions and homogeneity of the vegetation, rather than the eventual placement of the stand within a classification system.

Studies in the northern and central Rocky Mountain use plots 5 m (16.4 ft) by 10 m (32.8 ft) on a side, total area of 50 m^2 (538 ft^2), for sampling a broad range of riparian and wetland communities, including tall shrub types (Mattson 1984; Platts and others 1987; Tuhy and Jensen 1982; Youngblood and others 1985a, 1985b). For long stringer communities, the plot width is reduced and length is increased to maintain a constant plot size of 50 m^2 (538 ft^2). This plot size is considered adequate to include most species of a community, yet small enough for the sampler to see the entire plot. Each plot is located within a stand at least twice the area of the plot to avoid sampling ecotones between communities. When sampling Forest communities, a 375 m^2 (35.8 ft radius) circular plot is used. Again, in long stringer communities the plot size is adjusted accordingly.

Canopy cover (Daubenmire 1959) by species is ocularly estimated within each plot. Plants not identified in the field are collected for identification later. Data regarding successional relationships, and adjacent communities is also collected.

Data regarding physical site features are collected for each plot and include: 1) soil morphology, 2) depth to water table, 3) depth to a restrictive layer, 4) litter/duff accumulation, 5) stream morphology, 6) geomorphology, 7) human modifications, 8) elevation, 9) slope, 10) aspect, 11) configuration, and 12) both natural and human induced disturbances.

OFFICE METHODS

Development of the Montana riparian and wetland site classification follows six general procedures outlined below.

1) Specimens of plants are identified in the field, the office, or the University of Montana herbaria.
2) Data are entered into FUZPHY, a computer data analysis system developed by Dave Roberts of Utah State University, capable of summarizing large quantities of vegetation and environmental data.
3) A stepwise procedure of successive approximations is used to develop the classification (Pfister and Arno 1980). Preliminary association tables are created using plot species and canopy cover values. Stands are then rearranged several times to group stands into sets with the greatest vegetation similarities. Plot-to-plot similarity relations, plot-to-set similarity relations, and set-to-set similarity relations were analyzed using a modified Sorensen's Index (the program SIMREL in FUZPHY). The final placement of each sample plot in a set is based on both floristic and environmental relationships.
4) Average canopy cover, canopy cover range, and constancy tables are created for each group.
5) A dichotomous key to the preliminary types is developed based on the presence or abundance of diagnostic plant species that indicate the presence of certain environmental conditions (indicator species). The key is then applied to all plots and necessary revisions were made to accommodate variations in the data.
6) A description is prepared for each habitat type and community type. A general discussion of vegetation, physical site features, and management implications is included.

A number of riparian habitat types and community types have been defined by various classifications for Montana (Pfister and others 1977; Mueggler and Stewart 1980) and adjacent states: for northern Idaho (Cooper and others 1991); for Idaho and-Wyoming (Mueggler 1988); for eastern Idaho and western Wyoming (Steele and others 1983); for eastern Idaho-western Wyoming (Youngblood and others 1985). The authors of this publication attempted to adopt these previously defined types. However, many of the riparian habitat types from the classifications are not equivalent, or did not match Montana Riparian and Wetland Association descriptions. Consequently, we selected the riparian habitat types and community types that best fit the ecological conditions observed in Montana or defined new types.

TAXONOMIC CONSIDERATIONS

Taxonomic nomenclature follows Brunsfeld and Johnson (1985) for the Salicaceae. All other taxa follow Barkley (1986) and

Hitchcock and others (1969).

Occasionally, some species present problems in positive identification. Due to the frequent absence of inflorescences and to similarities in morphology and ecological amplitude, the following taxonomic considerations were made:

1) *Salix geyeriana* (Geyer willow) includes *Salix lemmonii* (Lemmons willow).
2) *Salix lutea* (yellow willow) includes: *Salix eriocephala* (diamond willow), *Salix rigida* (diamond willow), and *Salix missouriensis* (Missouri willow) (Great Plains Flora Association 1986).
3) *Picea* spp. (spruce) includes: *Picea engelmannii* (Engelmann spruce) and *Picea glauca* (white spruce).
4) *Polygonum amphibium* (water smartweed) and *Polygonum coccinium* (water smartweed) are now considered conspecific and are both included under the former name.
5) *Agrostis stolonifera* (redtop) and *Agrostis alba* are now considered conspecific and are both included under the former name. Also included is *Agrostis scabra* (tickle-grass).

ECOLOGICAL EQUIVALENTS

We have grouped several species together in the key due to similarities in management concerns and environmental conditions. Therefore, stands comprised of the following combinations of species were grouped together:

1) The *Salix geyeriana* (Geyer willow) habitat types — includes all combinations of *Salix geyeriana* (Geyer willow) and *Salix boothii* (Booth willow).
2) The *Salix planifolia* (planeleaf willow) habitat type — includes all combinations of *Salix planifolia* (planeleaf willow) and *Salix commutata* (undergreen willow).
3) The *Carex rostrata* (beaked sedge) habitat type — includes all combinations of *Carex rostrata* (beaked sedge), *Carex vesicaria* (inflated sedge), and *Carex atherodes* (awned sedge).
4) The *Carex aquatilis* (water sedge) habitat type — includes all combinations of *Carex aquatilis* (water sedge) and *Carex lenticularis* (lentil-fruit sedge).
5) The *Carex lasiocarpa* (slender sedge) habitat type — includes all combinations of *Carex lasiocarpa* (slender sedge), *Carex lanuginosa* (woolly sedge), and *Carex buxbaumii* (Buxbaum's sedge).
6) The *Eleocharis palustris* (common spikesedge) habitat type — includes all combinations of *Eleocharis palustris* (common spikesedge) and *Eleocharis acicularis* (needle spike-rush).
7) The *Eleocharis pauciflora* (few-flowered spike-rush) habitat type — includes all combinations of *Eleocharis pauciflora* (few-flowered spike-rush) and *Eleocharis rostellata* (beaked spike-rush).
8) The *Calamagrostis canadensis* (bluejoint reedgrass) habitat type — includes all combinations of *Calamagrostis canadensis* (bluejoint reedgrass) and *Calamagrostis stricta* (narrow-spiked reedgrass).
9) The *Scirpus acutus* (hardstem bulrush) habitat type — includes all combinations of *Scirpus acutus* (hardstem bulrush) and *Scirpus validus* (softstem bulrush).
10) The *Typha latifolia* (common cattail) habitat type — includes all combinations of *Typha latifolia* (common cattail) and *Typha angustifolia* (narrow-leaved cattail).
11) The *Spartina pectinata* (prairie cordgrass) habitat type — includes all combinations of *Spartina pectinata* (prairie cordgrass) and *Spartina gracilis* (alkali cordgrass).
12) *Crataegus succulenta* (succulent hawthorn) community type — includes all combinations of *Crataegus succulenta* (succulent hawthorn) and *Crataegus douglasii* (Douglas hawthorn).
13) *Rosa woodsii* (woods rose) community type — includes all combinations of *Rosa woodsii* (woods rose) and *Rosa acicularis* (prickly rose).
14) The *Agrostis stolonifera* (redtop) community type — includes all combinations of *Agrostis stolonifera* (redtop) and *Agrostis scabra* (tickle-grass).

ECOLOGICAL TERMS AND CONCEPTS

The following classification of climax vegetation was first proposed by Tansley (1935) and later modified by Daubenmire (1952). A ***climax community*** is a final or steady state plant community which is self-perpetuating and in dynamic

equilibrium with its environment. ***Climatic climax*** vegetation develops on normal topography with fairly deep loamy soil. Where topography or soil exert sufficient influence to produce a self-perpetuating, steady-state vegetation distinct from the climatic climax, the terms ***topographic climax*** or ***edaphic climax*** respectively are used. Where special topographic conditions also favor the development of edaphic conditions distinct from the normal, and the climax vegetation is distinct from the climatic climax, the term ***topoedaphic climax*** is used. Where recurring disturbances, such as grazing or fire, exert the predominant influence in maintaining the structure and composition of the steady-state vegetation, the term ***disclimax*** is used. A ***zootic climax*** is stable vegetation which is distinct as a result of heavy use by animals. ***Fire climax*** is apparently stable vegetation which is distinctive as a result of periodic burning. ***Disclimaxes, such as the zootic climax or fire climax, are not the basis for recognizing habitat types.*** A ***seral community*** is a vegetation community that has theoretically not attained a steady state; seral communities successively occupy and replace others of a particular environment over time.

The following concepts and terminology are consistent with usage proposed by Daubenmire (1952, 1968, 1978) and used in numerous studies of vegetation based ecological site classification (habitat types) (Daubenmire 1952; Daubenmire and Daubenmire 1968; Daubenmire 1970; Cooper 1975; Hoffman and Alexander 1976, 1980, 1983, 1987; Pfister and others 1977; Moir and Ludwig 1979; Jorgensen 1979; Mueggler and Stewart 1980; Pfister and Arno 1980; Steele and others 1981; Hironaka and others 1983; Hanks and others 1983; Steele and others 1983; Alexander and others 1984a, 1984b; Alexander and others 1986; Cooper 1981; Cooper and Pfister 1985; Hansen and others 1984; Hansen and Hoffman 1988; Mauk and Henderson 1984; Alexander 1985; Youngblood and Mauk 1985; DeVelice and others 1986; Cooper and others 1991; Kovalchik 1987; Steele and Geier-Hayes 1987; Tiedeman and others 1987). For a review of vegetation based ecological site classifications (habitat types), see Ferguson and others (1989), and Pfister (1989).

A ***habitat type*** is defined as the land area that supports, or has the potential of supporting, the same climax vegetation. Each habitat type represents a relatively narrow segment of environmental variation having a certain potential for vegetation development. Although any given habitat type may support a wide variety of disturbance-caused or seral vegetation, the ultimate product of vegetational succession anywhere within that habitat type will be a similar plant community. Therefore, the habitat type is a vegetation based ecological site classification that uses the plant community as an indicator of integrated environmental factors as they affect species reproduction and plant community development. Changes in site conditions can include cyclical site changes such as normal climatic cycles in which sequential drying and filling of potholes or deposition of fresh alluvium on floodplains that create a drier site over time yet remaining the same habitat type. Habitat types has been used to classify grasslands, shrublands, woodlands, and forests throughout western United States. The habitat type classification system is currently being applied to lands in central and eastern United States.

A ***phase*** is a finer subdivision of a habitat type representing a minor variation in climax vegetation and environmental conditions.

The term ***plant association*** is used to group together all those stands of climax vegetation which occur in environments so similar that there is much floristic similarity throughout all layers of the vegetation. For our work, we have chosen to follow the lead of Kovalchik (1987) in the development of a vegetation based ecological site classification for riparian and wetland areas. Kovalchik (1987) uses the term ***riparian association*** as a vegetation type representing the latest successional stage attainable on a specific hydrologically influenced surface. Because the riparian association is the end result of plant succession, it reflects the most meaningful integration of environmental factors affecting vegetation.

In addition to habitat types, several major seral plant communities that are stable for time frames relevant to land management decisions have been described. These are referred to as ***community types.*** A ***community type*** is an aggregation of all plant communities distinguished by floristic and structural similarities in both overstory and undergrowth layers. Examples are the *Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) community type and the *Salix exigua* (sandbar willow) community type. However, in this classification the term ***community type*** can only represent seral or disclimax communities because the climax community types are defined as riparian associations.

Naming of the association follows the frequently used system of a binomial set with the dominant overstory species separated from the dominant or most diagnostic indicator of the undergrowth union by a slash. For example, numerous stands of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) association occur. The units of land on which these occur represent the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type. This latter nomenclature is useful because throughout the study region most parcels of land support vegetation in a successional stage (seral stage). Where those land units are recognized to be part of the *Salix geyeriana/Carex rostrata* (Geyer willow/beaked sedge) habitat type, they are so categorized. Thus a multitude of variation in the matrix of vegetation over the landscape theoretically can be categorized into a manageable number of units. The categories are defined to represent as close as possible the natural biotic potential (climaxes) of the region. A ***phase*** is a subdivision of a habitat type representing a minor variation in climax vegetation and environmental conditions. An example is the *Carex rostrata* (beaked sedge) habitat type, *Carex rostrata* (beaked sedge) phase. However, some riparian and wetland communities consist of only a single layer of vegetation; we consider this the overstory and ignore all references to additional layers (e.g., the *Carex limosa* [mud sedge] habitat type).

The process of change by which biotic communities replace each other and by which the physical environment becomes altered over a period of time is referred to as ***succession*** (Kimmins 1987). Two types of succession affect vegetation development: 1) ***primary succession,*** and (2) ***secondary succession.*** Succession that creates new soil surfaces, such as filling in a lake or development of vegetation on an alluvial bar, is ***primary succession.*** This is a slow process that may require many centuries to reach a stable or climax community. ***Secondary succession*** occurs after a disturbance, such as a fire, alters or destroys the vegetation cover, but not the soil. Regeneration (secondary succession) usually happens quickly, unless subsequent erosion removes the soil down to bedrock. However, a fire in a fen may burn enough peat to create a pond during wet seasons and initiate primary succession. Secondary succession may occur in either of two directions: toward or away from the climax community or potential natural community (PNC). For example, the establishment of *Fraxinus pennsylvanica* (green ash) seedlings under an overstory of cottonwoods would represent progressive succession toward the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type. The failure of *Fraxinus pennsylvanica* (green ash) to establish itself and the resulting domination of the understory by *Poa pratensis* (Kentucky bluegrass) could represent regressive succession away from the original PNC. As noted above, community types that represent steps along the successional pathway toward or away from the PNC are called seral stages or seral communities.

Our goal is to provide understanding of plant communities in relation to factors of time, physical environment (site), and treatment, and to document that understanding through a user-oriented taxonomic classification system. The concepts and terminology are illustrated in Figure 1 for further clarification. The upper cell is the ***plant association*** (climax vegetation type). After riparian associations are identified and defined, a taxonomic key is written to define the column (physical environment = site) that represents the ***habitat type.*** This key allows identification of the habitat type in most stages of succession. In some instances, the successional relationships are known. For example, community types A-2, A-3, and A-4 represent specific and clearly identified successional stages within association A (see Figure 2 for examples). On the other hand, community type B/C-2 represents a grazing disclimax that extends over two or more habitat types with insufficient evidence to distinguish the specific type (column). In association D, our present knowledge base only allows us to identify one seral stage, such as community type D-2. Finally, riparian association E represents the situation in which the time frame for the successional pathway is brief and the climax vegetation type (riparian plant association) is obtained after just a few years. In general, this pathway occurs when the pioneering species is a very aggressive plant that also represents the climax vegetation for the site, such as in the case a *Carex rostrata* (beaked sedge) and *Typha latifolia* (common cattail).

Until recently, ecologists and land managers have only had to deal with secondary succession when working with nonwetland or upland sites. However, in many riparian and wetland situations, primary succession is just as important as secondary succession in expressing the overall landscape mosaics. Figure 2 illustrates the importance of both primary and secondary succession in riparian and wetland sites.

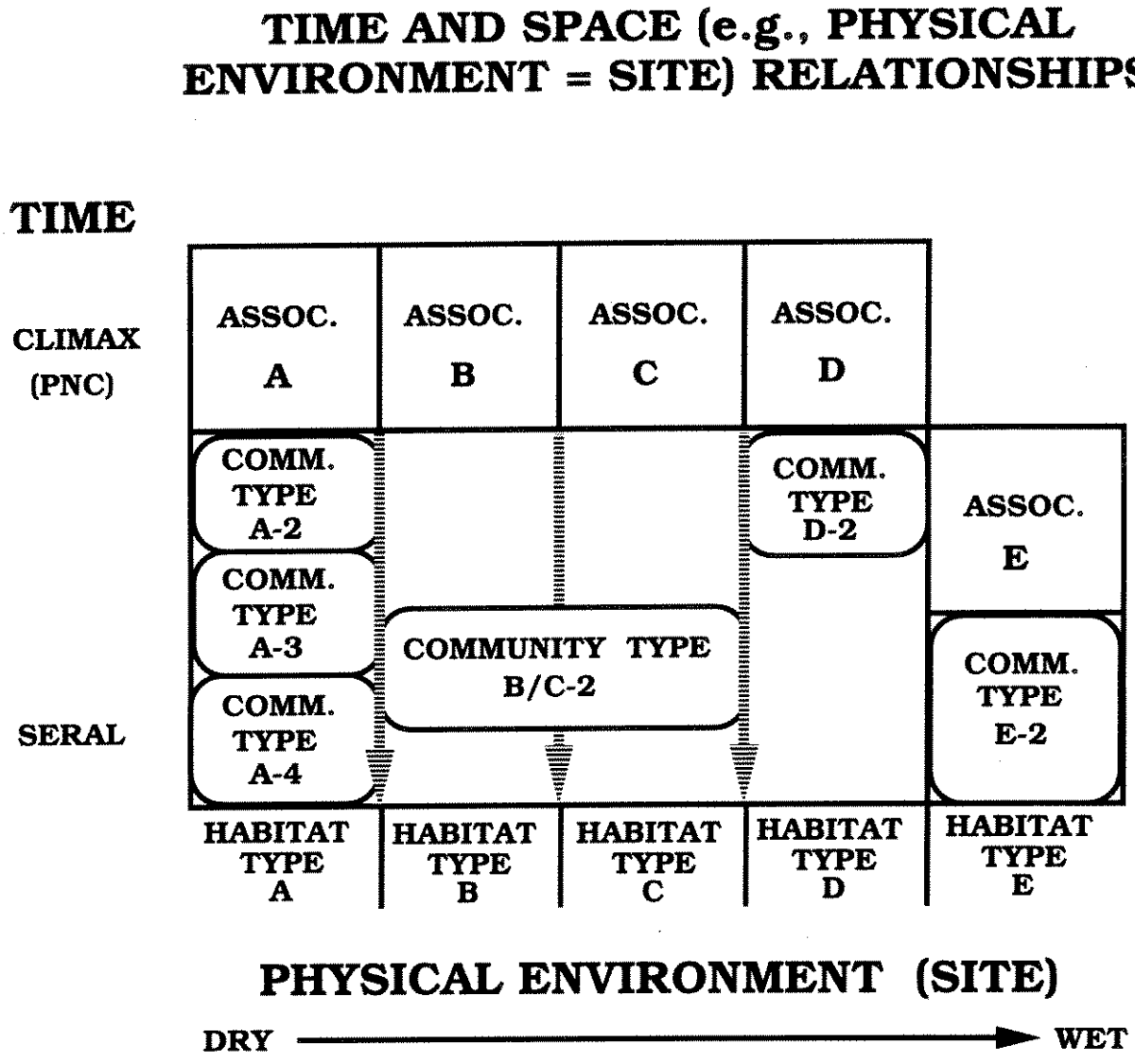


Figure 1. Illustration of the terminology as it relates to time and space (e.g., physical environment = site) for riparian-wetland sites.

RIPARIAN-WETLAND PLANT SUCCESSION

Climax (Potential Natural Vegetation)	Green Ash/Common Chokecherry Plant Association	Geyer Willow/Beaked Sedge Plant Association	Common Cattail Plant Association
Late Seral	Decadent Great Plains Cottonwood With an Understory Dominated by Green Ash and Chokecherry	Slightly Hedged, Fairly Dense Stand Dominated by Geyer and Booth Willow With an Understory of Beaked Sedge	Common Cattails With Understory of Widely Scattered Field Mint
Mid-Seral	Mature Stand of Great Plains Cottonwood With an Understory of Red-Osier Dogwood	Heavily Hedged, (Umbrella-Shaped) Widely Scattered Individuals of Booth's and Geyer's Willow with an Understory Dominated by Kentucky Bluegrass or Common Timothy	Common Cattails with an Understory of Smartweeds
Early Seral	Recently Exposed Alluvial Bar Dominated by Seedling Stage of Great Plains Cottonwood and Sand Bar Willow	Kentucky Bluegrass Dominated Site with a Trace of Booth's or Geyer's Willow	Recently Exposed Mud Flat with Young Seedlings of Common Cattail and a Wide Variety of Annuals
	Habitat Type (Primary Succession)	Habitat Type (Secondary Succession)	Habitat Type (Primary Succession)

Figure 2. Succession within three habitat types illustrating primary and secondary succession.

The most important characteristic of riparian and wetland areas is their dynamic nature. Not only does succession occur up and down seral stages within a habitat type, but the site potential itself may also be altered by a dramatic change in the hydrological or soil characteristics. Deep alluvial depositions in floodplains can alter the available water on a site. Rapid accumulations of organic materials can occur on fens, bogs, and wet meadows thereby altering the water holding capacity and nutrient availability of the soil. Site potential may change when sites are dewatered (the lowering of the water table) by draining or heavy livestock impacts. Permanently flooded areas due to human-caused activity or wildlife activity (beaver ponds) will also change site potential. Any case where the site potential has changed will in turn result in a different climax community (riparian association).

The time frame for successional processes varies greatly, depending upon the type, location, and origin of the riparian and wetland area. As an example, beaver ponds may silt-in within a few years or hundreds of years. In contrast, analysis of a few mountain meadows has shown them to be stable for the last 6,900 years (Windell and others 1986). In the Madison Range, Montana, Patten (1963) considered that the vegetation was still adjusting to the post-Pleistocene climate, but that vegetation patterns, including mountain meadows, are relatively stable.

The climax plant community (plant association), as the theoretical end result of succession, is an expression of the biotic potential of that site. Each habitat type is a relatively narrow segment of environmental variation and is defined by a certain potential for vegetational development. Although one habitat type may support a variety of disturbance-caused (seral) plant communities, the potential product of vegetational succession anywhere within one habitat type will be a similar climax community. Therefore, the habitat type classification uses the plant community as an expression of the environmental factors affecting species reproduction and plant community development.

The long-term product of succession is the climax or steady-state community. Theoretically this community, free of major disturbance, is self perpetuating and represents a meaningful integration of its total environment. It is from this assumption that climax vegetation is useful in the nomenclature of habitat types.

Some ecologists dispute the existence of successional end points in the form of climax communities. This argument has developed primarily from the study of global climate change which indicates plant communities progress along successional pathways, but are continually adapting to changes in climate and natural disturbance and thus never truly reach an end point in succession. This argument may have particular relevance to the highly dynamic environment of the riparian zone where hydrological influences are often more dramatic and may fluctuate significantly both seasonally and annually. These fluctuations and associated natural disturbances may provide for an ever changing environment and no specific potential vegetation community. Nevertheless, current knowledge of successional pathways and the temporal persistence of some major seral plant communities is relevant to a resource management perspective.

Habitat type classifications provide a permanent and ecologically based system of land stratification in terms of vegetational potential (Daubenmire 1976). As the habitat type is the basic unit in classifying land units or sites based on their biotic potential, it emphasizes similarities and differences in ecosystems which carry implications for a variety of land management objectives (Daubenmire 1984). Some of the practical implications of habitat type classification are in predicting range and wildlife forage production and wildlife habitat values, inventory, landtype mapping, timber production, species selection for regeneration and/or rehabilitation methods, development of best management practices, growth rates of trees and shrubs, susceptibility of trees and shrubs to insects and disease, depth of soil moisture penetration, potential for producing browse after fire, soil management criteria, impacts of recreational uses, natural areas for preservation, downed woody fuels on the forest floor, and successional trends following disturbance. In addition, habitat types offer a basis of comparison and evaluation in designing and carrying out field experiments in ecology or applied natural resource disciplines.

There are typically three misconceptions about the use of the habitat type classification system: 1) an abundance of climax vegetation is present on the current landscape, 2) natural resource managers need to manage solely for climax vegetation, and

3) the habitat type classification system requires climax or near-climax vegetation. In terms of the first two misconceptions, the opposite is actually the case. In the first case, a very high percentage of our landscape reflects some degree of disturbance resulting in the landscape being dominated by various seral stages. In the second case, management strategies usually favor seral species, regardless of the habitat type. In the case of the third misconception, comparing the relative reproductive success of the present plant species with known successional patterns generally permits accurate identification of the habitat type. In general, succession is more rapid for undergrowth species, thereby allowing insight into the identification of the proper habitat type for the site. Where stands have been severely disturbed, are in an early seral stage, or have a closed canopy resulting in a depauperate understory, comparison of the stand with adjacent stands can assist in the proper habitat type identification.

Habitat type classification systems are useful to land and resource managers in many ways: 1) they provide a permanent and ecologically based system of land stratification that is referenced to vegetation potential (Daubenmire 1976), 2) they provide a vegetational classification for near-climax to climax communities, 3) they provide a system in which successional stages can be identified and described, thereby increasing our knowledge and predictability of the landscape, and 4) they provide a basis for making predictions about various management decisions or natural disturbances on similar units of land.

HISTORICAL OVERVIEW OF RIPARIAN AND WETLAND AREAS

Historically, riparian or wetland areas were frequently the first lands settled by European immigrants. Western riparian and wetland areas provided an abundance of game, fish, and other easily harvestable natural resources needed by settlers until they could bring lands into production. Many water courses provided the only means of transporting large quantities of supplies and goods. In addition, water power was harnessed to mill grain, saw wood, and perform many other needed tasks. The same fertile, alluvial soils that provided excellent wildlife habitat also provided excellent farmlands after they were drained and cleared of dense stands of trees and shrubs. In addition, water from the streams, rivers, lakes, or ponds was commonly used to irrigate croplands. Trees were also cut for firewood, fence posts, building of homesteads, and for powering the steamboats that transported the settlers to the West. Along the Upper Missouri River in Montana between the years 1860 to 1890, the wood hungry steamboats consumed stands of cottonwoods that appeared to be unlimited. Each steamboat could use over 30 cords of wood in a normal day's operation and it is estimated that over 300,000 cords of wood were removed from the river corridor during the steamboat era (Damone 1987). By the turn of the century the river bottoms were completely denuded of any trees that could be utilized.

Riparian and wetland areas have been a focus of concern since the increased awareness of environmental issues in the 1960's. They harbor a third of the country's endangered or threatened species of plants and animals. The draining of more than 50 percent of the 215 million acres of riparian and wetland areas since colonial times is well documented. So are recent estimates which establish the rates of loss at between 300,000 and 450,000 acres per year (Feierabend and Zelazny 1987). In the mid-19th century, the Swamp Land Act made it official United States policy to encourage reclamation (e.g., the draining and filling of riparian and wetland areas) in order that "wastelands" might soon bear the fruits of sustained agriculture. Information on riparian and wetland areas was first collected to identify "nonproductive wet areas" so they could be drained and "reclaimed." Early surveys in the 1850's were done to identify those federally-owned riparian and wetland areas that could be given to the states for development. Surveys in 1906, 1919, 1946, and 1948 focused on drainage for public health and agricultural development (Heimlich and Langner 1986). The rate of loss increased dramatically from the mid-1950's to the mid-1970's. An overall loss of 11 million acres occurred during this period. About 80 percent of this loss, 440,00 acres per year, was due to the draining and clearing of riparian and wetland areas for agriculture (Feierabend and Zelazny 1987). Between mid-1970's and the mid-1980's, the United States lost 2.6 million acres of riparian and wetland areas. This loss amounts to approximately 4,000 square miles, a sum twice the size of the state of Delaware. On average, the lower 48 states have lost over 60 acres of riparian and wetland areas for every hour that passed between the 1780's and the 1980's. Most states have lost vast amounts of their riparian and wetland areas: California has lost 91 percent of its historic riparian and wetland areas; Ohio has lost 90 percent; Iowa, 89 percent; Indiana and Missouri, 87 percent; the prairie pothole region of the United States and Canada, 65 percent(also called the duck factory—this area is the most productive waterfowl breeding area in the world); and the Florida Everglades, 50 percent.

In addition to the draining of riparian and wetland areas, other human activities greatly changed the nature of riparian and wetland areas by the end of the 19th century. Improper timber harvesting and mining greatly impacted the riparian and wetland areas. Livestock confined within fences sometimes grazed riparian and wetland areas almost year-round. Riparian and wetland areas near farmsteads often became highly eutrophic from barnyard and feedlot runoff water. Fires, feared by both farmers and ranchers, were suppressed whenever possible, which allowed dead vegetation to accumulate in many riparian and wetland areas. In agricultural areas, bottomlands of ephemeral riparian or wetland areas were cultivated, some even during wet years. The vegetation in all or part of some riparian or wetland areas was mowed as often as possible for hay or bedding for livestock. Some riparian and wetland areas were burned in the fall to reduce the amount of snow trapped or to discourage the spread of "weeds". In more recent times cultivation of steep slopes, use of row crops, and the practice of summer fallowing have caused much topsoil to move into riparian or wetland areas, further changing their vegetative species composition and abundance (Kantrud 1986). Dissolved salts and residues from agricultural chemicals have moved into many riparian and wetland areas. Irrigation practices have also altered the hydrology and vegetation of riparian and wetland areas.

BENEFITS OF A HEALTHY AND PRODUCTIVE RIPARIAN OR WETLAND AREA

In a broad sense, "health" may be defined as the ability of a stream reach or wetland to perform its normal functions. These functions include sediment filtering, streambank building, water storage, aquifer recharge, and stream energy dissipation. A stream's health may also reflect management considerations. For example, although spotted knapweed (*Centaurea maculosa*) or leafy spurge (*Euphorbia esula*) along a streambank may help to trap sediment and provide deep soil-binding properties necessary for maintaining the streambanks, its presence would indicate a management concern.

Benefits of riparian and wetland vegetation are many. Healthy riparian and wetland vegetation stabilizes streambanks making them less likely to erode during high flow events; determines bank morphology; and aids in reducing streambank damage from ice, log debris, and animal trampling (Karr and Schlosser 1978, Platts 1979, Marlow and Pogacnik 1985). The roots of trees, shrubs, and herbaceous vegetation stabilize streambanks, providing cover in the form of overhanging banks. Streambank stabilization is important because much of a stream's sediment load, particularly during high flows, can be the result of bank erosion. Schlosser and Karr (1981) found levels of suspended solids increased quickly during storm events when the streambanks were devoid of vegetation. In more stable channel sections with well developed riparian and wetland vegetation, Schlosser and Karr (1981) found levels of suspended solids increased at a slower rate. Vegetation along streams also reduces the velocity and therefore the erosive energy of overbank flow during floods (Schumm and Meyer 1979).

Riparian and wetland vegetation also provides shade, preventing excessive water temperature fluctuations which can have harmful effects upon the aquatic life including the macro invertebrates and various fish species (Meehan and others 1977). Riparian and wetland vegetation can regulate water temperature by reducing maximum summer temperatures. Such temperature control can increase the oxygen-carrying capacity because the higher the water's temperature, the less oxygen it can hold. Vegetation removal can trigger an increase in water temperature that may adversely affect a stream's biota. Because many species of trout require well-oxygenated water for survival, an increase in water temperature will generally reduce the stream's fish population.

Riparian and wetland areas can also filter out nutrients and improve water quality. In agricultural watersheds, nutrient filtering in riparian and wetland areas can help control agricultural nonpoint-source pollution (Lowrance and others 1985). Sediment deposition is a natural process that takes place during periodic flooding. Accelerated upland erosion can increase sediment deposition in riparian and wetland areas because of downslope movement of dislodged soil material. Such deposition can change the soils, drainage, and vegetation associated with riparian or wetland areas (Lowrance and others 1985). Riparian and wetland vegetation can also reduce sediment and nutrient transport in a number of ways. Roots, especially those of woody vegetation, help stabilize streambanks by holding soil. Vegetation also increases hydraulic resistance to flow, thereby lowering flow velocities and causing sediment deposition.

Another important role of riparian and wetland vegetation is uptake and long-term storage of nutrients. Riparian and wetland areas are more productive because of the nutrient and water subsidies provided by periodic flooding (Brinson and others 1980). Nutrient uptake into leaves and other deciduous parts can be an important factor in short-term nutrient storage. However, because deciduous plant parts drop each year, nutrients soon become available for transport. High litterfall and generally wet conditions also result in soils high in organic matter.

Riparian and wetland ecosystems generally serve to dissipate water and wind energy that can damage agricultural land. Riparian forests serve as windbreaks. In the Great Plains, gallery forests are important natural barriers to winds. Riparian and wetland areas are also important in dissipating the energy of running water from runoff of agricultural land. In general, surface runoff slows as it flows through the riparian or wetland zone. This reduction in velocity causes sediment deposition and diminishes the water's erosive potential.
Many alluvial aquifers in the western United States are maintained by infiltration of upland runoff in the stream channel or alluvial deposits. These aquifers are an important source of water for human use. Water storage in such aquifers was once partially responsible for maintaining baseflow in western rivers, which are now dry beds much of the year. The loss of riparian and wetland ecosystems is responsible, in part, for the change from perennial to intermittent flow in some streams.

Riparian areas are important to instream ecosystems. Riparian vegetation produces the majority of the detritus that provides up to 90 percent of the organic matter necessary to support stream (aquatic) communities (Campbell and Franklin 1979). In forested ecosystems, up to 99 percent of the stream energy input may come from bordering riparian vegetation with only 1 percent coming from instream photosynthesis by algae and mosses (Cummins 1974). Even in large rivers such as the Missouri River, 54 percent of the organic matter ingested by fish comes from riparian vegetation (Kennedy 1977).

The riparian or wetland ecosystem is probably the single most productive type of wildlife habitat, benefiting the greatest number of species (Ames 1977, Hubbard 1977, Patton 1977). Examples of the wildlife values of riparian and wetland habitat are numerous. In western Montana 59 percent of the land bird species use riparian and wetland habitats for breeding purposes and 36 percent of those breed only in riparian or wetland areas (Mosconi and Hutto 1982). Thomas and others (1979) reported that of the 363 terrestrial species known to occur in the Great Basin of southeastern Oregon, 299 are either directly dependent on riparian or wetland zones or utilize them more than any other habitats. The influence of riparian and wetland ecosystems on wildlife is not only limited to those animal species that are restricted to the riparian or wetland zone. Population densities of birds in upland habitat adjacent to the riparian or wetland zone are influenced by the presence of riparian or wetland areas (Carothers 1977). When a riparian or wetland area is removed or heavily impacted by humans, not only are the riparian and wetland species of the area adversely influenced, but wildlife productivity in the adjacent uplands is also impacted.

Riparian and wetland areas are of vital importance to the livestock industry. Livestock tend to congregate in riparian or wetland areas and utilize the vegetation much more intensively than the vegetation of adjacent uplands (Kauffman and Krueger 1984). Reid and Pickford (1946) in northeast Oregon, reported that moist meadow soils in riparian or wetland zones are so highly productive that one acre has the potential grazing capacity equal to 10-15 acres of forested uplands. Although riparian and wetland areas cover only about 1-2 percent of the summer range area of the Pacific Northwest, they can potentially produce 20 percent of the summer range forage (Reid and Pickford 1946, Roath and Krueger 1982).

Cattle tend to prefer riparian or wetland areas for the same reasons other animals prefer and use these areas. The main reasons are the availability of water, shade, and the quality and variety of forage (Ames 1977, Severson and Boldt 1978). In addition, many of the various sedge species retain relatively constant crude protein levels until the first killing frost. Several sedges found in riparian and wetland zones of the Pacific Northwest exceed key upland forage species in sustained protein and energy content (Kauffman and Krueger 1984). In the Blue Mountains of Oregon, Roath and Krueger (1982) found that because of livestock concentrations, limits on livestock movements caused by steep slopes and uneven distribution of watering areas away from the creek, the riparian or wetland zone (covering about 2 percent of the Blue Mountain grazing allotment) accounted for 81 percent of the total herbaceous vegetation removed by cattle.

Improper livestock use of riparian areas can affect the streamside environment by changing, reducing, or eliminating vegetation bordering the stream. Improper grazing can also have a considerable effect on vegetation, resulting in decreased vigor, biomass, and an alteration of species composition and diversity (Ames 1977, Bryant and others 1972). The channel morphology can be changed by widening and shallowing of the streambed, gradual stream channel trenching, or braiding, depending on soils and substrate composition (Marcuson 1977, Platts 1979). The water quality itself can be altered by increasing water temperatures, nutrients, suspended sediments, bacterial counts, and by altering the timing and volume of water flow (Platts 1979, Kauffman and Krueger 1984). Overgrazing can cause bank sloughoff, accelerated sedimentation, and subsequent silt degradation of spawning and food producing areas (Platts 1979, Platts 1981). Hayes (in Kauffman and Krueger 1984) found that high forage removal, high amount of foraging time along banks, and high percentages of palatable sedges along the bank all contributed to a significant increase in the probability of sloughoff occurring during the grazing season.

The effects of excessive use of woody vegetation can also have a negative affect on the overall health of the riparian and wetland zone (Kauffman and Krueger 1984). Knopf and Cannon (1982) found that excessive cattle grazing significantly altered the size, shape, volume, and quantities of live and dead stems of willows. Cattle grazing was also found to influence the spacing of plants and the width of the riparian or wetland zone. Marcuson (1977) found shrub production to be 13 times greater in an ungrazed area than in a severely overgrazed area. Canopy cover was 82 percent greater in the ungrazed area. However, investigators have found that a change in management of the site can dramatically increase the shrub canopy cover (Crouch 1979, Davis 1982, Kauffman and Krueger 1984, Hansen 1985).

Heavy livestock grazing has had primarily adverse effects on these sites for wildlife. Heavy cattle grazing reduces significantly bird species composition and foraging guilds, as well as small mammal density and diversity (Kauffman and Krueger 1984). Heavy livestock grazing also influences soil compaction and bulk density. Alderfer and Robinson (1949), Bryant and others (1972), Orr (1960), and Rauzi and Hanson (1966) all found soil compaction increased linearly with increases in grazing intensity.

However, recent advancements in grazing systems have achieved some success in riparian or wetland rehabilitation and much success in riparian and wetland area management. The damage caused by hot season use or season-long grazing is well documented (Marcuson 1977, Severson and Boldt 1978, Windell and others 1986, Platts and others 1987). Specialized grazing schemes appear to hold promise for rehabilitating riparian or wetland areas without excluding cattle for long periods (Kauffman and Krueger 1984). In a study in northeastern Oregon, Bryant (1985) found herbage production increased one- to four- fold through proper timing and intensity of grazing.

In the West, riparian or wetland areas are important in the overall landscape mosaic, even though they represent a very small fraction of the total area. Located in areas of greater than normal moisture, they are more productive than the surrounding upland vegetation. They add to the overall diversity of the vegetation. They also attract livestock and wildlife for the forage, thermal cover, nesting habitat, water, browse species, and protection they afford (Ames 1977, Severson and Boldt 1978). Because of this, riparian and wetland areas are focal points for livestock, timber, and wildlife management. Management strategies that recognize all resource values must be designed to maintain or restore the integrity of riparian and wetland communities.

Proper stewardship of a riparian or wetland areas is, in effect, money in the bank for the land manager. Proper management of riparian or wetland areas means decreased streambank erosion and floodplain losses (Gunderson 1968, Marcuson 1977), increased forage production for livestock (Pond 1961, Kauffman and Krueger 1984), and an increase in wildlife and fisheries resource (Duff 1979, Van Velson 1979).

RIPARIAN AND WETLAND LANDFORMS

The riparian or wetland soils of Montana have developed in response to the influences of climate, living organisms (both plants and animals), geologic parent material, time, and local topography (relief). Soil development is closely related to the physical position of the riparian or wetland site and landform gradients. The degree and rate of development is primarily determined by the effects of environmental gradients influencing the above mentioned formative factors (Platts and others 1987).

Three general landform types of fluvial valley bottoms have been described in the Rocky Mountains by Tuhy and Jensen (1982); they are: 1) glaciated headwaters, 2) narrow V-canyons, and 3) broad valleys.

Glaciated headwater sites generally contain seeps and bogs. Seeps may include moderate to steep valley slopes and are usually fed by subsurface flows emanating from snowmelt or aquifer discharge. Seeps grade to large, broad, concave, and nearly level, bog formations.

Narrow V-canyons are related to steep gradient locations and low order streams. Streams may be down cutting into geologic materials at headwater positions while lower positions may be graded into broad valley streams.

Broad valley streams are usually found in conjunction with meandering, low velocity streams with characteristic seasonal flooding regimes. Stream channel movement across broad valleys brings with it a corresponding increase in the diversity of landform types (alluvial bars, levees, low-lying riparian or wetland area, and riparian or wetland meadows). Ground water primarily results from stream recharge but sideslope contributions may be considerable during runoff periods.

Seasonally high water tables, varying from several days to yearlong submergence, are a major shared characteristic of riparian or wetland soils. Length of submergence can be inferred from the state of the iron ion (Fe^{+2} or Fe^{+3}) found in the soil. Iron in a reduced state (Fe^{+2}), such as in waterlogged soils, produces a gray-green soil coloration. This reduced matrix, a type of redox depletion (gleyed soil), reflects an extended period of soil saturation. A fluctuating water table is often characterized by reddish-brown freckles or mottles, which form under alternating reducing and oxidizing conditions. These redox concentrations reflect the presence of the oxidized form of iron (Fe^{+3}). A complete description of these characteristics of wet soils (Redoximorphic features) is given on pages 27-29 of *Keys To Soil Taxonomy* (Soil Survey Staff 1992).

Soil development in glaciated headwater positions are associated with the nearly anaerobic conditions in soils near saturation. Decomposition and mineralization of organic matter is slowed and organic matter accumulates at the surface. Surface horizons in these areas usually consist of slightly decomposed (fibric) organic matter mats. Gleyed horizons are commonly found under these thick organic mats, yet occasionally dark mineral soils are found.

V-canyon soil development is influenced by the combined actions of fluvial erosion and alluvial/colluvial deposition. In relatively low gradient settings, layering of sand and organic matter may occur. Underlying materials are usually a heterogeneous mixture of rounded rocks ranging in size from gravel to boulders. Steeper gradients have surfaces often covered by a litter layer. The surface mineral horizon is often darkened by incorporated organic matter. Subtending materials are usually angular rock fragments eroded from adjoining valley slopes. V-canyon sites are highly permeable, due to high coarse fragment contents, and as such can be among the driest of riparian or wetland sites.

Soil development in broad valley areas constitutes a wide range of soil types due to the large range of geomorphological variables acting upon the soil. Three categories of broad valley sediment materials are: 1) alluvial (fine-grained), 2) fluvial (soils composed of sand, silt, and clay), and 3) valley fill (rounded gravels and cobbles).

Within broad valley sites, four landform types may be recognized with their corresponding distinct soil developmental processes. The first one is alluvial bars. Alluvial bars can indicate both the beginning of soil development and the lower limit of site regeneration. Erosion and sedimentation plays a dominant role in stream bar formation and regression. Initially, an

alluvial bar develops from fragmented valley fill having no soil development. Sandy materials are deposited and vegetation begins to take hold and hinder further site erosion. Organic matter accumulates and during normal seasonal flood regimes, a series of organic matter layers overlain by sandy layers may develop.

Channel levees are generally higher than adjoining riparian or wetland landscape positions. Surface horizons usually possess organic matter deposited from the previous growing season and the surface mineral horizon shows some darkening from the integration of mineralized organic matter.

Low-lying wetlands include isolated ox-bows, beaver ponds, channels, and other backwater locations. Ground water levels are generally near the surface. Organic matter accumulation is the primary developmental element seen in the soil morphology of these sites. Accretion of organic matter with fluvial sediments or the successive burying of organic matter layers by flood borne materials is representative of low-lying wetlands. With continued sediment accumulation, low-lying wetlands may develop increasingly mesic characteristics.

Riparian or wetland meadows form as areas of material accretion from adjacent uplands or tributary drainages. Yet, these areas are seldom disturbed by fluvial processes and soil development is usually more advanced than in other riparian site types. Relatively thick, dark surface horizons with relatively high organic matter contents is common. Underlying horizons may show signs of clay accumulation or stronger soil structure, both indicative of increased soil development.

Lacustrine wetlands (lakes) are commonly situated in topographic depressions or dammed river channels. Soils are fine textured and commonly organic (Histosols), but consist of both mineral and organic materials. These (limnic) materials are deposited in water through the action of aquatic organisms (diatoms), or derived from underwater and floating aquatic plants subsequently modified by aquatic animals. Limnic materials are commonly layered including marl, coprogenous earth, and diatomaceous earth. Marl is light colored and soft unconsolidated calcium carbonate, often mixed with varying amounts of clay. Coprogenous earth is sedimentary peat. Colors are olive to olive brown and has a slightly plastic but not sticky consistency. Diatomaceous earth is more mineral than organic and is formed by the accumulation of diatom skeletons.

CHARACTERISTICS OF RIPARIAN AND WETLAND ECOSYSTEMS IN MONTANA

Riparian and wetland ecosystems within Montana are associated with lakes, ponds, reservoirs (e.g., standing bodies of water), rivers and streams (e.g., moving bodies of water), or seeps and springs. Further subdivisions of these major ecosystems have been defined and studied; potholes and fens are lake related ecosystems and floodplains and oxbows are river or stream related ecosystems. Applying names to riparian and wetland areas implies distinct boundaries between types. In many instances, they form a continuum. For example, a floodplain formed by a stream is distinct from a marsh on the edge of a lake. Yet, subtle gradations exist, as where a delta is formed by the stream flowing into a lake. The delta/marsh has characteristics of a floodplain, such as alluvial deposition, but is also influenced by the lake's body of standing water.

Lake Ecosystems

Lakes are bodies of standing water. Water enters lakes from rivers, streams, groundwater, seeps, snowmelt, and precipitation. Water is lost through evaporation, transpiration, seepage, and surface outflow. In Montana, landforms supporting lakes are typically formed by glaciation. The continental glaciation north of the Missouri River and in the valleys of northwest Montana left moraines, hanging valleys, outwash plains, and terminal and lateral moraines. Prairie potholes and Flathead Lake are examples of lakes formed in depressions of glaciated landforms. Lakes in unglaciated regions are less common.

Water depth, nutrients, pH, and salt concentration determine plant and animal species composition of lake communities. Recognizable and consistent vegetative zonation patterns are associated with different water depths. The vegetation, from deep to shallow water depth, typically changes from marsh (emergent vegetation), wet meadow (herbaceous wetland), carr (shrub dominated wetland), to forest. Not all vegetation zones are always expressed. The following are two of the major types of lake ecosystems occurring in Montana.

Potholes — Potholes are depressional wetlands caused by glaciation. They are common to northern portions of the Great Plains. The numerous depressions capture water. Precipitation and snowmelt are the major sources of input water, yet input from groundwater is significant at times. Additions from snowmelt occur during spring thaw with overland flow draining over frozen soils. Typically water is retained in the potholes due to low soil permeability caused by a clay layer. Evapotranspiration is the major cause of water loss, although seepage and surface outflow also account for a significant portion. Freshwater potholes are predominantly recharge wetlands (water moves from the pothole to the ground water), whereas saline potholes are mostly discharge wetlands (water moves from the ground water, with dissolved salts, to the pothole). Most potholes have characteristics of both recharge and discharge wetlands resulting in varying degrees of salinity.

Salinity, climate (water availability), and human disturbance are the main factors controlling species composition in potholes (Van der Valk 1989). Freshwater potholes are commonly dominated by common cattail (*Typha latifolia*) and hardstem bulrush (*Scirpus acutus*), whereas alkaline potholes will have more prairie cordgrass (*Spartina pectinata*) and red glasswort (*Salicornia rubra*). Wet-drought year climatic cycles have profound affects on the vegetation. In Montana, precipitation is cyclical causing a series of wet years and drought years, often in 10 to 20 year cycles. During drought years, there is a water drawdown. Seeds from numerous annuals and some perennials (common cattail [*Typha latifolia*] and hardstem bulrush [*Scirpus acutus*]) germinate and cover the exposed mudflats. When precipitation returns, the mudflats are flooded and the annuals drown, but the perennials survive, expand, and, in one or two years, dominate the sites. The drawdown to mudflats are necessary for emergent vegetation to reestablish. After a few years of stable water levels the emergent vegetation begins to decline, and the site eventually reverts to open water (Weller and Spatcher 1965; Van der Valk and Davis 1978). When precipitation decreases, resulting in a drawdown and exposing the mudflats, the water level-vegetation cycle continues. The primary human disturbances affecting potholes and marshes are drainage and grazing. One-half of all potholes have been drained in North America and have been converted to cropland or upland vegetation, eliminating the riparian and wetland vegetation. The majority of the remaining potholes are grazed, which alters the species composition to varying degrees.

Fens—Fens are wetlands with organic (histic, peat) soils, typically dominated by sedges, grasses, or reeds. Groundwater, the primary water source in a fen, is nutrient rich due to its contact with mineral soils. Waters may be acidic or alkaline. Water tables are at or close to the surface throughout most of the year. Fens are uncommon but widely distributed in western Montana, occurring on small- to mid-size lakes, or low gradient (1 percent) slopes with an elevated water table. They do not occur on the Northern Great Plains except at the base of mountain ranges, such as the Pine Butte fen on the Rocky Mountain front.

Water regimes and nutrients are the principal factors controlling plant community distribution in fens. Beaver and fire can also play major roles (Sims and others 1982). Most fens have standing water dominated by emergent vegetation, open peatland with sedges and short shrubs, or raised peat dominated by shrubs and trees. The water dominated sites have lower available nutrients due to anaerobic conditions. On some lakes, floating mats of peat form on the lake's edge and have the potential to gradually cover the lake. On other lakes peat accumulates on the bottom and over time fills in the lake. Some low gradient fens develop patterned ground: a micro-relief of vegetated ridges and water filled hollows. Beaver typically have a major impact on the development and maintenance of fens by building dams, creating pools, and consuming woody vegetation. Beavers often increase fens by damming peatland borders and increasing the area of water. In Montana, peat occurring above the water table is temporary, often caused by a sudden drop in water table, as when a beaver pond drains. In the dry climate the peat will decompose and subside, or fire will burn the raised peat and return the cycle to standing water. Peat buildup, patterned ground, and pool formation are recurrent aspects of peatland development rather than unidirectional successional events. Stable site conditions are the exception rather than the rule (McAllister 1990).

Floodplain Ecosystems

Floodplains typically appear as flat expanses of land bordering a stream or river. Floodplains develop by the accumulation of overbank alluvial depositions. Most are made up of a series of alluvial terraces at varying levels. Floodplains are the dominant riparian ecosystem in Montana. Water inputs are from overbank flow (flooding), soil water recharge from channel

seepage, and groundwater from adjacent uplands. Flooding supplies nutrients and sediments (clay and silt) to the floodplain. Moving water erodes the outside curves of banks and deposits fresh alluvial materials on the point bars of inside curves. During overbank flow new channels may be formed. Overbank flows also deposit alluvium immediately adjacent to stream channels, creating natural levees. With recurrent deposits these levees can build to contain higher flows.

The lateral movement of the river initiates a dynamic series of vegetation events. Vegetation colonizes and stabilizes each new deposit of alluvium. Consequently, each new alluvial bar supports a distinct band of even aged vegetation, typically willows (*Salix* spp.) and cottonwoods (*Populus* spp.). As seasons progress and flow decreases, groundwater levels also decrease and lower the amount of plant available water to vegetation on these deposits. The rate of meandering determines the proportion of floodplain communities in the pioneer (or early seral), mid-seral, late seral, or climax (PNC) stage of succession. Where the river meanders frequently, few stands progress to later successional stages. Near the outer edges of the floodplain, the effect of the river is less pronounced, allowing later successional stages to develop. If certain portions of the floodplain remain undisturbed for a long enough period of time, they may develop to a climax community (PNC).

Oxbows — Oxbows are meander loops of a stream or river that have been cut off from the main channel. The meander loop is commonly cut off at the neck during the time of flood. The ends of the cut-off meander are blocked by bank sediments, and the main channel is now the new straighter course. Floodwater and groundwater (from both channel seepage and from uplands) are the dominant water inputs. Sediments transported by floodwaters are deposited in these areas and slowly fill the depressions. Water chemistry, sedimentation, and water fluctuations are the major factors affecting vegetation. With the filling in of oxbows, the vegetation progresses over time from marsh through wet meadow to shrub- and then tree- dominated communities.

Seep and Spring Ecosystems

Seeps and springs are areas where groundwater is discharged onto the land surface. They are common throughout Montana and are found on nearly any terrain including mountains, hillsides, and the prairie. On floodplains of any size, seeps and springs are common on toe slopes or elevated terraces on the floodplain edge. These areas may receive no floodwaters yet have wetland site characteristics and support wetland communities. Seeps and springs are also common on mountain hillsides and in mountain valleys where moist meadows often have little or no running water. They are less common in the prairie portion of the state. The abrupt boundary between upland and riparian or wetland vegetation often makes these areas readily recognizable. Discharge rates can vary over time depending on groundwater supplies.

RIPARIAN AND WETLAND SOILS

Riparian or wetland areas are ecosystems that occupy the transition between the upland and purely aquatic ecosystems. Within an ecosystem, soils may have a strong influence on the vegetation expression between sites. These influences are often seen as differences in species composition, species coverage, or growth form. Yet, to distinguish between the upland and riparian or wetland ecosystems, the soil often acts as a subtle counterpart to the primary influence of water. In the most simplistic terms, riparian and wetland areas are those areas where water from uplands are concentrated. Most riparian or wetland authors agree that water regimes are the driving force in determining floral and faunal characteristics and nutrient and energy flows (Mitsch and Gosselink 1986). Most wetland scientists and managers interpret water regimes as the timing, duration, depth, and extent of flooding (Heitmeyer and others 1991). However, this can be misleading. Some riparian and wetland areas, either naturally or through disturbance never experience inundation by flood waters. Generally, soils may reflect more differences between communities within an ecosystem, yet between the riparian and wetland areas and the upland ecosystems, water availability is the most influential factor distinguishing the two.

Soil Forming Factors

Any process of soil formation is a complex of or sequence of events. These events include both complicated reactions and comparatively simple rearrangements of matter, that intimately affects the soil in which the soil operates. Numerous events may take place simultaneously or in sequence to mutually reinforce or contradict each other (Buol and others 1980). Soil formation is often characterized in terms of five factors. Soils are dynamic natural bodies having properties derived from the

combined effect of ***climate*** and ***biotic activities*** as modified by ***topography***, acting on ***parent materials*** over periods of ***time***. It is important to emphasize the interdependency of all five factors with soil development. The following discussions of these five soil forming factors have in part been expanded or modified from Brady (1984).

Parent material—Parent materials of riparian or wetland soils are predominantly transported sediments. The exceptions are those seeps, springs, and occasional bogs where residual soils could have developed. In most all other instances the soils of a riparian or wetland area have developed from the lateral or vertical accretion of sediments by alluvial, colluvial, glacial, lacustrine, or less commonly aeolian processes. The most common, the alluvial deposits, are often stratified by particle size. The size of particles of a deposit is a direct function of the velocity of the water at the time of deposition.

All other factors held constant, the mineralogical composition of the parent material determines the rate of weathering. Soil particle size (texture) is highly correlated to mineralogical composition. Sands are largely made up of the highly weather resistant mineral quartz. Whereas the vast majority of clay sized particles are dominated by secondary silicate minerals, the silicate clays. The unique electro-chemical properties and tremendous surface area of these clays serve to increase the concentration of plant available nutrients and potential rate of physical and chemical processes.

Climate—Climate is perhaps the most influential of all five soil forming factors. Climate regulates the amount of water a site receives through precipitation and evaporation. The moisture content of the soil influences the rate of the physical and chemical processes involved in soil development. Water affects soil in a number of ways.

Wet soils warm-up more slowly in spring and cool more slowly in autumn. Water adds weight to the soil and acts as a lubricant between soil particles making soils more susceptible to damage when wet. When soils are saturated the spaces between soil particles are filled with water instead of air. Since most life forms require air (oxygen) to live, saturated soils are commonly oxygen deficient, and the comparative number of life forms found in saturated soil is reduced. The most abundant life forms found in the soil are microorganisms, whose food source is largely dead plant and animal remains. In riparian and wetland areas a comparatively higher amount of plant material is produced than on adjacent upland areas. This commonly results in an accumulation of organic material at the mineral soil surface. These organic accumulations are called organic soils or in some technically specific instances, Histic epipedons (a requirement of the soil order Histosols). Other common characteristics of wet soils is the presence of redox depletions (gleyed soil) and redox concentrations (mottles). Redox depletions result from a state of total lack of oxygen in the soil. This state is also called a reduced condition. All soils in Montana contain some iron. Iron in a reduced state (ferrous iron or soluble iron, Fe^{+2}), appears blue or gray in color. These saturated blue or gray soils are often called gleyed soils and the reduction process in the soil is called gleization. Redox concentrations are often an indication of poorly drained soils. Redox concentrations are segregations of the remaining oxidized iron (ferric iron, Fe^{+3}), in the soil when all other iron is reduced or has been removed by leaching. They appear as red or brown soft speckles, hardened nodules, or may line the inside of pores in the soil. They vary in size, shape, and in color contrast to the dominant soil color. A complete description of these characteristics of wet soils (Redoximorphic features) is given on pages 27-29 of *Keys To Soil Taxonomy* (Soil Survey Staff 1992).

Biotic Activity—Organic matter accumulation and decomposition, nutrient cycling, development of soil structure, soil mixing and many other processes are all enhanced or diminished by both the flora and fauna living on or within the soil.

Contrasting the effects of vegetation between riparian or wetland soils to upland soils is generally obvious. The amount of organic matter, either in the surface horizon or accumulating at the soil surface is usually greater in riparian and wetland soils. Much of this organic matter is intimately mixed into the soil through biological activity that is readily more abundant than in the adjacent upland soils. This increase in organic matter gives the soil a darker color (a higher Munsell color value), greater fertility, and higher moisture holding capacity.

Human activities are also important. The cutting of trees, overgrazing, cultivation, irrigation, draining, road construction, and

other development also enhance or diminish soil-forming factors. Activities like cutting trees, over grazing, cultivation, and draining remove the natural vegetation and often results in dewatering the site. Irrigation obviously increases the amount of water a site receives directly. While road construction, or any construction that covers or seals the soil surface, will concentrate the amount of water a sites receives into a smaller total area.

Topography—The topography of the land can enhance or diminish the effects of climate on soil formation. The most common of these effects are higher precipitation rates and lower air temperatures at higher elevations. Yet, by definition riparian or wetland areas are locations on the landscape where water concentrates. Excess water in soils of headwater areas and V-shaped canyons is drained far more rapidly than in soils of flat alluvial terraces, broad-valley positions, glacial depressions, and lacustrine systems. Soils on steep gradients are more susceptible to natural erosion by over-land flow than flatter areas, possibly eliminating the occurrence of a deep soil. Landform gradient also tends to produce lateral soil water movement. This water may carry salts, oxides, suspended material, or solutes to landscape depressions. In arid environments, potential evaporation rates exceed precipitation, thereby removing the water and concentrating these salts and often producing saline or alkaline soils.

Time—The length of time parent materials are exposed to weathering is directly related to the degree of soil development. Riparian soils are commonly alluvium and are typically younger than adjacent upland soils, but can be of any age. At the time of deposition, alluvial parent materials may be stratified by size but there has been no soil development, nor horizon differentiation. The time required for the development of a soil horizon is uniquely related to all five soil forming factors.

RIPARIAN AND WETLAND SOILS OF MONTANA

The following is a brief description of the soil orders represented in Montana. In addition, a short list of those riparian or wetland communities associated with each are also presented. More comprehensive and technical descriptions of these soil orders can be found in *Soil Taxonomy* (Soil Survey Staff 1975) or *Keys To Soil Taxonomy* (Soil Survey Staff 1992).

ENTISOLS are a common soil order of riparian or wetland areas of Montana. Entisols are typically found adjacent to stream and river channels and subject to active fluvial processes such as flooding, scouring, and deposition. These young floodplains soils are usually composed of coarse to moderately fine textured sediments and lack developed soil horizons. Other Entisols are found in anaerobic (saturated; lacking oxygen) environments which also restrict soil-forming processes. These soils show little to no evidence of soil development.

Entisols are most commonly located on active floodplains adjacent to streams and rivers. Major riparian and wetland types often associated with Entisols include:

Populus deltoides, *P. angustifolia*, and *P. trichocarpa* (Cottonwood) community types.
Picea/Equisetum arvense (spruce/field horsetail) habitat type
Salix exigua (sandbar willow) community type
Carex rostrata (beaked sedge) habitat type
Poa pratensis (Kentucky bluegrass) community type

MOLLISOLS are the most common soil order associated with riparian or wetland communities in Montana. The presence of a Mollisol indicates relatively stable soil-forming conditions. Landscape positions supporting Mollisols include broad valley bottoms, alluvial terraces, and gentle slopes. These soils are characterized by distinctive horizonation including deep, dark, surface horizons and high base saturation (mollic epipedon).

The vegetation associated with these soils typically has a large herbaceous component and includes riparian and wetland types within the following groups:

Populus tremuloides (quaking aspen)
Potentilla fruticosa (shrubby cinquefoil)

Artemisia cana (silver sagebrush)
Carex rostrata (beaked sedge) (part)
Most grass-dominated types

HISTOSOLS are uncommon in Montana and include the Dougcliff and Winginaw Soil Series. Histosols are associated with areas that typically experience season-long or longer wet conditions. Histosols are organic soils composed primarily of vegetative debris in various stages of decomposition. They are found on wet, broad, valley bottoms, along springs and seeps, on gentle slopes, in former beaver ponds, oxbows and glacial depressions.

riparian and wetland communities commonly associated with Histosols include:
Salix candida/Carex rostrata (hoary willow/beaked sedge) habitat type
Salix wolfii/Carex aquatilis (Wolf's willow/water sedge) habitat type
Scirpus acutus (hardstem bulrush) habitat type
Most *Carex* (sedge)-dominated types

INCEPTISOLS are moderately common as hydric soils in Montana. These soils develop under cool, moist to wet conditions and have one or more pedogenic horizons. Some soil development has occurred, yet morphological characteristics are too weak to classify in another soil order.

The more common riparian and wetland types associated with these Inceptisols are:
Salix geyeriana/Carex rostrata (Geyer willow/beaked sedge) habitat type
Carex aquatilis (water sedge) habitat type
Poa palustris (fowl bluegrass) community type

ALFISOLS are uncommon as riparian soils in Montana and include the Shonkin, Nishon and Nishon Warm Soil Series. These soils are somewhat poorly drained to poorly drained and commonly develop from alluvium or glacial till. Many have clay subsoils and perched water tables. These soils are typically found on terraces in shallow or closed basins.

Agropyron smithii (western wheatgrass) is the most common riparian or wetland type often with smaller components of *Carex* species (sedges).

VERTISOLS that qualify as hydric soils in Montana are rare and include the Bowdoin Ponded and Pendroy Ponded Soil Series. These soils typically have a perched water table at or near the surface in spring through mid-summer. High clay contents (>50 percent) are common throughout the profile and commonly occupy terraces and old lake beds.

The *Agropyron smithii* (western wheatgrass) habitat type is most commonly associated with these soils. Within this type there is often a large component of perennial forbs.

ARIDISOLS are highly incidental among riparian areas in Montana and include the Hovert Soil Series. They are somewhat poorly drained and are formed in alluvium. They are typically found in swales and depressions. Surface soils are typically loam textured and shallow (7.5 cm/3 in). Subsoils are often clay textured to a depth of 150 cm (60 in).

Agropyron smithii (western wheatgrass) is the most common riparian or wetland type with small components of *Carex* species (sedges) and perennial forbs.

ANDISOLS are also highly incidental among riparian areas in Montana and includes the Doker Soil Series. They are restricted to the northwest corner of the state. Andisols that qualify as hydric soils are found on floodplains. These soils are very deep, formed in alluvium originating from volcanic ejecta. Soil texture is typically silt loam.

Agropyron smithii (western wheatgrass) is the most common riparian or wetland type with small components of *Carex* (sedges) and *Salix* (willows) species.

THE PROBLEM OF DEFINING WETLANDS IN THE WEST

Introduction

Cowardin and others in 1979 pointed out that no single definition for wetland has been universally accepted, primarily due to the nearly unlimited variation in hydrology, soil, and vegetative types. Today, we still lack a single acceptable definition. In general, wetlands form the transition between aquatic and terrestrial (upland) ecosystems. Windell and others (1986) indicate that in many instances, wetlands have been described in terms of what they are not. Wetlands should not be viewed as dry land, although they may not always be flooded or wet. Wetlands are part of a continuous landscape that grades from wet to dry. In many cases, it is difficult to determine precisely their boundary.

Wetland Definitions

The term wetland is a catch-all that includes units on the landscape such as marshes, swamps, bogs, fens, and lowlands covered with shallow and sometimes ephemeral or intermittent waters. The term wetland also includes wet meadows, potholes, sloughs, the riparian zone, and river-overflow areas. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the wetland definition. Permanent waters deeper than 2 m (6.6 ft) are not included (Windell and others 1986).

Defining wetlands has become difficult as greater economic stakes have increased the involvement of more politics and less science. A universally accepted wetland definition satisfactory to all users has not yet been developed because the definition depends on the objectives and the field of interest. However, scientists generally agree that wetlands are characterized by one or more of the following criteria: 1) ***wetland hydrology,*** the driving force creating all wetlands; 2) ***hydric soils;*** and 3) ***hydrophytic vegetation.*** The problem is how to define and identify these three criteria.

Defining the boundaries of wetlands, referred to as "delineation" in the United States, became important when society began to recognize wetland values (Mitsch and Gosselink 1993). In the nineteenth and twentieth century, when wetland draining was a common practice and excepted by society, a precise wetland definition was not important. Wetland draining continued unabated into the the late 1960's. When the first national and international laws and regulations pertaining to wetland protection were written, the need for precision increased as it became apparent that definitions affected land use options. The definition of a wetland, then, took on greater importance than the definition of almost any other landscape component.

Wetlands have been defined in a variety of ways in recent years. In general, several factors, including the personal perspective of the observer, position of the wetland in the landscape, biodiversity, and function contribute to the difficulty of precise definition. Despite the difficulty, several formal definitions were proposed. The earliest was intended for managers and scientists, particularly those concerned with waterfowl and wildlife (Shaw and Fredine 1956).

> The term wetlands . . . refers to lowlands covered with shallow and sometimes temporary or intermittent waters. They are referred to by such names as marshes, swamps, bogs, wet meadows, potholes, sloughs, and river overflow lands. Shallow lakes and ponds, usually with emergent vegetation as a conspicuous feature, are included in the definition, but the permanent water of streams, reservoirs, and deep lakes are not included. Neither are water areas that are so temporary as to have little or no effect on the development of moist-soil vegetation.

The definition of Shaw and Fredine (1956) established two parameters necessary for a habitat to be considered a wetland: 1) the presence of surface water, and 2) the development of moist-soil vegetation (Kent 1994). Twenty-three years later at a workshop of the Canadian National Wetlands Working Group, a definition evolved which recognized hydric soils as a third parameter, and which noted the functional attributes of wetlands (Tarnocai 1979). In addition, it expanded the previous

definition of wetlands to include not only those habitats with surface water, but also those having saturated soils.

> Wetland is defined as land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophilic vegetation, and various kinds of biological activity which are adapted to the wet environment.

That same year, the USDI Fish and Wildlife Service adopted a definition which also recognized wetland hydrology, hydric soils, and hydrophytic vegetation as defining parameters (Cowardin and others 1979). The USDI Fish and Wildlife Service definition is different from the Canadian definition in that a wetland does not have to exhibit characteristics of all three parameters.

> Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. . . . Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Riparian (Lotic) Wetlands vs. Still Water (Lentic) Wetlands

Currently, there is much confusion surrounding the use of wetland terminology. The following definitions represent a synthesis and refinement of wetland terminology from Shaw and Fredine (1956), Stewart and Kantrud (1971), Boldt and others (1978), Cowardin and others (1979), American Fisheries Society (1980), Johnson and Carothers (1980), Cooperrider and others (1986), Windell and others (1986), Environmental Laboratory (1987), Kovalchik (1987), Federal Interagency Committee for Wetland Delineation (1989), Mitsch and Gosselink (1993), and Kent (1994).

In the semiarid and arid interior West, there are two types of wetlands: riparian (lotic) and still water (lentic) wetlands. ***Riparian wetlands (lotic wetlands)*** are wetlands associated with ***lotic,*** or running water systems found along rivers, streams, and drainageways. Such wetlands contain a defined channel and floodplain. The channel is an open conduit which periodically, or continuously, carries flowing water, dissolved and suspended material. Beaver ponds, seeps, springs, and wet meadows on the floodplain of, or associated with, a river or stream are part of the riparian wetland.

Still water wetlands (lentic wetlands) are wetlands associated with ***lentic,*** or still water systems. These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (e.g., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

Functional vs. Jurisdictional Wetland Criteria

Wetlands have many distinguishing features including the presence of water, hydric soils, and vegetation adapted to, or tolerant of, saturated soils. Wetland functions include (US Army Corps of Engineers 1992): 1) providing habitat, breeding grounds and food for waterfowl and other wildlife; 2) improving water quality by filtering excess nutrients, breaking down chemical and organic wastes, and by trapping sediments; 3) absorbing peak flows during flood events; and 4) recharging the water slowly into underground aquifers. Wetlands also support plant communities requiring additional moisture above that provided by the climate of the region, but which is collected by land form depressions. However, wetlands are not easily identified and delineated for jurisdictional purposes. This is because wetlands have a wide range of hydrologic conditions, are found along a moisture gradient between well-defined uplands and deepwater systems, and vary greatly in size, location, and human influence.

In general, wetlands can be grouped in two categories: ***functional wetlands*** and ***jurisdictional wetlands. Functional wetlands*** are wetlands that meet the definition outlined by Cowardin and others (1979). ***Jurisdictional wetland*** are those wetlands defined for purposes of Section 404 of the Clean Water Act and the Swampbuster Provision of the Food Security Act.

> The US Army Corps of Engineer (Federal Register 1982) and the Environmental Protection Agency (Federal Register 1980) jointly define wetlands for purposes of Section 404 of the Clean Water Act as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

The USDI Fish and Wildlife Service ***functional wetland*** definition (Cowardin and others 1979) is still one of the most widely accepted by wetland scientists in the United States today (Mitsch and Gosselink 1993). This definition, designed for scientists as well as land managers, is broad, flexible, and comprehensive as well as describing vegetation, hydrology, and soils. The main utility lies in identifying, classifying, and mapping of wetlands and other special aquatic and deepwater habitats. However, this definition has generally been difficult to apply to the regulation of wetland dredging or filling. In these cases, the US Army Corps of Engineer's and Environmental Protection Agency's ***jurisdictional wetland*** definition is used.

Due to the differences in definition, ***functional wetlands*** may not meet the criteria for determining ***jurisdictional wetlands. Functional wetlands*** need to meet only one of the three criteria, while ***jurisdictional wetlands*** need to meet all three criteria, except in limited situations. Even though ***functional wetlands*** may not meet ***jurisdictional wetland*** requirements, they certainly perform wetland functions resulting from the greater amount of water that accumulates on or near the soil surface relative to the adjacent uplands. Examples include some woody draws occupied by the *Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry) habitat type and some floodplain sites occupied by the *Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) habitat type or the *Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) habitat type. Currently, many of these sites fail to meet ***jurisdictional wetland*** criteria. Nevertheless, these functional wetlands provide important wetland functions vital to wetland dependent species, and may warrant special managerial consideration. In the West, not all ***functional wetlands*** are ***jurisdictional wetlands,*** but typically ***jurisdictional wetlands*** are ***functional wetlands.***

There is an ongoing debate in the United States regarding the criteria used to delineate ***jurisdictional wetlands.*** In early 1991, modifications were proposed to the 1989 Manual entitled the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1989). The modifications were in response to Congressional lobbying that wanted the jurisdictional wetland definitions relaxed in order to lessen the regulatory burden. A new manual was published for public comment in August 1991, but was quickly and heavily criticized for its lack of scientific credibility and unworkability, and was eventually abandoned in 1992. If the proposed changes had been enacted, many scientists felt the Western United States would lose over 50 percent of the jurisdictional wetlands. The draining since colonial times of more than 50 percent of the 215 million acres of riparian and wetland areas in this country is well documented (Feierabend and Zelazny 1987). Currently, the National Academy of Sciences was directed by Congress to review the jurisdictional wetland criteria. During this time, the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1989) has been withdrawn for use by federal agencies. Most federal agencies re-instituted the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987) pending recommended changes from this review. Although jurisdictional wetland determination and delineation will remain important tools for wetland managers, the exact rules for using these tools is expected to remain uncertain for many years to come (Mitsch and Gosselink 1993).

Appendix 10 represents the first approximation of the habitat types and community types in Montana meeting the jurisdictional wetland criteria of the 1987 *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987).

1987 Corps of Engineers Wetlands Delineation Manual Criteria

Hydrophytic vegetation is defined as macrophytic plant life growing in water, soil or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content. The USDI Fish and Wildlife Service in cooperation

with the US Army Corps of Engineers, the Environmental Protection Agency, and the USDA Soil Conservation Service has published the *National List Of Plant Species That Occur In Wetlands* from a review of the scientific literature and review by wetland experts and botanists (Reed 1988a, Reed 1988b). The two regions that cover Montana are Region 4 (North Plains Region) and Region 9 (Northwest Region). Plants are separated into four basic groups, commonly called wetland indicator status, based on a plant species frequency of occurrence in wetlands: 1) ***obligate wetland plants (OBL)*** that occur almost always (estimated probability >99 percent) in wetlands under natural conditions, 2) ***facultative wetland plants (FACW)*** that usually occur in wetlands (estimated probability 67-99 percent), but occasionally are found in nonwetlands, 3) ***facultative plants (FAC)*** that are equally likely to occur in wetlands or nonwetlands (estimated probability 34-66 percent), and (4) ***facultative upland plants (FACU)*** that usually occur in nonwetlands (estimated probability 67-99 percent), but occasionally are found in wetlands (estimated probability 1-33 percent). If a species occurs almost always (estimated probability >99 percent) in nonwetlands under natural conditions, it is considered an ***obligate upland plant (UPL).***

Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. These soils commonly develop under conditions sufficiently wet to support the growth and regeneration of hydrophytic vegetation. The National Technical Committee for Hydric Soils developed the criteria given below for hydric soils. The criteria are selected soil properties that are documented in *Soil Taxonomy* (Soil Survey Staff, 1975) and *Keys To Soil Taxonomy* (Soil Survey Staff, 1992). A general list of hydric soils was created by the Soil Conservation Service (SCS) using this criteria and is updated annually each October. State lists of hydric soils (series and subgroup) are available from the SCS State Conservationist in each state. The SCS also maintains lists of map units (Soil Survey) that contain or may in some delineations contain hydric soils for each conservation district in the United States. These lists are recommended by the SCS for use in making jurisdictional wetland determinations (USDA Soil Conservation Service 1990). Caution must be exercised in using the soil survey list for determining the presence of hydric soil at specific sites because upland (nonwetland) soil map units may have inclusions of hydric soil that were not delineated on the map; and conversely. In addition, some map units (alluvial areas, swamp, muck and peat) may be hydric soil areas, but are not on the hydric soils lists because they were not given a series name at the time of mapping. In most cases a field inspection of the site is required for hydric soil determinations.

The following criteria (USDA Soil Conservation Service 1990) reflect those soils that meet the definition of hydric soil. Again, it should be noted that these criteria are currently being re-evaluated with emphasis on the need for regional delineation.

1. All Histosols except Folists, or
2. Soils in Aquic suborders, Aquic subgroups, Albolls suborder, Salorthids great group, or Pell great groups of Vertisols, Pachic subgroups, or Cumulic subgroups that are:
    a. Somewhat poorly drained and have a frequently occurring water table less than 15 cm (0.5 ft) from the surface for a significant period (usually more than 2 weeks) during the growing season, or
    b. Poorly drained or very poorly drained and have either:
        1. A frequently occurring water table at less than 15 cm (0.5 ft) from the surface for a significant period (usually more than 2 weeks) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 50 cm (20 in), or for other soils
        2. A frequently occurring water table at less than 30 cm (1 ft) from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is equal to or greater than 15 cm/hr (6.0 in/hr) in all layers within 50 cm (20 in), or
        3. A frequently occurring water table at less than 46 cm (1.5 ft) from the surface for a significant period (usually more than 2 weeks) during the growing season if permeability is less than 15 cm/hr (6.0 in/hr) in any layer within 50 cm (20 in), or
3. Soils that are ponded for a long duration or a very long duration during the growing season, or
4. Soils that are frequently flooded for a long duration or a very long duration during the growing season.

Hydric Soils of Montana—The following is provided as an aid to understanding some soil classification terms used on the Hydric Soils of Montana list. Hydric soils are listed by both series name and associated soil classification to the subgroup level. Series names are usually given with reference to local geographical features (e.g., Bear Lake). Whereas the names of soil classification units are made up of successive formative elements much like syllables. These formative elements are commonly derived from Latin or Greek. Each conveys a concept of soil character or genesis, thus the name automatically describes the general kind of soil being classified. The formative elements also relate to the different categorical levels in the classification system. This may be illustrated as follows:

Mollisol	order
Aquoll	suborder
Calciaquoll	great group
Typic Calciaquoll	subgroup

Note that given the subgroup name (Typic Calciaquoll), the great group, suborder, and order to which the soil belongs can be identified by the formative elements (in bold type) that make it up (Brady 1984).

Table 1 is a list of the soil orders that are found on the Hydric Soils of Montana list (USDA SCS 1990). A brief description of each is given, and some explanation of their formative elements.

Table 1. Soil orders and formative elements of Hydric Soils of Montana

Order	Formative Element	Derivation	Description
Alfisols	alf	Pedalfer. (Al-Fe) Soil	Mineral soils with argillic horizon (clay accumulation); less organic matter, lower base saturation, and lighter colored than Mollisols.
Andisols	and	Jap.–*ando* (black)	Dark mineral soils developed in volcanic ash, pumice, cinders, other volcanic ejecta and volcaniclastic materials.
Ar**id**isols	id	L.–*aridus*. (dry)	Mineral soils in areas of low rainfall and high evaporation rates); usually dry with limited plant available water.
Entisols	ent	Recent Soil.	Very young mineral soils; very weak or no horizon development; no deep, wide cracks in most years.
Histosols	ist	Gr.–*histos*. (tissue)	Organic soils containing greater than 30 percent organic matter to a depth of 40 cm (16 in).
Inc**ept**isols	ept	L.–*inceptum*	Mineral soils; some horizon

		(beginning)	development with some weatherable minerals; no accumulation of clays; low organic matter content; more developed than Entisols.
Mollisols	oll	L.–*mollis*. (soft)	Mineral soils; thick, dark surface horizon, high organic matter content; high base saturation.
Vertisols	ert	L.–*verto* (turn or invert)	Mineral soils with a high content of swelling clays; deep, wide cracks develop each year during dry periods.

Table 2 lists and provides some explanation of the formative elements of hydric soils of Montana, based upon (Soil Survey Staff 1992) (Brady 1984) (Buol and others 1980) (Foth and Schaffer 1980) (Soil Survey Staff 1975). Some formative elements may be used at several categorical levels in the classification; they are listed and described only once for brevity. As knowledge of Montana's soils increases, the Hydric Soils list will be updated. Currently there are counties in Montana that do not have published Soil Surveys.

Table 2. Formative elements of hydric soils of Montana

Formative Element	Derivation	Connotation
		Suborder
alb	L.–*albus*, white	Presence of albic horizon (a leached clean horizon)
aqu	L.–*aqua*, water	Characteristics associated with wetness
arg	L.–*argilla*, clay	Presence of argillic horizon (an accumulation of clay)
fibr	L.–*fibra*, fiber	Slightly decomposed plant litter
ust	L.–*ustus*, burnt	Of dry climates; hot in summer
		Great Group
bor	Gr.–*boreas*, northern	Cool
calc	L.–*calcis*, lime	Calcic horizon (an accumulation of calcium carbonate)
chrom	Gr.–*chroma*, color	High chroma (strong or vivid color)
cry	Gr.–*Kryos*, cold	Cold
fluv	L.–*fluvus*, river	Flood plain
hapl	Gr.–*haplous*, simple	Meets minimum requirements
natr	Mod.–natrium, sodium	Natric horizon (an accumulation of soluble salts)
		Subgroup
aeric	Gr.–*aerios*, air	Aeration
cumulic	L.–*cumulus*, heap	Thick top soil
entic	Mod.–recent	Recent or young soil with little development
mollic	L.–*mollis*, soft	Having characteristics of a Mollisol
orth	Gr.–*orthos*, true	Common

terric	L.–*terra*, earth	Mineral subsoil (usually noted in Histosols)
typic	Mod.–typical	Typical, nothing unusual
ud	L.–*udus*, humid	Humid climate; commonly moist
vertic	L.–*verto*, turn or invert	Having characteristics of a Vertisol; swelling clays

Wetland hydrology is the third criterion for wetland delineation. Permanent or periodic inundation, or soil saturation to the surface, at least seasonally, are the driving forces behind wetland formation. The presence of water for a week or more during the growing season typically creates anaerobic conditions in the soil, which affect the types of plants that can grow and the types of soils that develop. Numerous factors influence the wetness of an area, including precipitation, geologic substrate (a restricting layer such as rock or clay that causes a perched water table), topography, soil permeability, and plant cover. All wetlands usually have at least a seasonal abundance of water. This water may come from direct precipitation, overbank flooding, surface water runoff due to precipitation or snow melt, and ground water. The frequency and duration of inundation and soil saturation vary widely from permanent flooding or saturation to irregular flooding or saturation. Many wetlands are found along rivers and lakes where flooding is likely to occur, while other wetlands form in isolated depressions surrounded by upland where surface water collects. Still others develop on slopes of varying steepness, in surface water drainageways or where ground water discharges to the land surface in springs or seepage areas.

Of the three technical criteria for wetland identification, wetland hydrology is often the most difficult to quantify in the field, due largely to annual, seasonal, and daily fluctuations.

An area has wetland hydrology when saturated to the surface or inundated at some point in time during an average rainfall year, as defined below:

1. Saturation to the surface normally occurs when soils in the following natural drainage classes meet the following conditions:
   a. In somewhat poorly drained mineral soils, the water table is less than 15 cm (0.5 ft) from the surface for usually one week or more during the growing season, or
   b. In low permeability (<15 cm/hr [6 in]), poorly drained or very poorly drained mineral soils, the water table is less than 46 cm (1.5 ft) from the surface for usually one week or more during the growing season, or
   c. In more permeable (≥ 15 cm/hr [6 in]), poorly drained or very poorly drained mineral soils, the water table is less than 30 cm (1 ft) from the surface for usually one week or more during the grow season, or
   d. In poorly drained or very poorly drained organic soils, the water table is usually at a depth where saturation to the surface occurs more than rarely. (Note: organic soils that are cropped are often drained, yet the water table is closely managed to minimize oxidation of organic matter. These soils often retain their hydric characteristics and if so, meet the wetland hydrology criterion.)
2. An area is inundated at some time if ponded or frequently flooded with surface water for one week or more during the growing season.

CAUTION: An area saturated for a week during the growing season, especially early in the growing season, is not necessarily a wetland. However, in the vast majority of cases, an area that meets the National Technical Committee for Hydric Soils criteria for hydric soil is a wetland.

The frequency and duration of inundation or soil saturation are important in separating wetlands from nonwetlands. Duration usually is considered the most important factor. Areas of lower elevation in a floodplain or marsh have longer duration of inundation and saturation and often most frequent periods of these conditions than most areas at high levels. Floodplain configuration may significantly affect the duration of inundation by increasing runoff or by causing poor drainage. Soil permeability related to the texture of the soil also influences the duration of inundation or soil saturation. Water moves more slowly through clayey soils than sandy or loamy soils and therefore have lower permeability and remain saturated much longer. Amount and kind of plant cover affects both the degree of inundation and duration of saturated soil conditions. Excess water drains more slowly in areas of abundant plant cover, thereby increasing duration of inundation or soil saturation. On the other hand, transpiration rates are higher in areas of abundant plant cover, which may reduce the duration of soil saturation.

KEY TO RIPARIAN AND WETLAND SITES OF THE NORTHERN GREAT PLAINS OF MONTANA

PREFACE

1. The northern Great Plains comprise approximately two thirds of the state (see Appendix 1). The geographic boundaries for this key are the state boundaries on the southern, eastern, and northern edges of the region, and the foothills of the Rocky Mountains comprise the western edge. In the western half of the northern Great Plains, scattered outlier mountains include: Crazy, Little Belt, Big Belt, Little Rocky, Judith, Highwood, Moccasin, Bull, Snowy, and Bear Paw Mountains. Because the flora and soils are similar to those of the Rocky Mountains, these outlier mountains are not included in the northern Great Plains key; they are included in the Rocky Mountains, foothills, and intermountain valleys key.

2. In general, the key is designed to classify the wettest sites first, with the driest extremes of the riparian and wetland zone classified last (the key goes from wet to dry).

3. The key will identify the site potential; if that is not possible due to disturbance, both natural (recently deposited alluvial bars) and/or human-caused (livestock, logging), the key will then "drop" you into a community type. (Reminder: This publication describes several major seral plant communities (community types) that are stable for time frames relevant to land management decisions.) The possible potential(s) for the site can be projected by reading the discussion in the Potential Natural Community section of each community type.

4. Most of the conifer stands sampled were successionally late seral to climax, while all other types (deciduous trees, willows, non-willow shrubs, sedges, and herbaceous non-sedges) were sampled from early seral to climax.

INSTRUCTIONS

1. Accurately identify and record the canopy cover for all indicator species. The indicator species are those species used in the key.

2. The plot being classified must be representative of the stand as a whole. If not, take another plot (environmental and/or vegetation homogeneity (uniformity) is a primary consideration in plot selection).

3. Identify the potential lifeform using the ***Lifeform Group Key***. Generally a tree species is considered successfully reproducing if 10 or more individuals per acre (25/ha) occupy or will occupy the site.

4. Within the correct lifeform group, key to the ***Habitat Type or Community Type*** by following the key literally. ***All*** conditions stipulated for each couplet must be satisfied in order to make the correct choice. The first set of conditions satisfied by site characteristics should generally supply the correct classification.

5. Determine the correct ***Phase*** (if appropriate) by matching stand characteristics with phase descriptions for the habitat type. The first phase description that matches the stand is the correct one.

Knowledge of a specific phase may be very important in the development of management prescriptions.

6. In sites where the vegetation is obviously depauperate (unusually sparse) because of heavy grazing or browsing pressure, dense shading, or duff accumulations, adjust the key downward to reflect the reduced canopy cover (for example, a canopy cover with at least 5 percent would then refer to a canopy cover with at least 1 percent). Extrapolation from the nearest non-depauperate condition occurring on a comparable site will assist in the correct determination of the type.

   In addition, when classifying a site, be aware of and avoid ***microsites.*** ***Microsites*** are small areas that are atypical for the stand as a whole. Examples include windthrow pockets filled with colluvium/alluvium or raised hummocks of willows growing on either active or abandon beaver dams comprised of woody materials.

7. In sites that are heavily impacted by grazing or browsing pressures, see if there are ***ANY*** shrub or tree growth or remnants (stumps). In extreme situations, the potential natural community (such as a willow habitat type) may be present only in the form of dwarf-looking, widely scattered individuals. If this is the case, again adjust the key downward to reflect the reduced canopy cover. Once again, extrapolation from the nearest non-grazed or non-browsed condition occurring on a comparable site will assist in the correct determination of the type.

8. Habitat type or community type can be projected for a site in an early seral stage by examining the closest site(s) having the same site conditions (soils, hydrologic characteristics, position on the landscape, etc.).

9. ***Caution!*** The potential of a site may change if there is a dramatic change in the soil and/or water characteristics of the site.

10. ***Warning! The key is not the classification! Validate your determination by comparing the site characteristics with the written description of the type.***

KEY TO LIFEFORM GROUPS

1. Coniferous trees present *AND* successfully reproducing (10 or more trees per acre) *AND* not restricted to microsites. . . . . **Coniferous Tree Communities (p. 00)**

1. Coniferous trees absent *OR* if present, restricted to microsites *AND* not successfully reproducing. . . . **2**

   2. *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) present *AND* successfully reproducing (10 or more trees per acre) *AND* not restricted to microsites. . . . . **Deciduous Tree Communities (p. 00)**

2. *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) absent ***OR*** if present, restricted to microsites ***AND*** not successfully reproducing. 3

3. Deciduous tree species other than *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) present with a combined canopy cover of at least 25 percent. . . . . **Deciduous Tree Communities (p. 00)**

3. Deciduous trees with a combined canopy cover of less than 25 percent. 4

4. Shrubs present with a combined canopy cover of at least 10 percent. . . **Shrub Communities (p. 00)**

4. Shrubs with a combined canopy cover of less than 10 percent; herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent cover. . . . . **Herbaceous Communities (p. 00)**

KEY TO THE CONIFER TREE COMMUNITIES

Coniferous trees present ***AND*** successfully reproducing (10 or more trees per acre) ***AND*** not restricted to microsites.

1. *Pseudotsuga menziesii* (Douglas fir) present and reproducing successfully. 2

1. *Pseudotsuga menziesii* (Douglas fir) absent or not reproducing successfully. 3

2. Cottonwoods with at least 5 percent canopy cover ***OR*** *Cornus stolonifera* (red-osier dogwood), willows, *Equisetum arvense* (field horsetails), or *Actaea rubra* (baneberry), individually or in combination, with at least 1 percent canopy cover. . . . . ***Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) Habitat Type (p. 00)**

2. Cottonwoods with less than 5 percent canopy cover ***AND*** *Cornus stolonifera* (red-osier dogwood), willows, *Equisetum arvense* (field horsetails), or *Actaea rubra* (baneberry), individually or in combination, with less than 1 percent canopy cover. 8

3. *Pinus ponderosa* (ponderosa pine) present and reproducing successfully. 4

3. *Pinus ponderosa* (ponderosa pine) absent, or if present, not reproducing successfully. 6

4. Cottonwoods with at least 5 percent canopy cover ***OR*** *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover; *Fraxinus pennsylvanica* (green ash) may be present. . . . . .

. . ***Pinus ponderosa/Cornus stolonifera*** **(ponderosa pine/red-osier dogwood) Habitat Type (p. 00)**

4. Cottonwood with less than 5 percent canopy cover *AND Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; *Fraxinus pennsylvanica* (green ash) may be present. 5

5. *Prunus virginiana* (common chokecherry) or *Amelanchier alnifolia* (western serviceberry) with at least 5 percent canopy cover *AND* east of the Continental Divide; *Fraxinus pennsylvanica* (green ash) may be present. . . . . .
. . . ***Pinus ponderosa/Prunus virginiana*** **(ponderosa pine/common chokecherry) Habitat Type (p. 00)**

5. *Prunus virginiana* (common chokecherry) or *Amelanchier alnifolia* (western serviceberry) with less than 5 percent canopy cover ***OR*** west of the Continental Divide; *Fraxinus pennsylvanica* (green ash) absent. . . 8

6. *Juniperus scopulorum* (Rocky Mountain juniper) present and reproducing successfully. *Populus tremuloides* (quaking aspen) and *Fraxinus pennsylvanica* (green ash) absent, or if present, not reproducing successfully. 7

6. *Populus tremuloides* (quaking aspen) or *Fraxinus pennsylvanica* (green ash) present and reproducing successfully. . . . . **GO TO THE DECIDUOUS KEY (p. 00)**

7. Cottonwoods with at least 5 percent canopy cover ***OR*** *Cornus stolonifera* (red-osier dogwood), *Poa pratensis* (Kentucky bluegrass) or *Agrostis stolonifera* (redtop), individually or in combination, with at least 1 percent canopy cover. . . . . .
. . . . . ***Juniperus scopulorum/Cornus stolonifera*** **(Rocky Mountain juniper/red-osier dogwood) Habitat Type (p. 00)**

7. Cottonwoods with less than 5 percent canopy cover *AND Cornus stolonifera* (red-osier dogwood), *Poa pratensis* (Kentucky bluegrass), and *Agrostis stolonifera* (redtop), individually or in combination, with less than 1 percent canopy cover. 8

8. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

8. Not a riparian or wetland site; refer to Pfister and others 1977.

KEY TO DECIDUOUS TREE COMMUNITIES

Fraxinus pennsylvanica (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) present *AND* successfully reproducing (10 or more trees per acre) *AND* not

restricted to microsites ***OR*** deciduous tree species other than *Fraxinus pennsylvanica* (green ash), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) with a combined canopy cover of at least 25 percent.

1. *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) with at least 5 percent canopy cover. 2

1. *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), *Acer negundo* (box-elder), or *Populus tremuloides* (quaking aspen) with less than 5 percent canopy cover. 7

    2. *Fraxinus pennsylvanica* (green ash) or *Ulmus americana* (American elm) with at least 5 percent canopy cover. . . . . ***Fraxinus pennsylvanica/Prunus virginiana*** **(green ash/common chokecherry) Habitat Type (p. 00)**

    2. *Fraxinus pennsylvanica* (green ash) or *Ulmus americana* (American elm) with less than 5 percent canopy cover. 3

3. *Acer negundo* (box-elder) with at least 5 percent canopy cover. . . . . ***Acer negundo/Prunus virginiana*** **(box-elder/common chokecherry) Habitat Type (p. 00)**

3. *Acer negundo* (box-elder) with less than 5 percent canopy cover; *Populus tremuloides* (quaking aspen) with at least 5 percent canopy cover. 4

    4. *Berberis repens* (creeping Oregongrape) with at least 25 percent canopy cover; restricted to southeast Montana. . . . . ***Populus tremuloides/Berberis repens*** **(quaking aspen/creeping Oregongrape) Habitat Type (p. 00)**

    4. *Berberis repens* (creeping Oregongrape) with less than 25 percent canopy cover. 5

5. Willows, *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), *Alnus incana* (mountain alder), or *Cornus stolonifera* (red-osier dogwood), individually or in combination, with at least 5 percent canopy cover. . . . . ***Populus tremuloides/Cornus stolonifera*** **(quaking aspen/red-osier dogwood) Habitat Type (p. 00)**

5. Willows, *Amelanchier alnifolia* (western serviceberry), *Prunus virginiana* (common chokecherry), or *Cornus stolonifera* (red-osier dogwood), individually or in combination, with less than 5 percent canopy cover. . 6

    6. Site ***WITH*** at least ***TWO*** of the following species present: *Osmorhiza occidentalis* (western sweet-cicely), *Viola canadensis* (Canada violet), *Heracleum lanatum* (cow-parsnip), *Actaea rubra* (baneberry), or *Galium triflorum* (sweetscented bedstraw). . . . . ***Populus tremuloides/Osmorhiza occidentalis*** **(quaking aspen/western sweet-cicely) Habitat Type (p. 00)**

    6. Site ***WITHOUT*** at least ***TWO*** of the following species present: *Osmorhiza occidentalis* (western sweet-cicely),*Viola canadensis* (Canada violet), *Heracleum lanatum* (cow-parsnip), *Actaea rubra* (baneberry), or *Galium triflorum* (sweetscented bedstraw); *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), or *Agrostis stolonifera* (redtop), individually or in combination, with at least 5

percent canopy cover. . . . . ***Populus tremuloides/Poa pratensis* (quaking aspen/Kentucky bluegrass) Community Type (p. 00)**

7. *Populus trichocarpa* (black cottonwood), *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood) with a greater canopy cover than other individual tree species. 8

7. Other individual tree species with a greater canopy cover than *Populus trichocarpa* (black cottonwood), *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood). 19

8. *Populus trichocarpa* (black cottonwood) with a greater canopy cover than either *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood). 9

8. *Populus angustifolia* (narrowleaf cottonwood) or *P. deltoides* (Great Plains cottonwood) with a greater canopy cover than *P. trichocarpa* (black cottonwood). 12

9. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus trichocarpa* (black cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . ***Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/recent alluvial bar) Community Type (p. 00)**

9. Pole or mature age classes (dbh > 5.0 inches) of *Populus trichocarpa* (black cottonwood) dominate the site. 10

10. Shrub species with at least 25 percent canopy cover. 11

10. Shrub species with less than 25 percent canopy cover. . . . . ***Populus trichocarpa*/Herbaceous (black cottonwood/herbaceous) Community Type (p. 00)**

11. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . ***Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) Community Type (p. 00)**

11. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . ***Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) Community Type (p. 00)**

12. *Populus angustifolia* (narrowleaf cottonwood) with a greater canopy cover than *P. deltoides* (Great Plains cottonwood). 13

12. *Populus deltoides* (Great Plains cottonwood) with a greater canopy cover than *P. angustifolia* (narrowleaf cottonwood). 16

13. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus angustifolia* (narrowleaf cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . ***Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/recent alluvial bar) Community Type (p. 00)**

13. Pole or mature age classes (dbh > 5.0 inches) of *Populus angustifolia* (narrowleaf cottonwood) dominate the site. **14**

14. Shrub species with at least 25 percent canopy cover. **15**

14. Shrub species with less than 25 percent canopy cover. . . . . ***Populus angustifolia*/Herbaceous (narrowleaf cottonwood/herbaceous) Community Type (p. 00)**

15. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . ***Populus angustifolia/Cornus stolonifera*(narrowleaf cottonwood/red-osier dogwood) Community Type (p. 00)**

15. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . ***Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry) Community Type (p. 00)**

16. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus deltoides* (Great Plains cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . ***Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/recent alluvial bar) Community Type (p. 00)**

16. Pole or mature age classes (dbh > 5.0 inches) of *Populus deltoides* (Great Plains cottonwood) dominate the site. **17**

17. Shrub species with at least 25 percent canopy cover. **18**

17. Shrub species with less than 25 percent canopy cover. . . . . ***Populus deltoides*/Herbaceous (Great Plains cottonwood/herbaceous) Community Type (p. 00)**

18. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . ***Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood) Community Type (p. 00)**

18. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . ***Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry)**

. . . . . **Community Type (p. 00)**

19. *Salix amygdaloides* (peach-leaf willow) or *Elaeagnus angustifolia* (Russian olive) with a greater canopy cover than other individual tree species. **20**

19. Other individual tree species with a greater canopy cover than *Salix amygdaloides* (peach-leaf willow) or *Elaeagnus angustifolia* (Russian olive). **21**

20. *Salix amygdaloides* (peach-leaf willow) with a greater canopy cover than *Elaeagnus angustifolia* (Russian olive). . . . . ***Salix amygdaloides* (peach-leaf willow) Community Type (p. 00)**

20. *Elaeagnus angustifolia* (Russian olive) with a greater canopy cover than *Salix amygdaloides* (peach-leaf willow). . . . . ***Elaeagnus angustifolia* (Russian olive) Community Type (p. 00)**

21. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

21. Not a riparian or wetland site; refer to the following for possible fit: Hansen and others 1985, Hansen and Hoffman 1988, Mueggler 1988, Mackie 1970.

KEY TO SHRUB COMMUNITIES

Shrubs present with a combined canopy cover of at least 10 percent.

1. Willows with at least 10 percent canopy cover. . . . . **Willow Key**

1. Willows)with less than 10 percent canopy cover. . . . . **Non-Willow Key (p. 00)**

WILLOW KEY

1. *Salix lutea* (yellow willow) with at least 10 percent canopy cover. **2**

1. *Salix lutea* (yellow willow) with less than 10 percent canopy cover. **4**

2. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 10 percent canopy cover. . . . . .

. . . . . ***Salix lutea/Carex rostrata* (yellow willow/beaked sedge) Habitat Type (p. 00)**

2. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 10 percent canopy cover. 3

3. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Salix lutea/Calamagrostis canadensis* (yellow willow/bluejoint reedgrass) Habitat Type (p. 00)**

3. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with less than 5 percent canopy cover. . . . . ***Salix lutea* (yellow willow) Community Type (p. 00)**

4. ***Individual non-willow species*** with a greater canopy cover than any ***individual willow species.*** . . . . . **GO TO THE NON-WILLOW KEY (p. 00)**

4. ***Individual willow species*** with a greater canopy cover than any ***individual non-willow species.*** . . . 5

5. *Salix bebbiana* (Bebb willow) with a greater canopy cover than any other individual willow species. . . . . ***Salix bebbiana* (Bebb willow) Community Type (p. 00)**

5. Other individual willow species with a greater canopy cover than *Salix bebbiana* (Bebb willow). 6

6. *Salix exigua* (sandbar willow) with a greater canopy cover than any other individual willow species. . . . . ***Salix exigua* (sandbar willow) Community Type (p. 00)**

6. Other individual willow species with a greater canopy cover than *Salix exigua* (sandbar willow). . . . 7

7. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

7. Not a riparian or wetland site.

NON-WILLOW KEY

1. *Potentilla fruticosa* (shrubby cinquefoil) with at least 10 percent canopy cover. . . . . ***Potentilla fruticosa/Deschampsia cespitosa*(shrubby cinquefoil/tufted hairgrass) Habitat Type (p. 00)**

1. *Potentilla fruticosa* (shrubby cinquefoil) with less than 10 percent canopy cover. 2

2. *Artemisia cana* (silver sagebrush) with at least 10 percent canopy cover. . . . . ***Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass) Habitat Type (p. 00)**

2. *Artemisia cana* (silver sagebrush) with less than 10 percent canopy cover. 3

3. *Sarcobatus vermiculatus* (black greasewood) with at least 10 percent canopy cover. . . . . ***Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) Habitat Type (p. 00)**

3. *Sarcobatus vermiculatus* (black greasewood) with less than 10 percent canopy cover. 4

4. *Shepherdia argentea* (thorny buffaloberry) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Shepherdia argentea* (thorny buffaloberry) Community Type (p. 00)**

4. *Shepherdia argentea* (thorny buffaloberry) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 5

5. *Crataegus succulenta* (succulent hawthorn) or *C. douglasii* (black hawthorn), individually or in combination, with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Crataegus succulenta* (succulent hawthorn) Community Type (p. 00)**

5. *Crataegus succulenta* (succulent hawthorn) or *C. douglasii* (black hawthorn), individually or in combination, with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. . . 6

6. *Tamarix chinensis* (salt cedar) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Tamarix chinensis* (salt cedar) Community Type (p. 00)**

6. *Tamarix chinensis* (salt cedar) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 7

7. *Prunus virginiana* (common chokecherry) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Prunus virginiana* (common chokecherry) Community Type (p. 00)**

7. *Prunus virginiana* (common chokecherry) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 8

8. *Rosa woodsii* (woods rose) or *R. acicularis* (prickly rose), individually or in combination, with at least 15

percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Rosa woodsii* (woods rose) Community Type (p. 00)**

8. *Rosa woodsii* (woods rose) or *R. acicularis* (prickly rose), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **9**

9. *Symphoricarpos occidentalis* (western snowberry) or *S. albus* (common snowberry), individually or in combination, with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Symphoricarpos occidentalis* (western snowberry) Community Type (p. 00)**

9. *Symphoricarpos occidentalis* (western snowberry) or *S. albus* (common snowberry), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **10**

10. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

10. Not a riparian or wetland site; refer to following publications for possible fit: Mueggler and Stewart 1980, Hansen and others 1985, Hansen and Hoffman 1988, Jorgensen 1979.

KEY TO HERBACEOUS COMMUNITIES

Herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent cover.

1. Sedge species with a combined canopy cover of at least 25 percent. . . . . **Sedge Key**

1. Sedge species with a combined canopy cover of less than 25 percent. . . . . **Non-Sedge Key (p. 00)**

SEDGE KEY

1. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex rostrata* (beaked sedge) Habitat Type (p. 00)**

   a. *Carex aquatilis* (water sedge), *C. lenticularis* (lentil-fruit sedge), or grass species, individually or in combination, with less than 5 percent canopy cover. . . . . ***Carex rostrata* (beaked sedge) Phase**

b. *Carex aquatilis* (water sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 5 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Phase**

c. *Carex aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge) individually or in combination, with less than 5 percent canopy cover; grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with at least 5 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Phase**

1. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 25 percent canopy cover. 2

2. *Carex aquatilis* (water sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Habitat Type (p. 00)**

a. Grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with less than 5 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Phase**

b. Grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with at least 5 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Phase**

2. *Carex aquatilis* (water sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 25 percent canopy cover. 3

3. *Carex lasiocarpa* (slender sedge), *C. lanuginosa* (woolly sedge), or *C. buxbaumii* (Buxbaum's sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex lasiocarpa* (slender sedge) Habitat Type (p. 00)**

3. *Carex lasiocarpa* (slender sedge), *C. lanuginosa* (woolly sedge), or *C. buxbaumii* (Buxbaum's sedge), individually or in combination, with less than 25 percent canopy cover. . . . . **READ THE FOLLOWING PARAGRAPH**

The following herbaceous communities represent seral or human-caused disturbance communities. Before you use this portion of the key, do the following:

A. Carefully examine the stand and determine if *ANY* shrub species are present. If so, go back through the shrub key (p. 00) and reduce all canopy coverages to "present".

B. If *NO* shrub species are present, then go back through the herbaceous key and reduce all canopy coverages to 5 percent.

C. If the stand still does not key out, then use the following key to *EITHER* major seral or disturbance herbaceous community types *OR* unclassified riparian or wetland sites.

1. *Carex nebrascensis* (Nebraska sedge) with a greater canopy cover than any other individual sedge species. . . . . ***Carex nebrascensis* (Nebraska sedge) Community Type (p. 00)**

1. Other individual sedge species with a greater canopy cover than *Carex nebrascensis* (Nebraska sedge).

. 2

2. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

2. Not a riparian or wetland site.

NON-SEDGE KEY

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with at least 25 percent canopy cover. . . . . ***Typha latifolia* (common cattail) Habitat Type (p. 00)**

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with less than 25 percent canopy cover. 2

2. *Scirpus acutus* (hardstem bulrush) or *S. validus* (softstem bulrush), individually or in combination, with at least 15 percent canopy cover. . . ***Scirpus acutus* (hardstem bulrush) Habitat Type (p. 00)**

2. *Scirpus acutus* (hardstem bulrush) or *S. validus* (softstem bulrush), individually or in combination, with less than 15 percent canopy cover. 3

3. *Phragmites australis* (common reed) with at least 25 percent canopy cover. . . . . ***Phragmites australis* (common reed) Habitat Type (p. 00)**

3. *Phragmites australis* (common reed) with less than 25 percent canopy cover. 4

4. *Phalaris arundinacea* (reed canarygrass) with at least 25 percent canopy cover. . . . . ***Phalaris arundinacea* (reed canarygrass) Habitat Type (p. 00)**

4. *Phalaris arundinacea* (reed canarygrass) with less than 25 percent canopy cover. 5

5. *Glyceria borealis* (northern mannagrass) with at least 25 percent canopy cover. . . . . ***Glyceria borealis* (northern mannagrass) Habitat Type (p. 00)**

5. *Glyceria borealis* (northern mannagrass) with less than 25 percent canopy cover. 6

6. *Spartina pectinata* (prairie cordgrass) or *S. gracilis* (alkali cordgrass), individually or in combination, with at least 25 percent canopy cover. . . . . ***Spartina pectinata* (prairie cordgrass) Habitat Type (p. 00)**

6. *Spartina pectinata* (prairie cordgrass) or *S. gracilis* (alkali cordgrass), individually or in combination, with less than 25 percent canopy cover. 7

7. *Scirpus maritimus* (alkali bulrush) with at least 15 percent canopy cover. . . . . ***Scirpus maritimus* (alkali bulrush) Habitat Type (p. 00)**

7. *Scirpus maritimus* (alkali bulrush) with less than 15 percent canopy cover. 8

8. *Scirpus pungens* (sharp bulrush) or *S. americanus* (American bulrush), individually or in combination, with at least 15 percent canopy cover. . . . ***Scirpus pungens* (sharp bulrush) Habitat Type (p. 00)**

8. *Scirpus pungens* (sharp bulrush) or *S. americanus* (American bulrush), individually or in combination, with less than 15 percent canopy cover. 9

9. *Eleocharis palustris* (common spikesedge) or *E. acicularis* (needle spike-rush), individually or in combination, with at least 25 percent canopy cover. . . . . ***Eleocharis palustris* (common spikesedge) Habitat Type (p. 00)**

9. *Eleocharis palustris* (common spikesedge) or *E. acicularis* (needle spike-rush), individually or in combination, with less than 25 percent canopy cover. 10

10. *Eleocharis pauciflora* (few-flowered spike-rush) or *E. rostellata* (beaked spike-rush), individually or in combination, with at least 25 percent canopy cover. . . . . ***Eleocharis pauciflora* (few-flowered spike-rush) Habitat Type (p. 00)**

10. *Eleocharis pauciflora* (few-flowered spike-rush) or *E. rostellata* (beaked spike-rush), individually or in combination, with less than 25 percent canopy cover. 11

11. *Deschampsia cespitosa* (tufted hairgrass) with at least 15 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Habitat Type (p. 00)**

11. *Deschampsia cespitosa* (tufted hairgrass) with less than 15 percent canopy cover. 12

12. *Distichlis spicata* (inland saltgrass) with at least 25 percent canopy cover. . . . . ***Distichlis spicata* (inland saltgrass) Habitat Type (p. 00)**

12. *Distichlis spicata* (inland saltgrass) with less than 25 percent canopy cover. 13

13. *Agropyron smithii* (western wheatgrass) with at least 25 percent canopy cover *AND Glycyrrhiza lepidota* (American licorice) with less than 25 percent canopy cover. . . . . ***Agropyron smithii* (western wheatgrass) Habitat Type (p. 00)**

13. *Agropyron smithii* (western wheatgrass) with less than 25 percent canopy cover *OR Glycyrrhiza lepidota* (American licorice) with at least 50 percent canopy cover. 14

14. *Glycyrrhiza lepidota* (American licorice) with a greater canopy cover than any other individual herbaceous species. . . . . ***Glycyrrhiza lepidota* (American licorice) Community Type (p. 00)**

14. Other individual herbaceous species with a greater canopy cover than *Glycyrrhiza lepidota* (American licorice). . . . . **READ THE FOLLOWING PARAGRAPH**

The following herbaceous communities represent seral or human-caused disturbance communities. Before you use this portion of the key, do the following:

A. Carefully examine the stand and determine if ***ANY*** tree or shrub species are present. If so, go back through the tree or shrub key (p. 00) and reduce all canopy coverages to "present".

B. If ***NO*** tree or shrub species are present, then go back through the herbaceous key and reduce all canopy coverages to 5 percent; ignore the presence of the biennial forbs *Melilotus alba* (white sweet-clover) and *Melilotus officinalis* (yellow sweet-clover).

C. If the stand still does not key out, then use the following key to ***EITHER*** major seral or disturbance herbaceous community types ***OR*** unclassified riparian or wetland sites.

1. *Polygonum amphibium* (water smartweed) with a greater canopy cover than any other individual herbaceous species. . . . . ***Polygonum amphibium* (water smartweed) Community Type (p. 00)**

1. Other individual herbaceous species with a greater canopy cover than *Polygonum amphibium* (water smartweed). **2**

2. *Salicornia rubra* (red glasswort) with a greater canopy cover than any other individual herbaceous species. . . . . ***Salicornia rubra* (red glasswort) Community Type (p. 00)**

2. Other individual herbaceous species with a greater canopy cover than *Salicornia rubra* (red glasswort). **3**

3. *Poa palustris* (fowl bluegrass) with a greater canopy cover than any other individual herbaceous species. . . . . ***Poa palustris* (fowl bluegrass) Community Type (p. 00)**

3. Other individual herbaceous species with a greater canopy cover than *Poa palustris* (fowl bluegrass). . . **4**

4. *Bromus inermis* (smooth brome) with a greater canopy cover than any other individual herbaceous species. . . . . ***Bromus inermis* (smooth brome) Community Type (p. 00)**

4. Other individual herbaceous species with a greater canopy cover than *Bromus inermis* (smooth brome). **5**

5. *Juncus balticus* (Baltic rush) with a greater canopy cover than any other individual herbaceous species. . . . . ***Juncus balticus* (Baltic rush) Community Type (p. 00)**

5. Other individual herbaceous species with a greater canopy cover than *Juncus balticus* (Baltic rush). . . . **6**

6. *Agrostis stolonifera* (redtop) with a greater canopy cover than any other individual herbaceous species. . . . . ***Agrostis stolonifera* (redtop) Community Type (p. 00)**

6. Other individual herbaceous species with a greater canopy cover than *Agrostis stolonifera* (redtop). 7

7. *Hordeum jubatum* (foxtail barley) with a greater canopy cover than any other individual herbaceous species. . . . . ***Hordeum jubatum* (foxtail barley) Community Type (p. 00)**

7. Other individual herbaceous species with a greater canopy cover than *Hordeum jubatum* (foxtail barley). 8

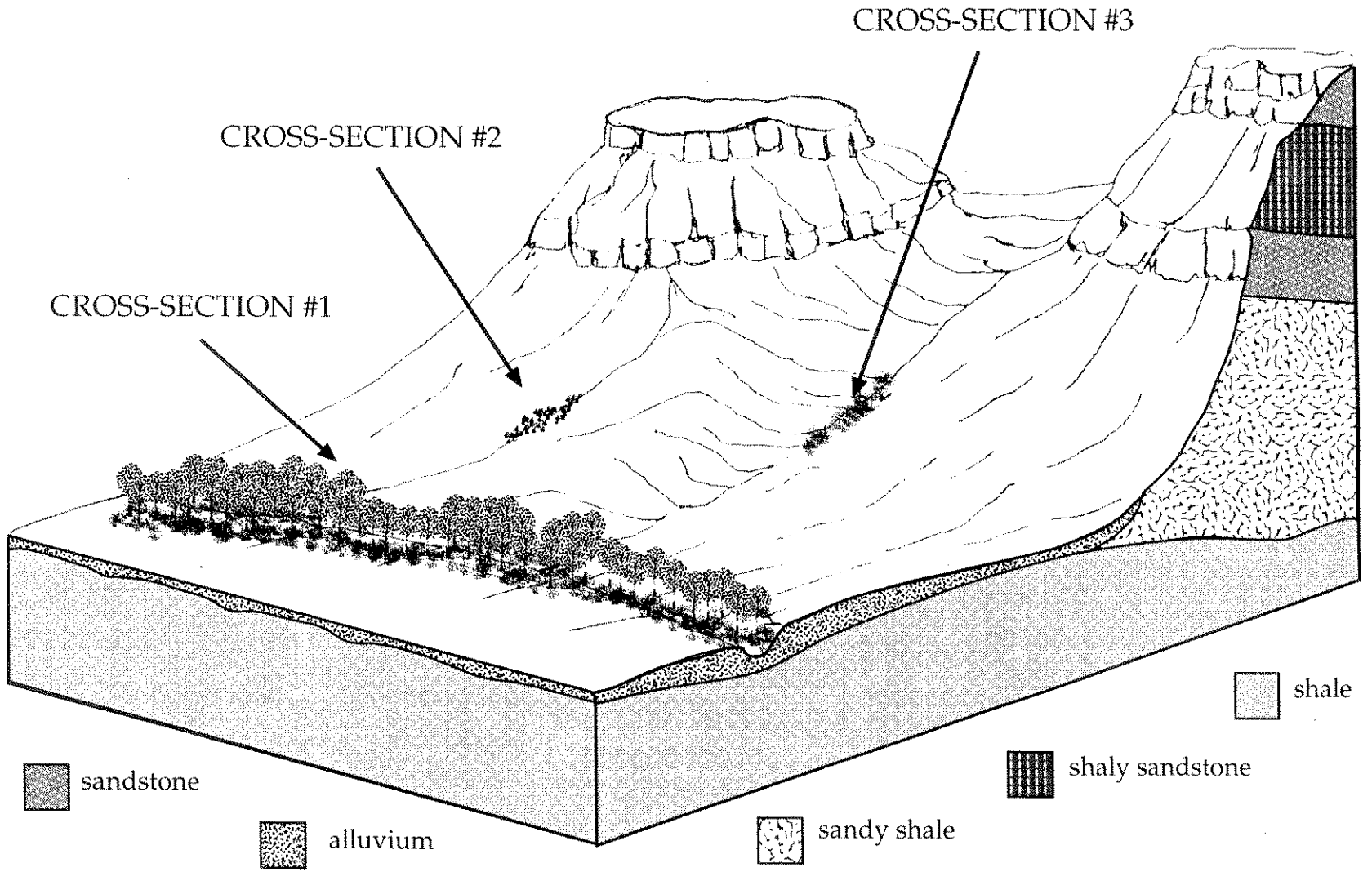
8. *Poa pratensis* (Kentucky bluegrass) with a greater canopy cover than any other individual herbaceous species. . . . . ***Poa pratensis* (Kentucky bluegrass) Community Type (p. 00)**

8. Other individual herbaceous species with a greater canopy cover than *Poa pratensis* (Kentucky bluegrass). 9

9. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

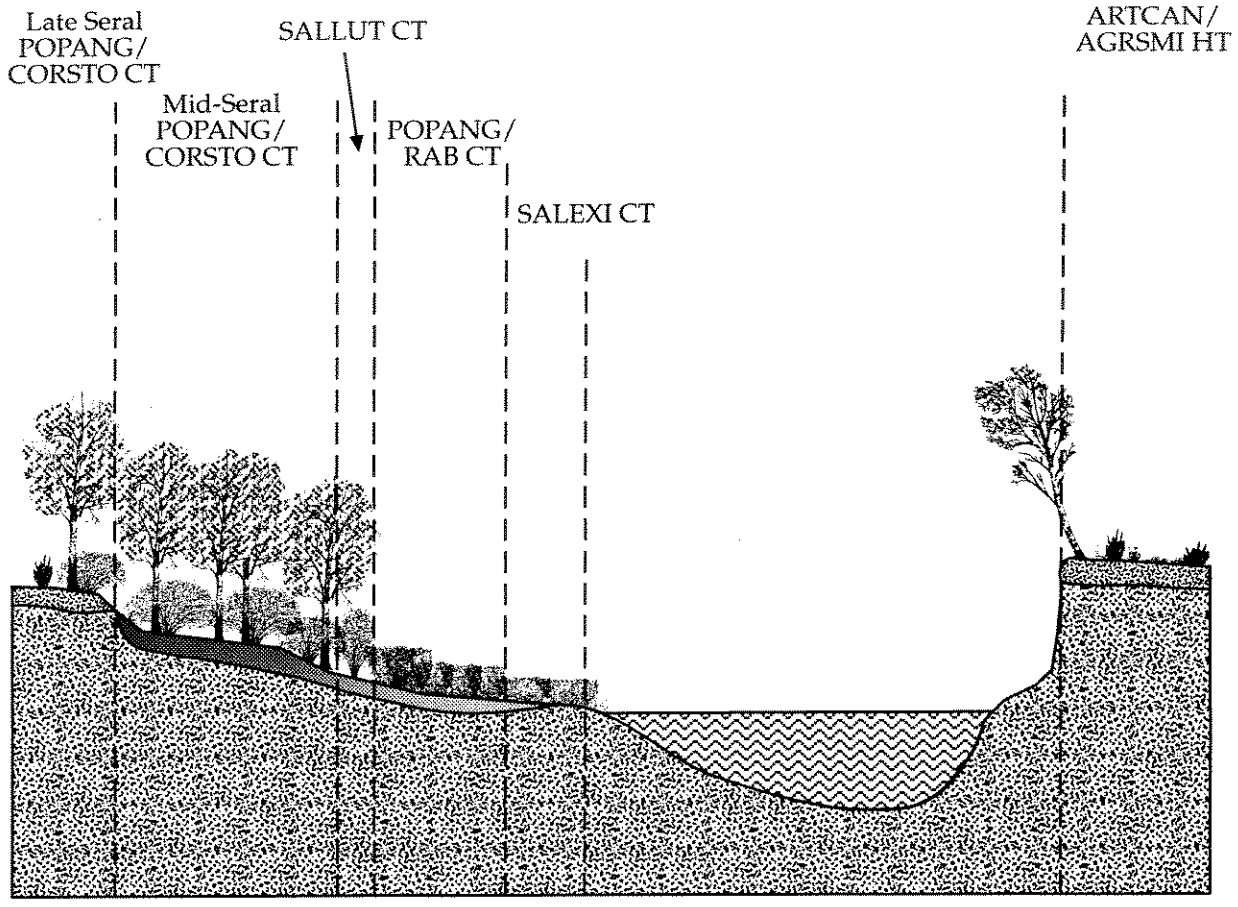
9. Not a riparian or wetland site; refer to the following publications for possible fit: Mueggler and Stewart 1980, Hansen and others 1985, Hansen and Hoffman 1988, Jorgensen 1979.

CENTRAL MONTANA
GREAT FALLS AREA



CENTRAL MONTANA
GREAT FALLS AREA

CROSS-SECTION #1. Gallery Forest Complex



These soils are weakly developed. As the illustration suggests, soils are older and more developed on higer terraces (Inceptisols), and development decreases moving toward open water (Entisols to recent alluvium). Hydric soil and wetland hydrology indicators are common on floodplains. However, they are less common and less likely to be indicators of recent hydrology on higher terraces.

These soils are either Inceptisols or Mollisols. Redoximorphic features are rare, but, if present, are usually relict indicators of past hydrologic conditions.

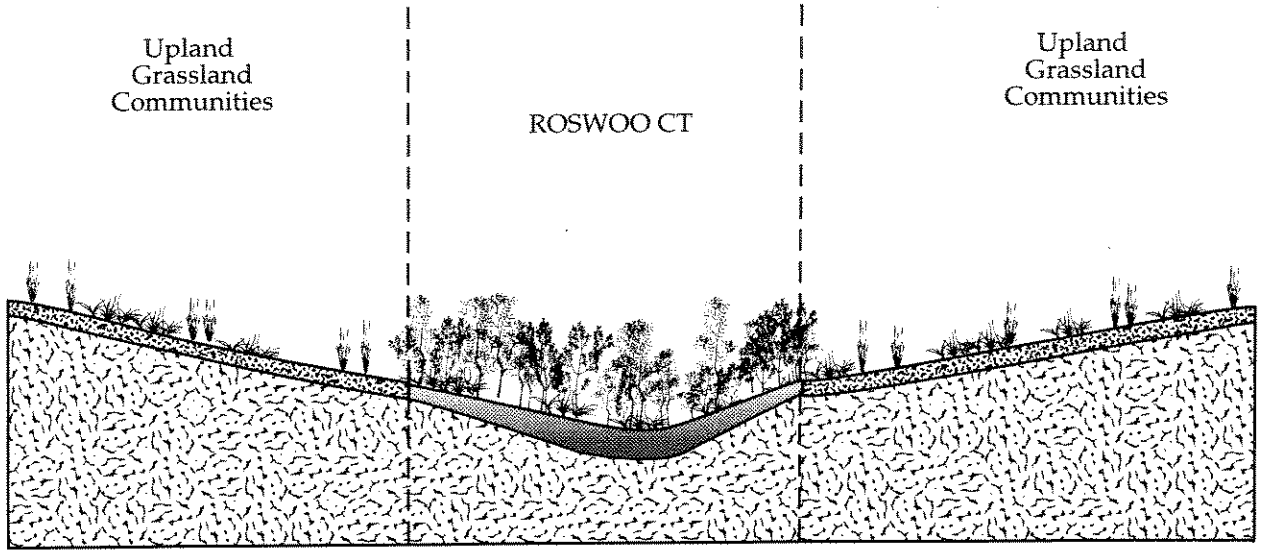
Undifferentiated Parent Material

Open water

Key: POPANG/CORSTO=*Populus angustifolia/Cornus stolonifera*
(narrowleaf cottonwood/red-osier dogwood)
POPANG/RAB=*Populus angustifolia/Recent Alluvial Bar*
(narrowleaf cottonwood/recent alluvial bar)
SALLUT=*Salix lutea* (yellow willow)
SALEXI=*Salix exigua* (sandbar willow)
ARTCAN/AGRSMI=*Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass)

CENTRAL MONTANA
GREAT FALLS AREA

CROSS-SECTION #2. Seep/Ephemeral Stream Complex



These soils are shallow and weakly developed, but are deeper, wetter, higher in organic matter and darker than adjacent upland soils. Redoximorphic features are not present.

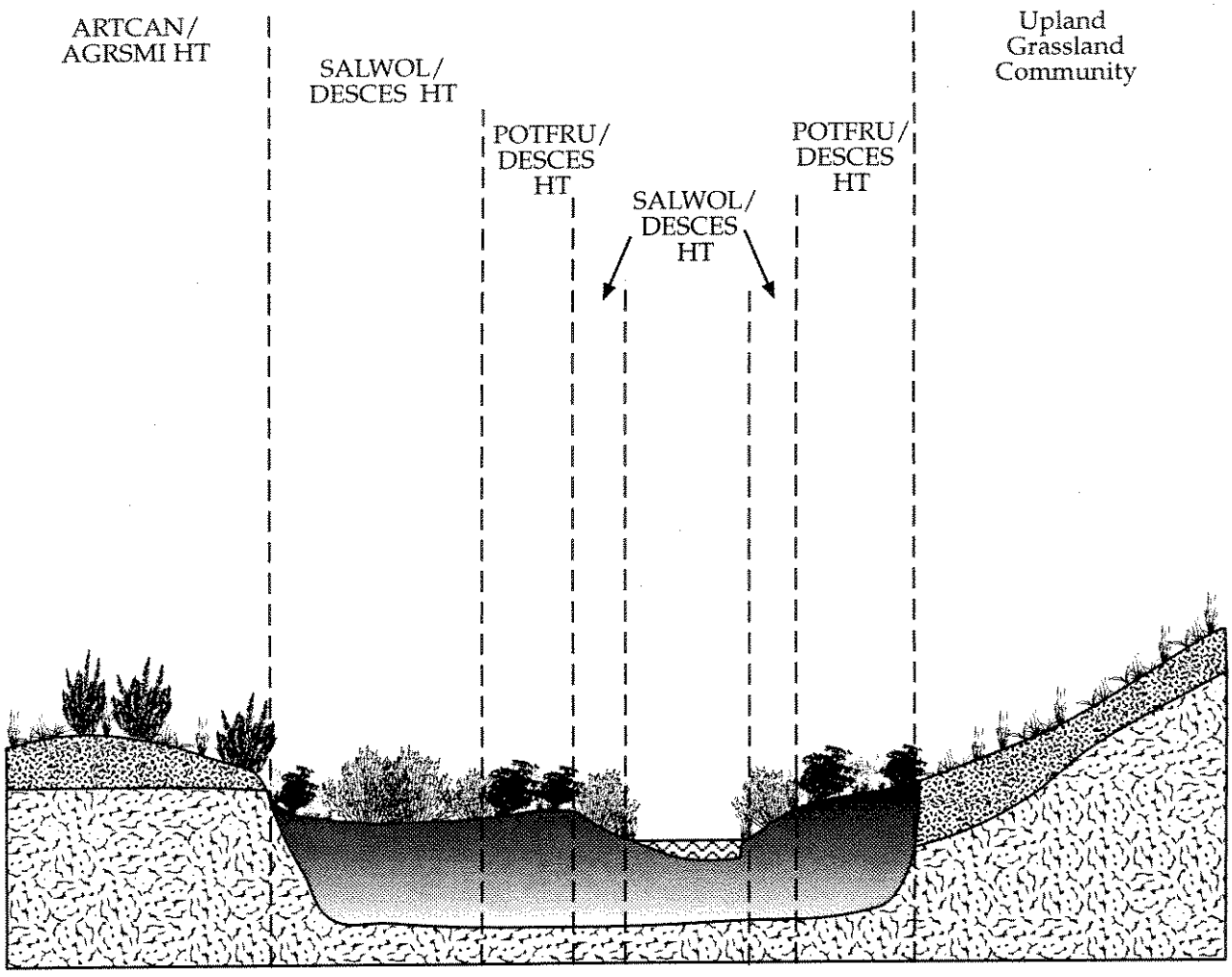
These are shallow, weakly developed upland soils.

Undifferentiated Parent Materials

Key: ROSWOO=*Rosa woodsii* (Wood's rose)

CENTRAL MONTANA
GREAT FALLS AREA

CROSS-SECTION #3. Intermittent Stream Woody Draw



These soils are saturated or moist throughout the growing season. Redoximorphic features and wetland hydrology indicators are usually present.

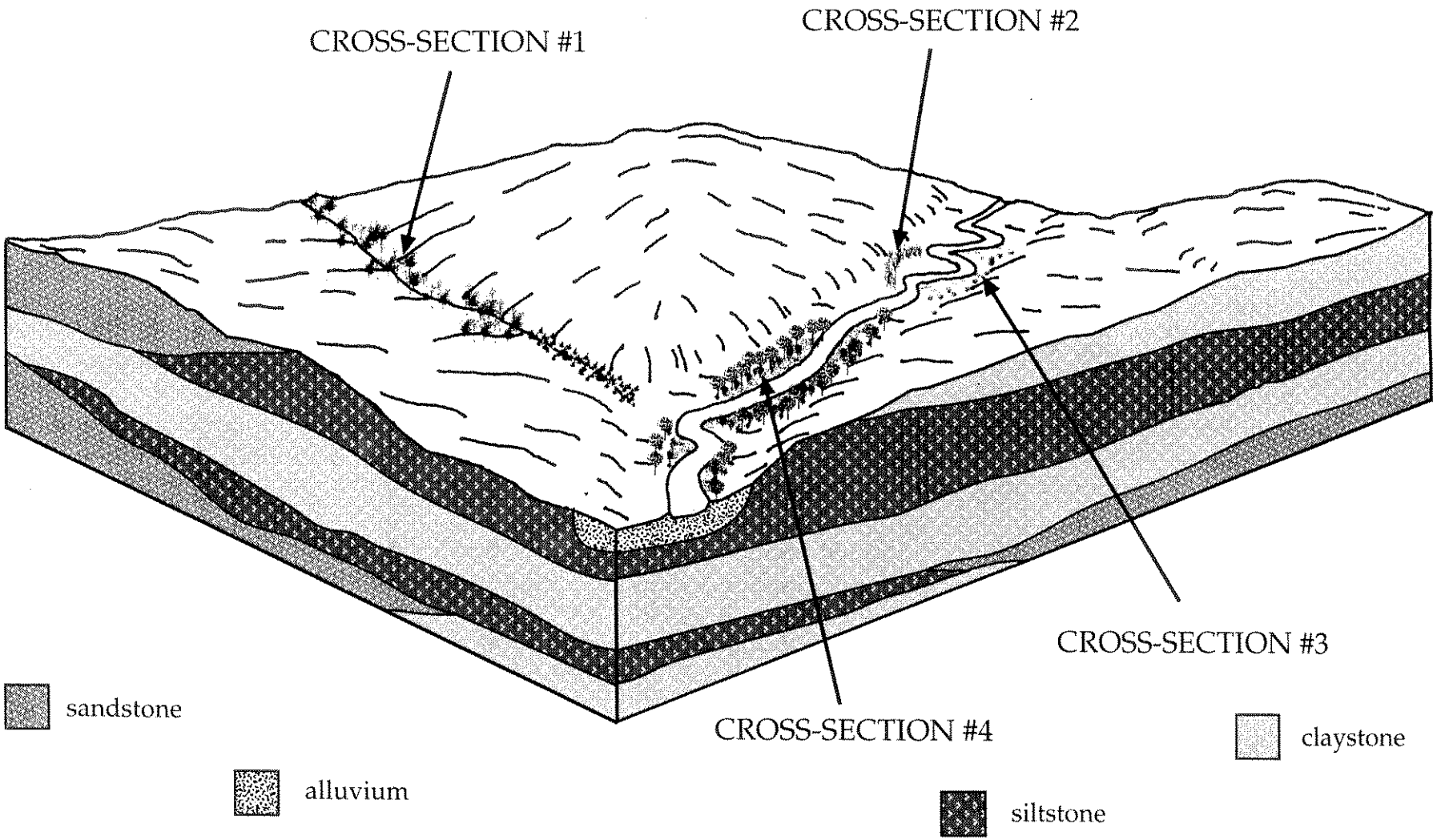
These are shallow, weakly developed upland soils

Undifferentiated Alluvial Parent Material

Open water

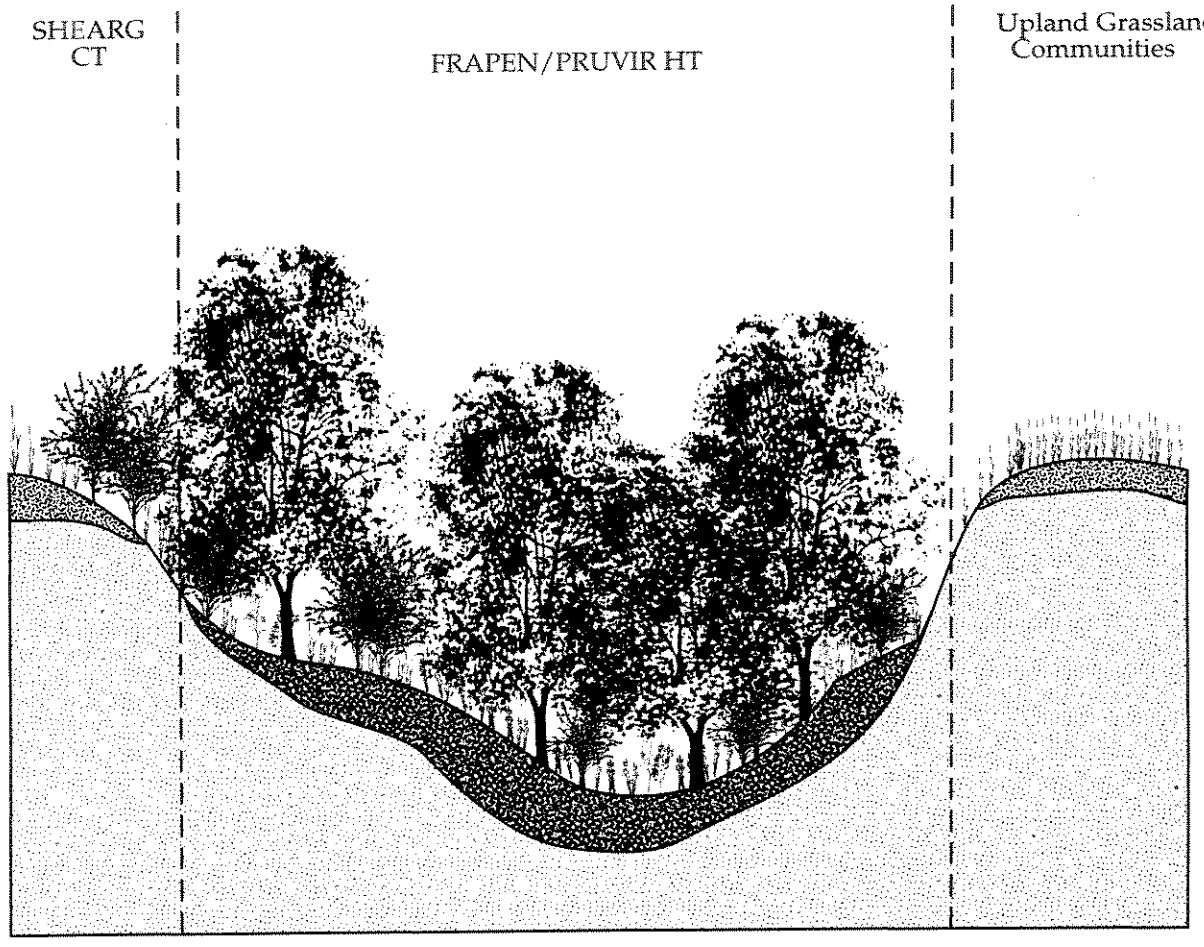
Key: ARTCAN/AGRSMI=*Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass)
SALWOL/DESCES=*Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass)
POTFRU/DESCES=*Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass)

CENTRAL & EASTERN MONTANA SEDIMENTARY PLAINS



CENTRAL & EASTERN MONTANA SEDIMENTARY PLAINS

CROSS-SECTION #1. Woody Draw



These soils commonly have an organic litter layer 2-5 cm thick; are deeper, darker, and have higher moisture and organic matter content than adjacent upland soils. Redoximorphic features of any kind are rare. If present, redox concentrations are found at the very bottom of the draw. They are commonly described as few in abundance, fine in size, and faint in contrast to the soil matrix.

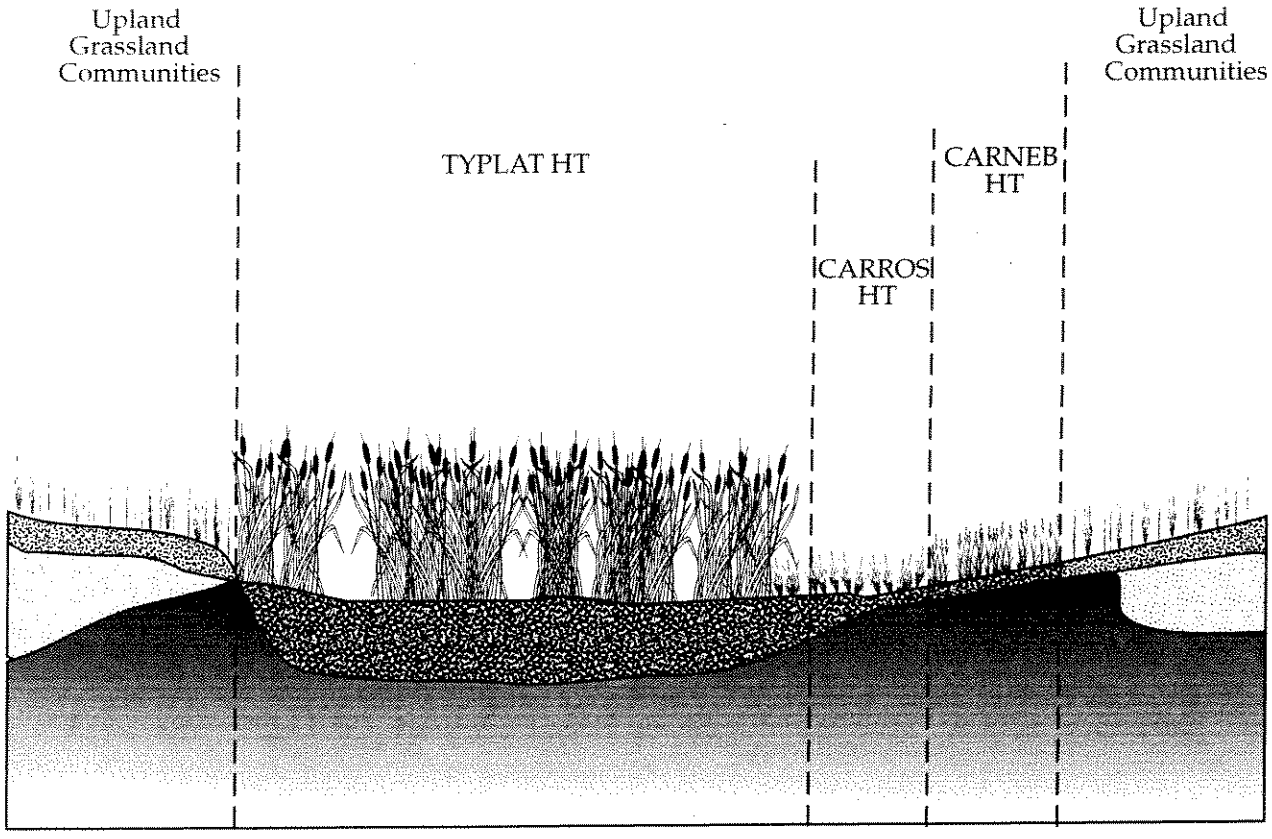
Upland soils. These soils are commonly shallow, weak-structured, calcareous, and thus, poorly developed.

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Key: SHEARG=*Shepherdia argentea* (thorny buffaloberry)
FRAPEN/PRUVIR=*Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry)

CENTRAL & EASTERN MONTANA SEDIMENTARY PLAINS

CROSS-SECTION #2. Cattail Marsh



These soils are histosols (saprists or fibrists). Hydric soil and wetland hydrology indicators are present.

These soils are saturated throughout the year. Soil matrix chromas are less than 2. Redox depletions are commonly profuse in abundance, coarse in size, and prominent in contrast to the soil matrix.

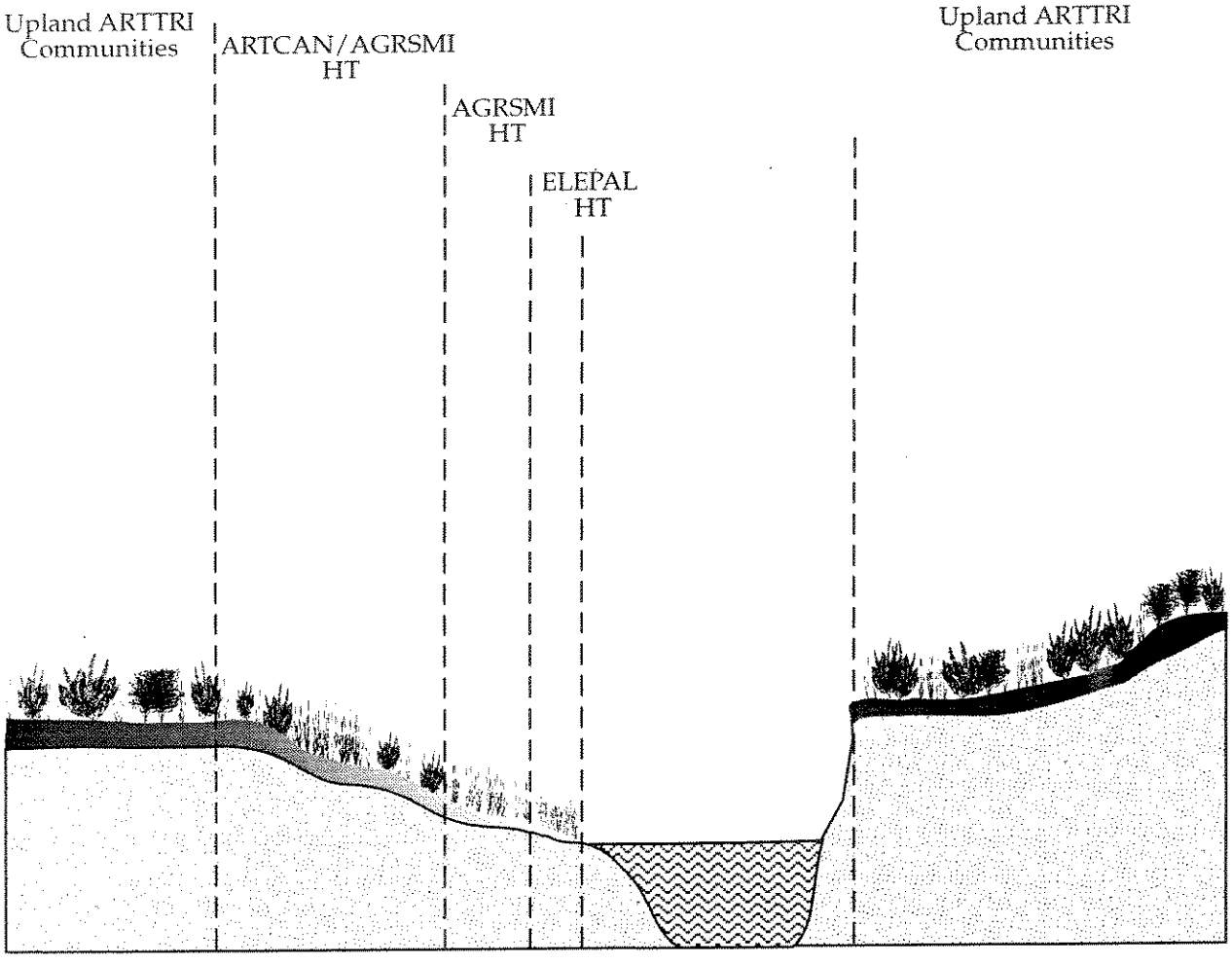
Upland soils. These soils are commonly, shallow, weak-structured, calcareous, and thus, poorly developed. Most of these soils have textures in the clay family.

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Key: TYPLAT=*Typha latifolia* (common cattail)
CARNEB=*Carex nebrascensis* (Nebraska sedge)
CARROS=*Carex rostrata* (beaked sedge)

CENTRAL & EASTERN MONTANA SEDIMENTARY PLAINS

CROSS-SECTION #3. Herbaceous Riparian and Abandoned Floodplain Complexes



These soils are weakly developed. As the illustration suggests, soils are older and more developed on higer terraces (Inceptisols), and development decreases moving toward open water (Entisols to recent alluvium). Hydric soil and wetland hydrology indicators are common on floodplains. However, they are less common and less likely to be indicators of recent hydrology on higher terraces.

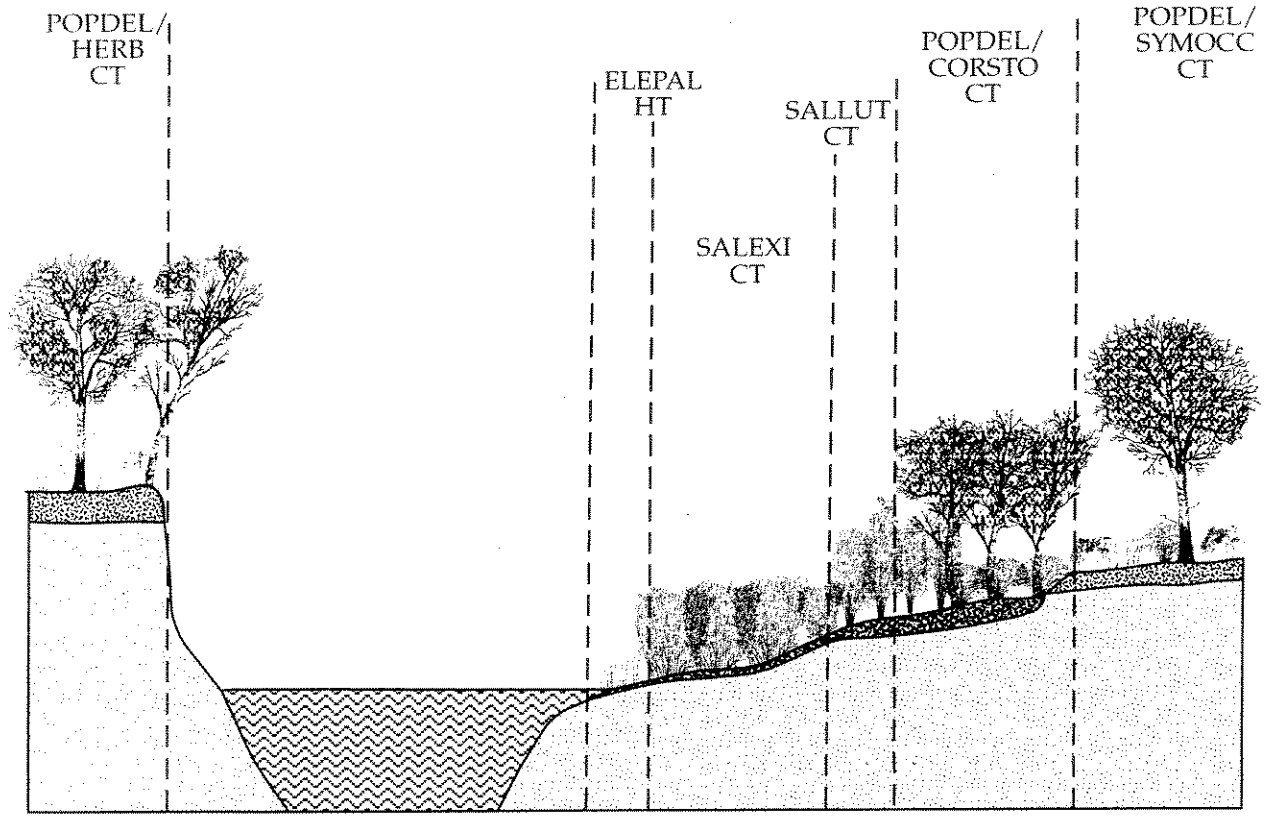
Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Open water

Key: ARTTRI=*Artemisia tridentata* (big sagebrush)
ELEPAL=*Eleocharis palustris* (common spikesedge)
ARTCAN/AGRSMI=*Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass)
AGRSMI=*Agropyron smithii* (western wheatgrass)

CENTRAL & EASTERN MONTANA SEDIMENTARY PLAINS

CROSS-SECTION #4. Recent Riparian Complex



These soils are typically Entisols (Fluvents or Aquents). Redoximorphic features are common within 30 cm of the surface on depressional sites and sites located immediately adjacent to open water.

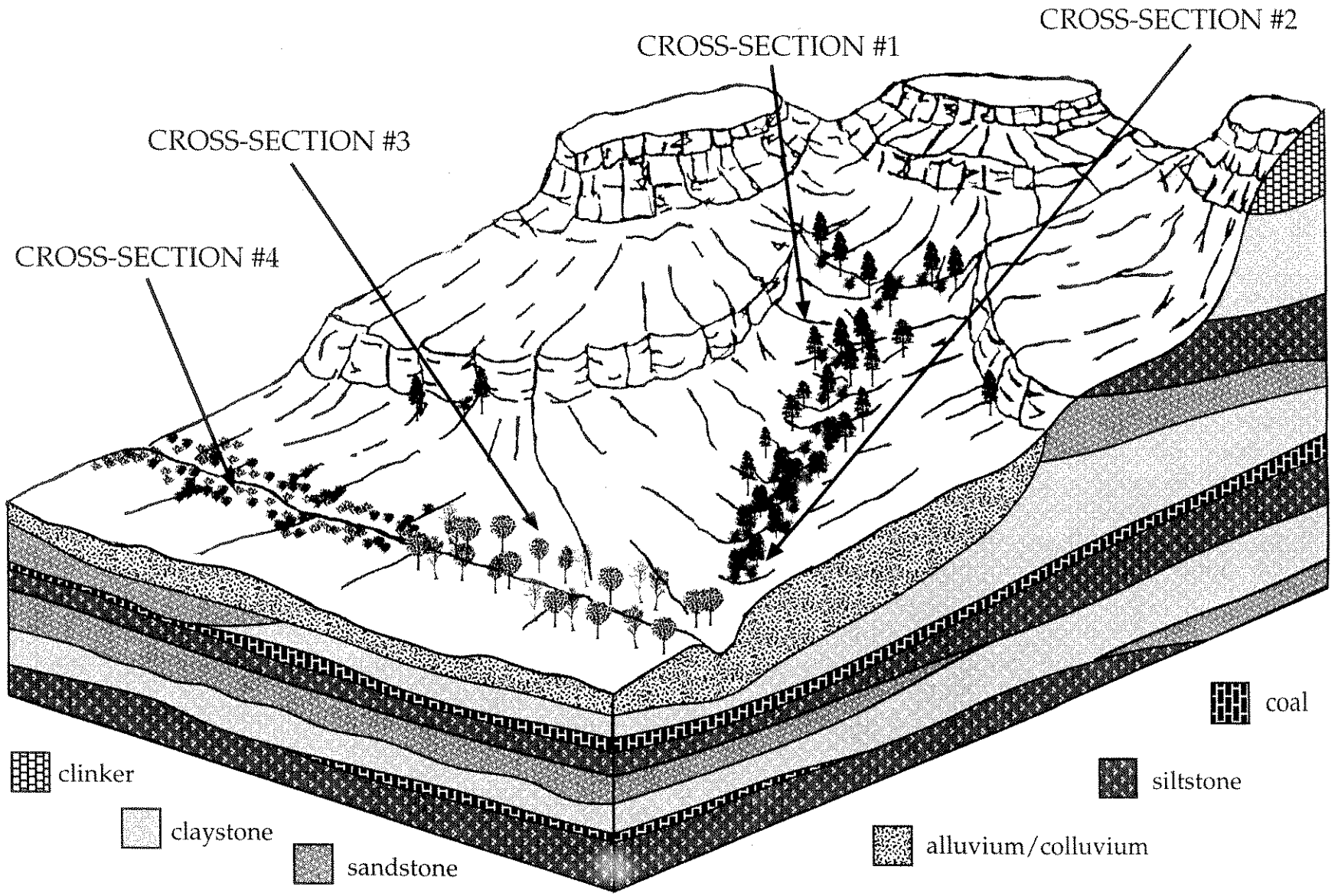
These soils are either Inceptisols or Mollisols. Sites with herbaceous understories are usually older and have commonly have mollic epipedons. Soil textures are commonly in the clay family. Redoximorphic features are rare, but, if present, are usually relict indicators of past hydrologic conditions.

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Open water

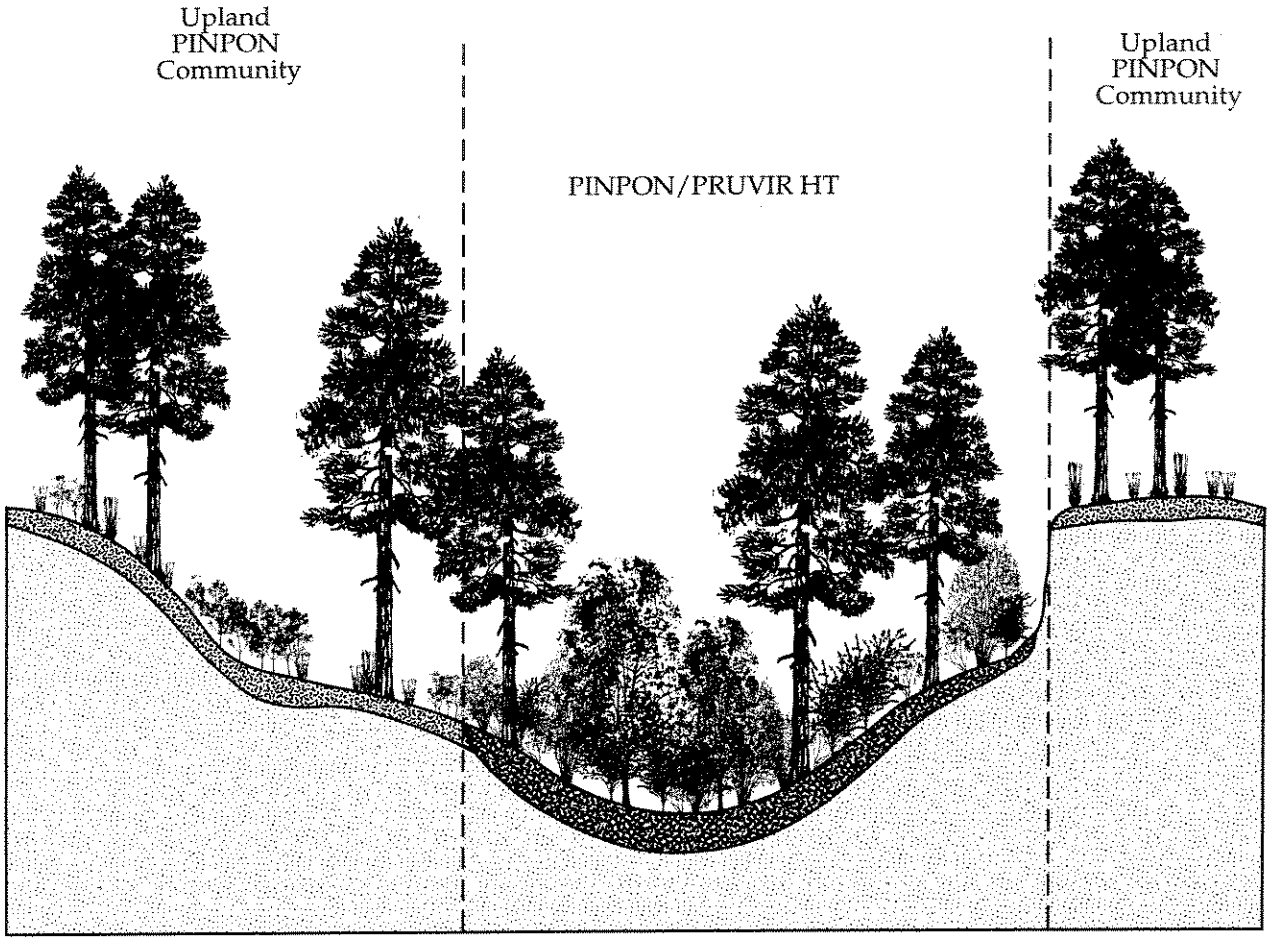
Key: POPDEL/HERB=*Populus deltoides/Herbaceous* (Great Plains cottonwood/herbaceous)
POPDEL/SYMOCC=*Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry)
POPDEL/CORSTO=*Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood)
ELEPAL=*Eleocharis palustris* (common spikesedge)
SALEXI=*Salix exigua* (sandbar willow)
SALLUT=*Salix lutea* (yellow willow)

SOUTHEASTERN MONTANA



SOUTHEASTERN MONTANA

CROSS-SECTION #1. Conifer Draw



These soils commonly have an organic litter layer 5 cm thick; are deeper, darker, and have higher moisture and organic matter content than adjacent upland soils. Surface soils are only briefly saturated during spring snowmelt or storm events. Redoximorphic features have not been found in these soils.

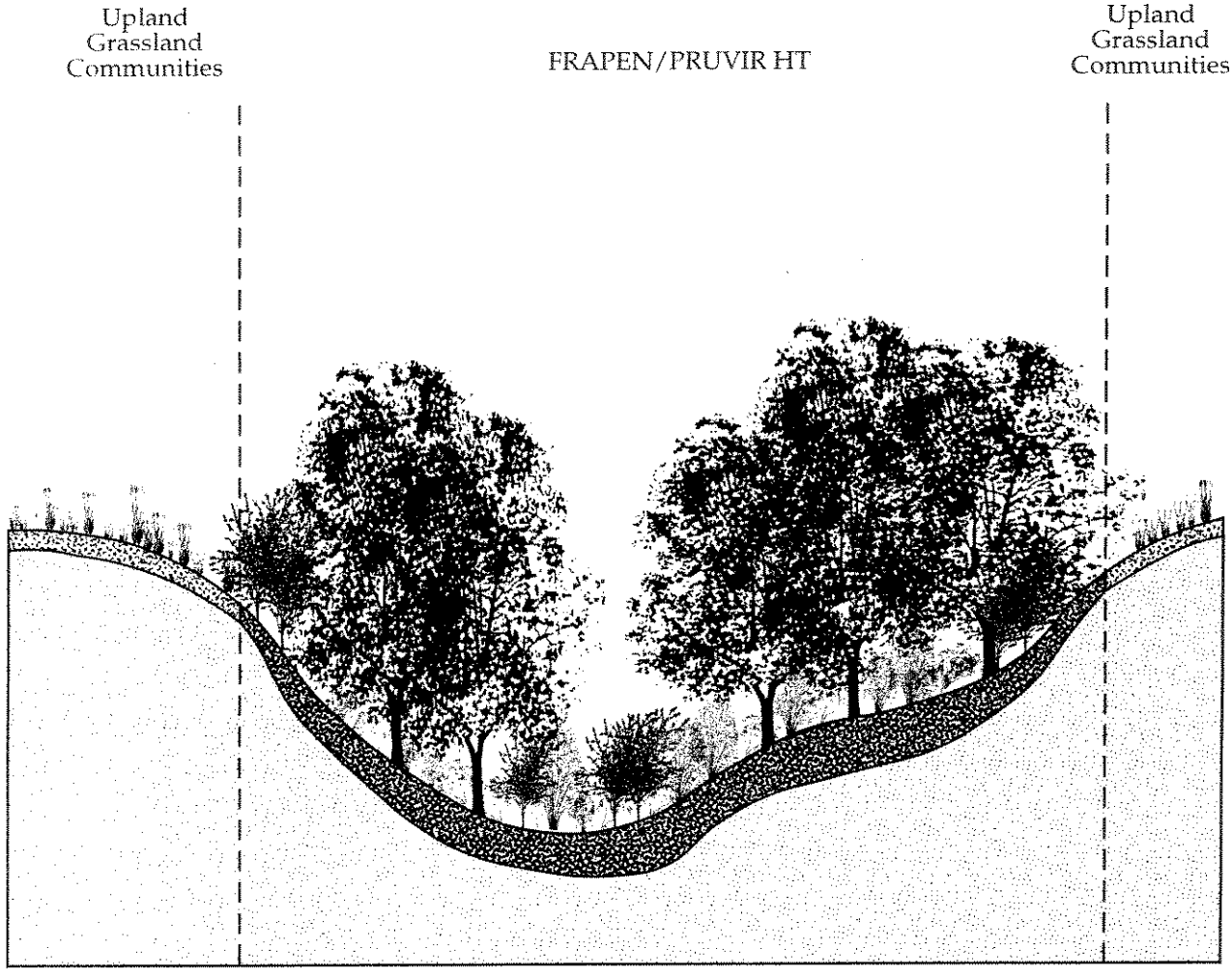
Upland soils. These soils are commonly shallow, weak-structured, calcareous, and thus, poorly-developed (Inceptisols).

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Key: PINPON=*Pinus ponderosa* (ponderosa pine)
PINPON/PRUVIR=*Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry)

SOUTHEASTERN MONTANA

CROSS-SECTION #2. Woody Draw



These soils commonly have an organic litter layer 3–5 cm thick; are deeper, darker, and have higher moisture and organic matter content than adjacent upland soils. Surface soils are only briefly saturated during spring snowmelt or storm events. Redoximorphic features of any kind are rare. If present, redox concentrations are found at the very bottom of the draw. They are commonly described as few in abundance, fine in size, and faint in contrast to the soil matrix.

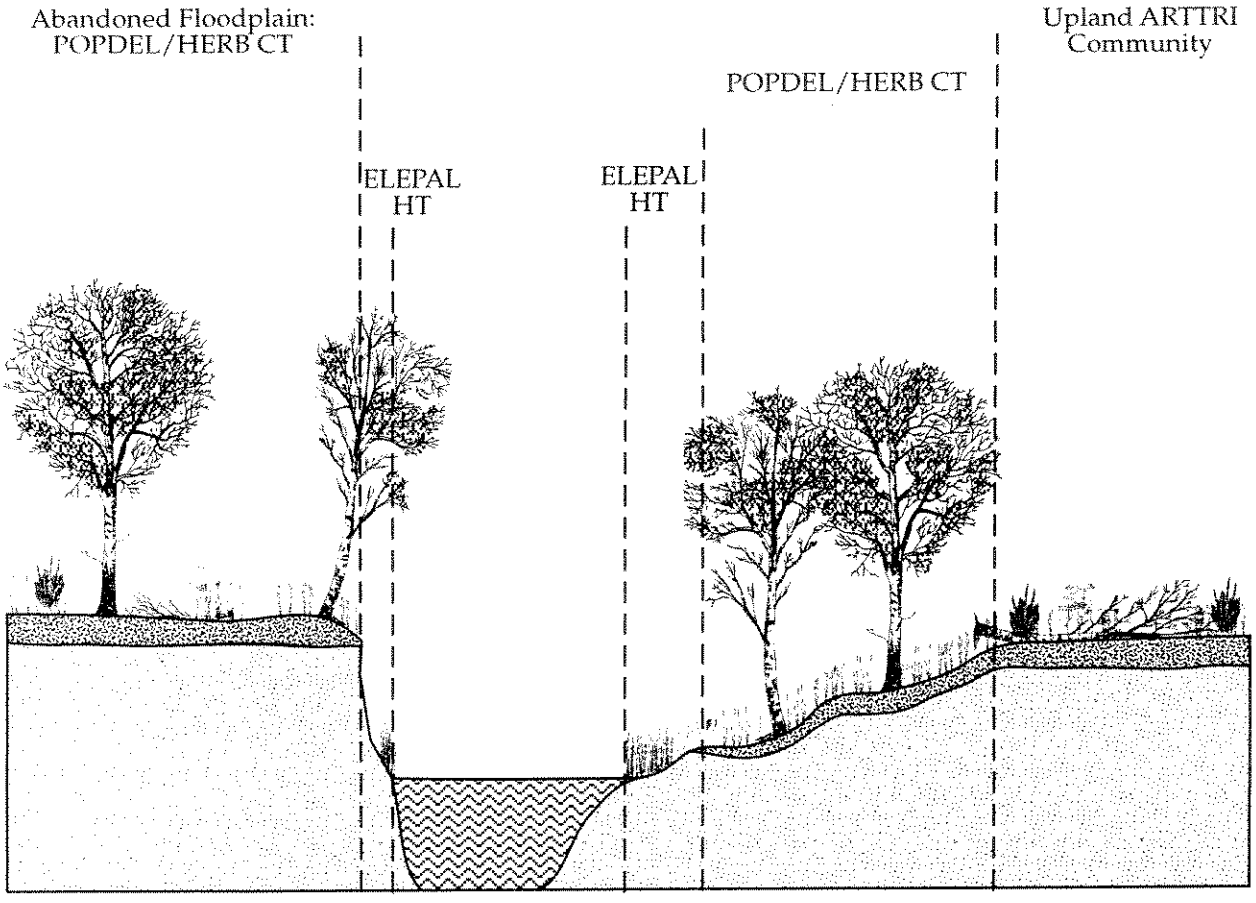
Upland soils. These soils are commonly shallow, weak-structured, calcareous, and thus, poorly-developed (Inceptisols). Most of these soils have textures in the clay family.

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Key: FRAPEN/PRUVIR=*Fraxinus pennsylvanica/Prunus virginiana* (green ash/common chokecherry)

SOUTHEASTERN MONTANA

CROSS-SECTION #3. Floodplain Communities



These soils are very weakly developed (Inceptisols). Soil development gradually decreases as one moves to the open water (Entisols to recent alluvium). Redoximorphic features are rare in all the woody types illustrated above. However, if present, they are usually relict indicators of past hydrologic conditions.

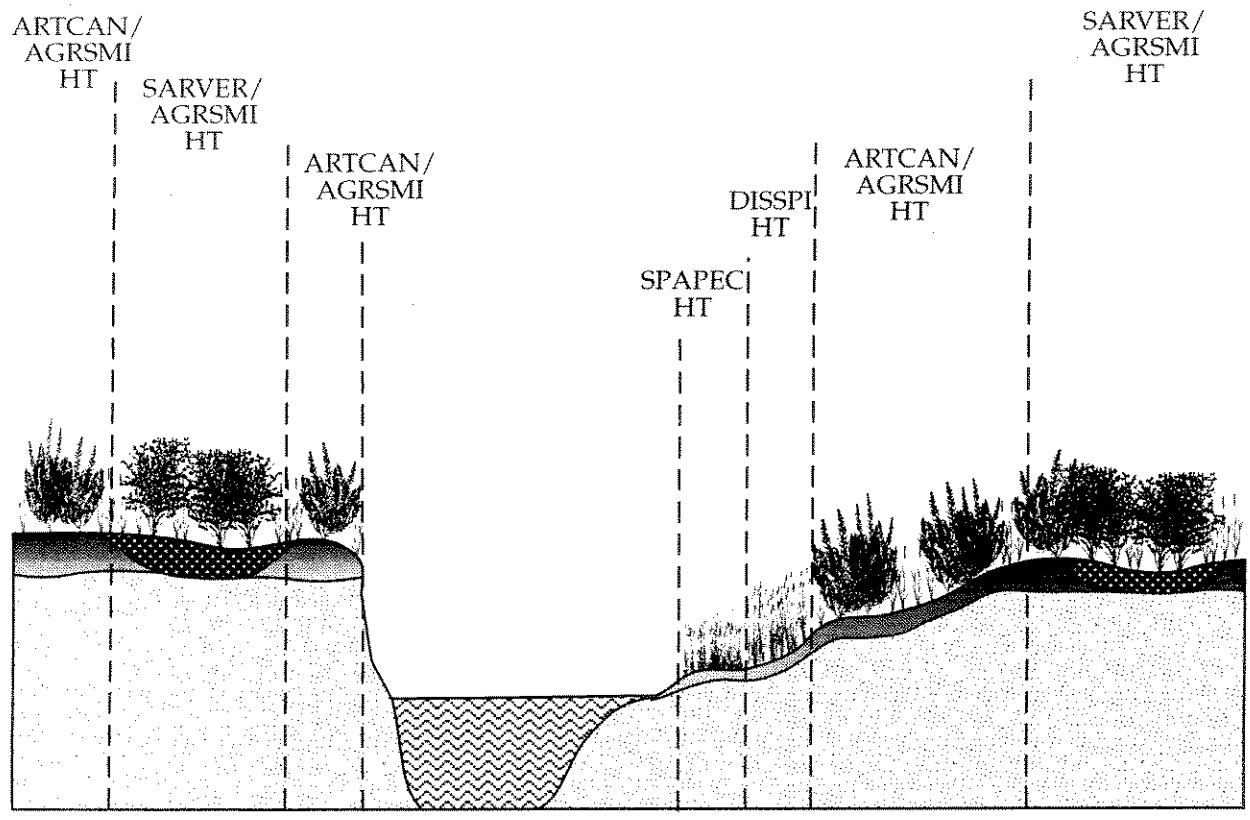
Undifferentiated parent material commonly derived from the sandstones and mudstones of the Fort Union formation. Soils of the ELEPAL HT are recent alluvium and regularly display redoximorphic features and/or hydric indicators.

Open water

Key: POPDEL/HERB=*Populus deltoides/Herbaceous* (Great Plains cottonwood/herbaceous)
ELEPAL=*Eleocharis palustris* (common spikesedge)
ARTTRI=*Artemisia tridentata* (big sagebrush)

SOUTHEASTERN MONTANA

CROSS-SECTION #4. Saline Communities



These soils are typically shallow and weakly developed (Inceptisols). Redoximorphic features are rare, but, if present, are usually relict indicators of past hydrologic conditions. Weak, fine, platy structures and buried grass crowns are common in surface horizons for sites immediately adjacent to intermittent streams; both are indicators of periodic or seasonal flooding.

These soils are alkaline. Soil pH is rarely below 8.2. Textures are commonly very heavy clay, and surfaces quickly seal when wetted.

Undifferentiated parent material commonly derived from sandstones and mudstones of the Fort Union formation

Open water

Key: ARTCAN/AGRSMI=*Artemisia cana/Agropyron smithii* (silver sagebrush/western wheatgrass)
SPAPEC=*Spartina pectinata* (prairie cordgrass)
DISSPI=*Distichlis spicata* (inland saltgrass)
SARVER/AGRSMI=*Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass)

KEY TO RIPARIAN AND WETLAND SITES OF THE ROCKY MOUNTAINS, FOOTHILLS, AND INTERMOUNTAIN VALLEYS OF MONTANA

PREFACE

1. The Rocky Mountains, foothills, and intermountain valleys comprise approximately one third of the state (see Appendix 1). The geographic boundaries for this key are the state boundaries on the southern, western, and northern edges of the region, and the foothills of the Rocky Mountains comprise the eastern edge. In the western half of the northern Great Plains, there are scattered outlier mountains that include: Crazy, Little Belt, Big Belt, Little Rocky, Judith, Highwood, Moccasin, Bull, Snowy, and Bear Paw Mountains. Because the flora and soils are similar to those of the Rocky Mountains, these outlier mountains are included in the Rocky Mountains, foothills, and intermountain valleys key.

2. In general, the key is designed to classify the wettest sites first, with the driest extremes of the riparian and wetland zone classified last.

3. The key will identify the site potential; if that is not possible due to disturbance, both natural (recently deposited alluvial bars) and/or human-caused (livestock, logging), the key will then "drop" into a community type. (Reminder: This publication describes several major seral plant communities (community types) that are stable for time frames relevant to land management decisions.) The possible potential(s) for the site can be projected by reading the discussion in the Potential Natural Community section of each community type.

4. Most of the conifer stands sampled were successionally late seral to climax, while all other types (deciduous trees, willows, non-willows shrubs, sedges, and herbaceous non-sedges) were sampled from early seral to climax.

INSTRUCTIONS

1. Accurately identify and record the canopy cover for all indicator species. The indicator species are those species used in the key.

2. The plot being classified must be representative of the stand as a whole. If not, find another plot. Uniformity (environmental and/or vegetation homogeneity) is a primary consideration in plot selection.

3. Identify the potential lifeform using the ***Lifeform Group Key***. Generally a tree species is considered successfully reproducing if 10 or more individuals per acre (25/ha) occupy or will occupy the site.

4. Within the correct lifeform group, key to the ***Habitat Type or Community Type*** by following the key literally. *All* conditions stipulated for each couplet must be satisfied in order to make a correct determination. The first set of conditions to satisfy the site characteristics should supply the correct classification.

5. Determine the correct *Phase* (if appropriate) by matching stand characteristics with phase descriptions for the habitat type. The first phase description that matches the stand is the correct one. Knowledge of a specific phase may be very important in the development of management prescriptions.

6. In sites where the vegetation is obviously depauperate (unusually sparse) because of heavy grazing or browsing pressure, dense shading, or duff accumulations, adjust the key downward to reflect the reduced canopy coverage (for example, a canopy cover requirement of at least 5 percent would adjusted down to a canopy cover with at least 1 percent). Extrapolation from the nearest non-depauperate condition occurring on a comparable site will assist in the correct determination of the type.

   In addition, when classifying a site, be aware of and avoid ***microsites.*** ***Microsites*** are small areas that are atypical for the stand as a whole. Examples include windthrow pockets filled with colluvium/alluvium or raised hummocks of willows growing on either active or abandon beaver dams comprised of woody materials.

7. In sites that are heavily impacted by grazing or browsing pressures, look around to see if you see *ANY* shrub or tree growth or remnants (stumps). In extreme situations, the potential natural community (such as a willow habitat type) may be present only in the form of dwarf-looking, widely scattered individuals. If this is the case, again adjust the key downward to reflect the reduced canopy cover. Once again, extrapolation from the nearest non-grazed or non-browsed condition occurring on a comparable site will assist in the correct determination of the type.

8. Habitat type or community type can be projected for a site in an early seral stage by examining the closest site(s) having the same site conditions (soils, hydrologic characteristics, position on the landscape, etc.).

9. *Caution!* The potential of a site may change if there is a dramatic change in the soil and/or water characteristics of the site.

10. ***Warning! The key is not the classification! Validate your determination by comparing the site characteristics with the written description of the type.***

KEY TO LIFEFORM GROUPS

1. Coniferous trees present *AND* successfully reproducing (10 or more trees per acre) *AND* not restricted to microsites. . . . . **Coniferous Tree Communities (p. 00)**

1. Coniferous trees absent *OR* if present, restricted to microsites *AND* not successfully reproducing. **2**

   2. *Populus tremuloides* (quaking aspen) present *AND* successfully reproducing (10 or more trees per acre) *AND* not restricted to microsites. . . . . **Deciduous Tree Communities (p. 00)**

2. *Populus tremuloides* (quaking aspen) absent *OR* if present, restricted to microsites *AND* not successfully reproducing. 3

3. Deciduous tree species other than *Populus tremuloides* (quaking aspen) present with a combined canopy cover of at least 25 percent. . . . . **Deciduous Tree Communities (p. 00)**

3. Deciduous trees absent *OR* if present, with a combined canopy cover of less than 25 percent. 4

4. Shrubs present with a combined canopy cover of at least 10 percent. . . **Shrub Communities (p. 00)**

4. Shrubs with a combined canopy cover of less than 10 percent; herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent canopy cover. . . . . **Herbaceous Communities (p. 00)**

KEY TO THE CONIFER TREE COMMUNITIES

(Coniferous trees present *AND* successfully reproducing (10 or more trees per acre) *AND* not restricted to microsites.)

1. *Tsuga heterophylla* (western hemlock) present and reproducing successfully. . . . . ***Tsuga heterophylla* (western hemlock) Series (p. 00)**

1. *Tsuga heterophylla* (western hemlock) absent, or if present, not reproducing successfully. 2

2. *Thuja plicata* (western redcedar) present and reproducing successfully, though success may be considerably less than competing species and often episodic. . . . . ***Thuja plicata* (western redcedar) Series (p. 00)**

2. *Thuja plicata* (western redcedar) absent, or if present, not reproducing successfully. 3

3. *Abies grandis* (grand fir) present and reproducing more successfully than *Abies lasiocarpa* (subalpine fir). . . . . ***Abies grandis* (grand fir) Series (p. 00)**

3. *Abies grandis* (grand fir) absent, or if present, not reproducing successfully. 4

4. *Abies lasiocarpa* (subalpine fir) present and reproducing more successfully than other tree species. . . . . ***Abies lasiocarpa* (subalpine fir) Series (p. 00)**

4. *Abies lasiocarpa* (subalpine fir) absent, or if present, not reproducing successfully. 5

5. *Picea engelmannii* (Engelmann spruce) or *P. glauca* (white spruce) present and reproducing successfully. .

. . . . . ***Picea* (spruce) Series (p. 00)**

5. *Picea engelmannii* (Engelmann spruce) or *P. glauca* (white spruce) absent, or if present, not reproducing successfully. 6

6. *Pseudotsuga menziesii* (Douglas fir) present and reproducing successfully. . . . . ***Pseudotsuga menziesii* (Douglas fir) Series (p. 00)**

6. *Pseudotsuga menziesii* (Douglas fir) absent or not reproducing successfully. 7

7. *Pinus ponderosa* (ponderosa pine) present and reproducing successfully. . . . . ***Pinus ponderosa* (ponderosa pine) Series (p. 00)**

7. *Pinus ponderosa* (ponderosa pine) absent, or if present, not reproducing successfully. 8

8. *Pinus contorta* (lodgepole pine) present and reproducing successfully. . . . . ***Pinus contorta* (lodgepole pine) Series (p. 00)**

8. *Pinus contorta* (lodgepole pine) absent, or if present, not reproducing successfully. 9

9. *Juniperus scopulorum* (Rocky Mountain juniper) present and reproducing successfully. *Populus tremuloides* (quaking aspen) and *Fraxinus pennsylvanica* (green ash) absent, or if present, not reproducing successfully. . . . . ***Juniperus scopulorum* (Rocky Mountain juniper) Series (p. 00)**

9. *Populus tremuloides* (quaking aspen) or *Fraxinus pennsylvanica* (green ash) present and reproducing successfully. . . . . **GO TO THE DECIDUOUS KEY (p. 00)**

Tsuga heterophylla (western hemlock) SERIES
Key To The Habitat Types

1. *Oplopanax horridum* (devil's club) with at least 5 percent canopy cover. . . . . ***Thuja plicata/Oplopanax horridum* (western redcedar/devil's club) Habitat Type (p. 00)**

1. *Oplopanax horridum* (devil's club) with less than 5 percent canopy cover. 2

2. *Athyrium filix-femina* (ladyfern) with at least 5 percent canopy cover, *OR Athyrium filix-femina* (ladyfern) with at least 1 percent canopy cover if in combination with *Senecio triangularis* (arrowleaf groundsel), *Trautvetteria caroliniensis* (false bugbane), or *Streptopus amplexifolius* (clasping-leaved twisted stalk). . . . ***Thuja plicata/Athyrium filix-femina* (western redcedar/ladyfern) Habitat Type, *Athyrium filix-femina* (ladyfern) Phase (p. 00)**

2. *Athyrium filix-femina* (ladyfern) with less than 5 percent canopy cover, or not as above. 3

3. *Gymnocarpium dryopteris* (oak-fern) with at least 1 percent canopy cover. . . . . ***Tsuga heterophylla/Gymnocarpium dryopteris* (western hemlock/oak-fern) Habitat Type (p. 00)**

3. *Gymnocarpium dryopteris* (oak-fern) with less than 1 percent canopy cover. 4

4. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

4. Not a riparian or wetland site; refer to following publications for possible fit: Pfister and others 1977, Cooper and others 1991.

Thuja plicata (western redcedar) SERIES
Key To The Habitat Types

1. *Oplopanax horridum* (devil's club) with at least 5 percent canopy cover. . . . . ***Thuja plicata/Oplopanax horridum* (western redcedar/devil's club) Habitat Type (p. 00)**

1. *Oplopanax horridum* (devil's club) with less than 5 percent canopy cover. 2

2. *Athyrium filix-femina* (ladyfern) with at least 5 percent canopy cover, ***OR*** *Athyrium filix-femina* (ladyfern) with at least 1 percent canopy cover if in combination with *Senecio triangularis* (arrowleaf groundsel), *Trautvetteria caroliniensis* (false bugbane), or *Streptopus amplexifolius* (clasping-leaved twisted stalk). . . ***Thuja plicata/Athyrium filix-femina* (western redcedar/ladyfern) Habitat Type, ... *Athyrium filix-femina* (ladyfern) Phase (p. 00)**

2. *Athyrium filix-femina* (ladyfern) with less than 5 percent canopy cover, or not as above. 3

3. *Gymnocarpium dryopteris* (oak-fern) with at least 1 percent canopy cover. . . . . ***Thuja plicata/Gymnocarpium dryopteris* (western redcedar/oak-fern) Habitat Type (p. 00)**

3. *Gymnocarpium dryopteris* (oak-fern) with less than 1 percent canopy cover. 4

4. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

4. Not a riparian or wetland site; refer to following publications for possible fit: Pfister and others 1977,

Cooper and others 1991.

Abies grandis (grand fir) SERIES
Key To The Habitat Types

1. *Oplopanax horridum* (devil's club) with at least 5 percent canopy cover. . . . . ***Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) Habitat Type (p. 00)**

1. *Oplopanax horridum* (devil's club)with less than 5 percent canopy cover. 2

    2. *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Athyrium filix-femina* (ladyfern), individually or in combination, with at least 1 percent canopy cover, ***OR*** *Populus trichocarpa* (black cottonwood) with at least 5 percent canopy cover. . . . ***Abies grandis/Athyrium filix-femina* (grand fir/ladyfern) Habitat Type (p. 00)**

    2. *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Athyrium filix-femina* (ladyfern), individually or in combination, with less than 1 percent canopy cover, ***AND*** *Populus trichocarpa* (black cottonwood) with less than 5 percent canopy cover. 3

3. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

3. Not a riparian or wetland site; refer to following publications for possible fit: Pfister and others 1977, Cooper and others 1991.

Abies lasiocarpa (subalpine fir) SERIES
Key To The Habitat Types

1. *Oplopanax horridum* (devil's club) with at least 5 percent canopy cover. . . . . ***Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club) Habitat Type (p. 00)**

1. *Oplopanax horridum* (devil's club) with less than 5 percent canopy cover. 2

    2. *Ledum glandulosum* (Labrador tea) with at least 5 percent canopy cover. . . . . ***Abies lasiocarpa/Ledum glandulosum* (subalpine fir/Labrador tea) Habitat Type (p. 00)**

a. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), horsetails, or *Senecio triangularis* (arrowleaf groundsel), individually or in combination, with at least 5 percent canopy cover; willows and/or wet site indicator sedges maybe present. . . . . ***Calamagrostis canadensis* (bluejoint reedgrass) Phase**

b. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), horsetails, or *Senecio triangularis* (arrowleaf groundsel), individually or in combination, with less than 5 percent canopy cover; *Vaccinium scoparium* (whortleberry), *Linnaea borealis* (twinflower), *Cornus canadensis* (bunchberry), *Vaccinium cespitosum* (dwarf huckleberry), *Calamagrostis rubescens* (pinegrass), or *Carex geyeri* (elk sedge) maybe present. . . . . ***Ledum glandulosum* (Labrador tea) Phase**

2. *Ledum glandulosum* (Labrador tea) with less than 5 percent canopy cover. 3

3. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) Habitat Type (p. 00)**

a. *Vaccinium cespitosum* (dwarf huckleberry) with at least 1 percent canopy cover. . . . . ***Vaccinium cespitosum* (dwarf huckleberry) Phase**

b. *Vaccinium cespitosum* (dwarf huckleberry) with less than 1 percent canopy cover; *Ligusticum canbyi* (Canby's licorice-root) or *Trautvetteria caroliniensis* (false bugbane) with at least 1 percent canopy cover. . . . . ***Ligusticum canbyi* (Canby's licorice-root) Phase**

c. *Ligusticum canbyi* (Canby's licorice-root) or *Trautvetteria caroliniensis* (false bugbane) with less than 1 percent canopy cover. . . . . ***Calamagrostis canadensis* (bluejoint reedgrass) Phase**

3. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with less than 5 percent canopy cover. 4

4. *Streptopus amplexifolius* (clasping-leaved twisted stalk), *Senecio triangularis* (arrowleaf groundsel), *Mitella breweri* (Brewer's mitrewort), *M. pentandra* (five-stamened mitrewort), or *Gymnocarpium dryopteris* (oak-fern), individually or in combination, with at least 1 percent canopy cover. . . . . ***Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/clasping-leaved twisted stalk) Habitat Type (p. 00)**

a. *Menziesia ferruginea* (fool's huckleberry) with at least 5 percent canopy cover. . . . . ***Menziesia ferruginea* (fool's huckleberry) Phase**

b. *Menziesia ferruginea* (fool's huckleberry) with less than 5 percent canopy cover. . . . . ***Streptopus amplexifolius* (clasping-leaved twisted stalk) Phase**

4. *Streptopus amplexifolius* (clasping-leaved twisted stalk), *Senecio triangularis* (arrowleaf groundsel),

Mitella breweri (Brewer's mitrewort), *M. pentandra* (five-stamened mitrewort), or *Gymnocarpium dryopteris* (oak-fern), individually or in combination, with less than 1 percent canopy cover. . . . 5

5. *Actaea rubra* (baneberry) with at least 1 percent canopy cover. . . . . ***Abies lasiocarpa/Actaea rubra* (subalpine fir/baneberry) Habitat Type (p. 00)**

5. *Actaea rubra* (baneberry) with less than 1 percent canopy cover. 6

6. Site ***WITH*** at least ***TWO*** of the following moist site forbs present: *Galium triflorum* (sweetscented bedstraw), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Actaea rubra* (baneberry). . . . . ***Abies lasiocarpa/Galium triflorum* (subalpine fir/sweetscented bedstraw) Habitat Type (p. 00)**

6. Site ***WITHOUT*** at least ***TWO*** of the following moist site forbs present: *Galium triflorum* (sweetscented bedstraw), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Actaea rubra* (baneberry). . . 7

7. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

7. Not a riparian or wetland site; refer to following publications for possible fit: Pfister and others 1977, Cooper and others 1991.

Picea (spruce) SERIES
Key To The Habitat Types And Community Type

1. *Lysichiton americanum* (skunk cabbage) present and not restricted to microsites. . . . . ***Picea/Lysichiton americanum* (spruce/skunk cabbage) Habitat Type (p. 00)**

1. *Lysichiton americanum* (skunk cabbage) absent. 2

2. *Equisetum arvense* (field horsetails) with at least 25 percent canopy cover. . . . . ***Picea/Equisetum arvense* (spruce/field horsetail) Habitat Type (p. 00)**

2. *Equisetum arvense* (field horsetails) with less than 25 percent canopy cover. 3

3. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass) with at least 5 percent canopy cover. . . . . ***Picea/Calamagrostis canadensis* (spruce/bluejoint reedgrass) Community Type (p. 00)**

3. *Calamagrostis canadensis* (bluejoint reedgrass) and *C. stricta* (narrow-spiked reedgrass) with less than 5 percent canopy cover. 4

4. *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), or willows present. . . . . ***Picea/Cornus stolonifera* (spruce/red-osier dogwood) Habitat Type (p. 00)**

4. *Cornus stolonifera* (red-osier dogwood), *Alnus incana* (mountain alder), or willows absent. 5

5. Site ***WITH*** at least ***TWO*** of the following moist site forbs present: *Galium triflorum* (sweetscented bedstraw), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Actaea rubra* (baneberry). . . . . ***Picea/Galium triflorum* (spruce/sweetscented bedstraw) Habitat Type (p. 00)**

5. Site ***WITHOUT*** at least ***TWO*** of the following moist site forbs present: *Galium triflorum* (sweetscented bedstraw), *Streptopus amplexifolius* (clasping-leaved twisted stalk), or *Actaea rubra* (baneberry). 6

6. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

6. Not a riparian or wetland site; refer to following publications for possible fit: Pfister and others 1977, Cooper and others 1991.

Pseudotsuga menziesii (Douglas fir) SERIES
Key To The Habitat Type

1. Cottonwoods with at least 5 percent canopy cover *OR* *Cornus stolonifera* (red-osier dogwood), willows (except *Salix scouleriana* [Scouler willow]), *Equisetum arvense* (field horsetails), *Poa pratensis* (Kentucky bluegrass), or *Actaea rubra* (baneberry), individually or in combination, with at least 1 percent canopy cover. . . . ***Pseudotsuga menziesii/Cornus stolonifera* (Douglas fir/red-osier dogwood) Habitat Type (p. 00)**

1. Cottonwoods with less than 5 percent canopy cover *AND* *Cornus stolonifera* (red-osier dogwood), willows (except *Salix scouleriana* [Scouler willow]), *Equisetum arvense* (field horsetails), *Poa pratensis* (Kentucky bluegrass), or *Actaea rubra* (baneberry), individually or in combination, with less than 1 percent canopy cover. 2

2. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it

must have at least 25 percent canopy cover in the stand.)

2. Not a riparian or wetland site; refer to Pfister and others, 1977, for possible fit.

Pinus ponderosa (ponderosa pine) SERIES
Key To The Habitat Types

1. Cottonwoods with at least 5 percent canopy cover *OR* *Cornus stolonifera* (red-osier dogwood) or *Poa pratensis* (Kentucky bluegrass), individually or in combination, with at least 1 percent canopy cover. . . . . ***Pinus ponderosa/Cornus stolonifera* (ponderosa pine/red-osier dogwood) Habitat Type (p. 00)**

1. Cottonwoods with less than 5 percent canopy cover *AND* *Cornus stolonifera* (red-osier dogwood) or *Poa pratensis* (Kentucky bluegrass), individually or in combination, with less than 1 percent canopy cover. . 2

2. *Prunus virginiana* (common chokecherry) or *Amelanchier alnifolia* (western serviceberry) with at least 5 percent canopy cover *AND* east of the Continental Divide; *Fraxinus pennsylvanica* (green ash) may be present. . . . . ***Pinus ponderosa/Prunus virginiana* (ponderosa pine/common chokecherry) Habitat Type (p. 00)**

2. *Prunus virginiana* (common chokecherry) or *Amelanchier alnifolia* (western serviceberry) with less than 5 percent canopy cover *OR* west of the Continental Divide; *Fraxinus pennsylvanica* (green ash) absent. 3

3. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

3. Not a riparian or wetland site; refer to Pfister and others, 1977, for possible fit.

Pinus contorta (lodgepole pine) SERIES
Key To The Habitat Type

1. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass) Habitat Type (p. 00)**

a. *Vaccinium cespitosum* (dwarf huckleberry) with at least 1 percent canopy cover. . . . . ***Vaccinium cespitosum* (dwarf huckleberry) Phase**

b. *Vaccinium cespitosum* (dwarf huckleberry) with less than 1 percent canopy cover; *Ligusticum canbyi* (Canby's licorice-root) or *Trautvetteria caroliniensis* (false bugbane) with at least 1 percent canopy cover. . . . . ***Ligusticum canbyi* (Canby's licorice-root) Phase**

c. *Ligusticum canbyi* (Canby's licorice-root) or *Trautvetteria caroliniensis* (false bugbane) with less than 1 percent canopy cover. . . . . ***Calamagrostis canadensis* (bluejoint reedgrass) Phase**

1. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with less than 5 percent canopy cover. 2

2. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

2. Not a riparian or wetland site; refer to Pfister and others, 1977, for possible fit.

Juniperus scopulorum (Rocky Mountain juniper) SERIES
Key To The Habitat Type

1. Cottonwoods with at least 5 percent canopy cover *OR* *Cornus stolonifera* (red-osier dogwood), *Poa pratensis* (Kentucky bluegrass), or *Agrostis stolonifera* (redtop), individually or in combination, with at least 1 percent canopy cover. . . . . ***Juniperus scopulorum/Cornus stolonifera* (Rocky Mountain juniper/red-osier dogwood) Habitat Type (p. 00)**

1. Cottonwoods with less than 5 percent canopy cover *AND* *Cornus stolonifera* (red-osier dogwood), *Poa pratensis* (Kentucky bluegrass), or *Agrostis stolonifera* (redtop), individually or in combination, with less than 1 percent canopy cover. 2

2. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

2. Not a riparian or wetland site.

KEY TO DECIDUOUS TREE COMMUNITIES

Populus tremuloides (quaking aspen) present ***AND*** successfully reproducing (10 or more trees per acre) ***AND*** not restricted to microsites ***OR*** deciduous tree species other than *Populus tremuloides* (quaking aspen) present with a combined canopy cover of at least 25 percent.

1. *Populus tremuloides* (quaking aspen) present and reproducing successfully. 2

1. *Populus tremuloides* (quaking aspen) absent, or if present, not reproducing successfully. 5

    2. Willows, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), *Alnus incana* (mountain alder), or *Prunus virginiana* (common chokecherry), individually or in combination, with at least 5 percent canopy cover. . . . . ***Populus tremuloides/Cornus stolonifera*** **(quaking aspen/red-osier dogwood) Habitat Type (p. 00)**

    2. Willows, *Cornus stolonifera* (red-osier dogwood), *Amelanchier alnifolia* (western serviceberry), or *Prunus virginiana* (common chokecherry), individually or in combination, with less than 5 percent canopy cover. 3

3. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Populus tremuloides/Calamagrostis canadensis*** **(quaking aspen/bluejoint reedgrass) Habitat Type (p. 00)**

3. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with less than 5 percent canopy cover. 4

    4. Site ***WITH*** at least ***TWO*** of the following species present: *Osmorhiza occidentalis* (western sweet-cicely), *Viola canadensis* (Canada violet), *Heracleum lanatum* (cow-parsnip), *Actaea rubra* (baneberry), or *Galium triflorum* (sweetscented bedstraw). . . . . ***Populus tremuloides/Osmorhiza occidentalis*** **(quaking aspen/western sweet-cicely) Habitat Type (p. 00)**

    4. Site ***WITHOUT*** at least ***TWO*** of the following species present: *Osmorhiza occidentalis* (western sweet-cicely), *Viola canadensis* (Canada violet), *Heracleum lanatum* (cow-parsnip), *Actaea rubra* (baneberry), or *Galium triflorum* (sweetscented bedstraw), *Poa pratensis* (Kentucky bluegrass), *Phleum pratense* (common timothy), or *Agrostis stolonifera* (redtop), individually or in combination, with at least 5 percent canopy cover. . . . . ***Populus tremuloides/Poa pratensis*** **(quaking aspen/Kentucky bluegrass) Community Type (p. 00)**

5. *Populus trichocarpa* (black cottonwood), *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood) with a greater canopy cover than other individual tree species. 6

5. Other individual tree species with a greater canopy cover than *Populus trichocarpa* (black cottonwood), *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood). 17

6. *Populus trichocarpa* (black cottonwood) with a greater canopy cover than either *P. angustifolia* (narrowleaf cottonwood), or *P. deltoides* (Great Plains cottonwood). 7

6. *Populus angustifolia* (narrowleaf cottonwood) or *P. deltoides* (Great Plains cottonwood) with a greater canopy cover than *P. trichocarpa* (black cottonwood). 10

7. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus trichocarpa* (black cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . ***Populus trichocarpa*/Recent Alluvial Bar (black cottonwood/recent alluvial bar) Community Type (p. 00)**

7. Pole or mature age classes (dbh > 5.0 inches) of *Populus trichocarpa* (black cottonwood) dominate the site. 8

8. Shrub species with at least 25 percent canopy cover. 9

8. Shrub species with less than 25 percent canopy cover. . . . . ***Populus trichocarpa*/Herbaceous (black cottonwood/herbaceous) Community Type (p. 00)**

9. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . ***Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood) Community Type (p. 00)**

9. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . ***Populus trichocarpa/Symphoricarpos occidentalis* (black cottonwood/western snowberry) Community Type (p. 00)**

10. *Populus angustifolia* (narrowleaf cottonwood) with a greater canopy cover than *P. deltoides* (Great Plains cottonwood). 11

10. *Populus deltoides* (Great Plains cottonwood) with a greater canopy cover than *P. angustifolia* (narrowleaf cottonwood). 14

11. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus angustifolia* (narrowleaf cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . ***Populus angustifolia*/Recent Alluvial Bar (narrowleaf cottonwood/recent alluvial bar) Community Type (p. 00)**

11. Pole or mature age classes (dbh > 5.0 inches) of *Populus angustifolia* (narrowleaf cottonwood) dominate the

site. 12

12. Shrub species with at least 25 percent canopy cover. 13

12. Shrub species with less than 25 percent canopy cover. . . . . .
. ***Populus angustifolia*/Herbaceous (narrowleaf cottonwood/herbaceous) Community Type (p. 00)**

13. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . .
. . . . . ***Populus angustifolia/Cornus stolonifera* (narrowleaf cottonwood/red-osier dogwood)**
. . . . . **Community Type (p. 00)**

13. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . .
. . . ***Populus angustifolia/Symphoricarpos occidentalis* (narrowleaf cottonwood/western snowberry)**
. . . . . **Community Type (p. 00)**

14. Seedling or sapling age classes (dbh < 5.0 inches) of *Populus deltoides* (Great Plains cottonwood) dominate the site; site is a recently deposited alluvial bar. . . . . .
. . . . . ***Populus deltoides*/Recent Alluvial Bar (Great Plains cottonwood/recent alluvial bar)**
. . . . . **Community Type (p. 00)**

14. Pole or mature age classes (dbh > 5.0 inches) of *Populus deltoides* (Great Plains cottonwood) dominate the site. 15

15. Shrub species with at least 25 percent canopy cover. 16

15. Shrub species with less than 25 percent canopy cover. . . . . .
. . . ***Populus deltoides*/Herbaceous (Great Plains cottonwood/herbaceous) Community Type (p. 00)**

16. *Cornus stolonifera* (red-osier dogwood) with at least 1 percent canopy cover. . . . . .
. . . . . ***Populus deltoides/Cornus stolonifera* (Great Plains cottonwood/red-osier dogwood)**
. . . . . **Community Type (p. 00)**

16. *Cornus stolonifera* (red-osier dogwood) with less than 1 percent canopy cover; understory may be dominated by *Symphoricarpos occidentalis* (western snowberry), or *Symphoricarpos alba* (common snowberry) and/or *Rosa woodsii* (woods rose) or *Rosa acicularis* (prickly rose). . . . . .
. . ***Populus deltoides/Symphoricarpos occidentalis* (Great Plains cottonwood/western snowberry)**
. . . . . **Community Type (p. 00)**

17. *Salix amygdaloides* (peach-leaf willow) or *Elaeagnus angustifolia* (Russian olive) with a greater canopy cover than other individual tree species. 18

17. Other individual tree species with a greater canopy cover than *Salix amygdaloides* (peach-leaf willow) or *Elaeagnus angustifolia* (Russian olive). 19

18. *Salix amygdaloides* (peach-leaf willow) with a greater canopy cover than *Elaeagnus angustifolia* (Russian olive). . . . . ***Salix amygdaloides* (peach-leaf willow) Community Type (p. 00)**

18. *Elaeagnus angustifolia* (Russian olive) with a greater canopy cover than *Salix amygdaloides* (peach-leaf willow). . . . . ***Elaeagnus angustifolia* (Russian olive) Community Type (p. 00)**

19. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

19. Not a riparian or wetland site; refer to the following for possible fit: Hansen and others 1985, Hansen and Hoffman 1988, Mueggler 1988, Mackie 1970.

KEY TO SHRUB COMMUNITIES

Shrubs present with a combined canopy cover of at least 10 percent.

1. Willows with at least 10 percent canopy cover. . . . . **Willow Key**

1. Willows with less than 10 percent canopy cover. . . . . **Non-Willow Key (p. 00)**

WILLOW KEY

1. *Salix geyeriana* (Geyer willow), *S. boothii* (Booth willow), *S. drummondiana* (Drummond willow), or *S. lutea* (yellow willow), individually or in combination, with at least 10 percent canopy cover. **2**

1. *Salix geyeriana* (Geyer willow), *S. boothii* (Booth willow), *S. drummondiana* (Drummond willow), or *S. lutea* (yellow willow), individually or in combination, with less than 10 percent canopy cover. **10**

2. *Salix lutea* (yellow willow) with a greater canopy cover than *S. drummondiana* (Drummond willow) ***OR*** the combined canopy cover of *S. geyeriana* (Geyer willow) and *S. boothii* (Booth willow). . . . **3**

2. *Salix drummondiana* (Drummond willow) ***OR*** the combined canopy cover of *S. geyeriana* (Geyer willow) and *S. boothii* (Booth willow) with a greater canopy cover than *S. lutea* (yellow willow). . . **5**

3. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water

sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 10 percent canopy cover. . . . . ***Salix lutea/Carex rostrata*** **(yellow willow/beaked sedge) Habitat Type (p. 00)**

3. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 10 percent canopy cover. 4

    4. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Salix lutea/Calamagrostis canadensis*** **(yellow willow/bluejoint reedgrass) Habitat Type (p. 00)**

    4. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with less than 5 percent canopy cover. . . . . ***Salix lutea*** **(yellow willow) Community Type (p. 00)**

5. *Salix geyeriana* (Geyer willow) or *S. boothii* (Booth willow), individually or in combination, with a greater canopy cover than *Salix drummondiana* (Drummond willow). 8

5. *Salix drummondiana* (Drummond willow) with a greater canopy cover than the combined canopy cover of *S. geyeriana* (Geyer willow) and *S. boothii* (Booth willow). 6

    6. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 10 percent canopy cover. . . . ***Salix drummondiana/Carex rostrata*** **(Drummond willow/beaked sedge) Habitat Type (p. 00)**

    6. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 10 percent canopy cover. 7

7. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Salix drummondiana/Calamagrostis canadensis*** **(Drummond willow/bluejoint reedgrass) Habitat Type (p. 00)**

7. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with less than 5 percent canopy cover. . . . . ***Salix drummondiana*** **(Drummond willow) Community Type (p. 00)**

    8. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), *C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 10 percent canopy cover. . . . . ***Salix geyeriana/Carex rostrata*** **(Geyer willow/beaked sedge) Habitat Type (p. 00)**

8. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge),*C. atherodes* (awned sedge), *C. aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 10 percent canopy cover. **9**

9. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with at least 5 percent canopy cover. . . . . ***Salix geyeriana/Calamagrostis canadensis* (Geyer willow/bluejoint reedgrass) Habitat Type (p. 00)**

9. *Calamagrostis canadensis* (bluejoint reedgrass), *C. stricta* (narrow-spiked reedgrass), or *Deschampsia cespitosa* (tufted hairgrass), individually or in combination, with less than 5 percent canopy cover. . . . . ***Salix geyeriana* (Geyer willow) Community Type (p. 00)**

10. *Salix planifolia* (planeleaf willow) or *S. commutata* (undergreen willow), individually or in combination, with at least 10 percent canopy cover. . . . . ***Salix planifolia/Carex aquatilis* (planeleaf willow/water sedge) Habitat Type (p. 00)**

10. *Salix planifolia* (planeleaf willow) or *S. commutata* (undergreen willow), individually or in combination, with less than 10 percent canopy cover. **11**

11. *Salix candida* (hoary willow) with at least 10 percent canopy cover. . . . . ***Salix candida/Carex rostrata* (hoary willow/beaked sedge) Habitat Type (p. 00)**

11. *Salix candida* (hoary willow) with less than 10 percent canopy cover. **12**

12. *Salix wolfii* (Wolf's willow) with at least 10 percent canopy cover. **13**

12. *Salix wolfii* (Wolf's willow) with less than 10 percent canopy cover. **14**

13. *Carex aquatilis* (water sedge), *C. rostrata* (beaked sedge), *C. atherodes* (awned sedge), *C. vesicaria* (inflated sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 5 percent canopy cover. . . . . ***Salix wolfii/Carex aquatilis* (Wolf's willow/water sedge) Habitat Type (p. 00)**

13. *Carex aquatilis* (water sedge), *C. rostrata* (beaked sedge), *C. atherodes* (awned sedge), *C. vesicaria* (inflated sedge), or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 5 percent canopy cover. . . . . ***Salix wolfii/Deschampsia cespitosa* (Wolf's willow/tufted hairgrass) Habitat Type (p. 00)**

14. ***Individual non-willow species*** with a greater canopy cover than any ***individual willow species***. . . . . **GO TO THE NON-WILLOW KEY (p. 00)**

14. ***Individual willow species*** with a greater canopy cover than any ***individual non-willow species***. **15**

15. *Salix lasiandra* (Pacific willow) with a greater canopy cover than any other individual willow species. . . . . ***Salix lasiandra* (Pacific willow) Community Type (p. 00)**

15. Other individual willow species with a greater canopy cover than *Salix lasiandra* (Pacific willow). . . **16**

16. *Salix bebbiana* (Bebb willow) with a greater canopy cover than any other individual willow species. . . . . ***Salix bebbiana* (Bebb willow) Community Type (p. 00)**

16. Other individual willow species with a greater canopy cover than *Salix bebbiana* (Bebb willow). . **17**

17. *Salix exigua* (sandbar willow) with a greater canopy cover than any other individual willow species. . . . . ***Salix exigua* (sandbar willow) Community Type (p. 00)**

17. Other individual willow species with a greater canopy cover than *Salix exigua* (sandbar willow). **18**

18. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

18. Not a riparian or wetland site.

NON-WILLOW KEY

1. *Betula glandulosa* (bog birch) with at least 10 percent canopy cover. . . . . ***Betula glandulosa/Carex rostrata* (bog birch/beaked sedge) Habitat Type (p. 00)**

1. *Betula glandulosa* (bog birch) with less than 10 percent canopy cover. **2**

2. *Kalmia microphylla* (small-leaved laurel) with at least 10 percent canopy cover. . . . . ***Kalmia microphylla/Carex scopulorum* (small-leaved laurel/Holm's Rocky Mountain sedge) Habitat Type (p. 00)**

2. *Kalmia microphylla* (small-leaved laurel) with less than 10 percent canopy cover. **3**

3. *Potentilla fruticosa* (shrubby cinquefoil) with at least 10 percent canopy cover. . . . . ***Potentilla fruticosa/Deschampsia cespitosa* (shrubby cinquefoil/tufted hairgrass) Habitat Type (p. 00)**

3. *Potentilla fruticosa* (shrubby cinquefoil) with less than 10 percent canopy cover. **4**

4. *Artemisia cana* (silver sagebrush) with at least 10 percent canopy cover. . . . . ***Artemisia cana/Festuca idahoensis* (silver sagebrush/Idaho fescue) Habitat Type (p. 00)**

4. *Artemisia cana* (silver sagebrush) with less than 10 percent canopy cover. 5

5. *Sarcobatus vermiculatus* (black greasewood) with at least 10 percent canopy cover. . . . . ***Sarcobatus vermiculatus/Agropyron smithii* (black greasewood/western wheatgrass) Habitat Type (p. 00)**

5. *Sarcobatus vermiculatus* (black greasewood) with less than 10 percent canopy cover. 6

6. *Betula occidentalis* (water birch) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Betula occidentalis* (water birch) Community Type (p. 00)**

6. *Betula occidentalis* (water birch) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 7

7. *Alnus incana* (mountain alder) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Alnus incana* (mountain alder) Community Type (p. 00)**

7. *Alnus incana* (mountain alder) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 8

8. *Alnus sinuata* (sitka alder) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Alnus sinuata* (sitka alder) Community Type (p. 00)**

8. *Alnus sinuata* (sitka alder) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 9

9. *Shepherdia argentea* (thorny buffaloberry) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Shepherdia argentea* (thorny buffaloberry) Community Type (p. 00)**

9. *Shepherdia argentea* (thorny buffaloberry) with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 10

10. *Crataegus succulenta* (succulent hawthorn) or *C. douglasii* (black hawthorn), individually or in combination, with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in the tallest layer. . . . . ***Crataegus succulenta* (succulent hawthorn) Community Type (p. 00)**

10. *Crataegus succulenta* (succulent hawthorn) or *C. douglasii* (black hawthorn), individually or in combination, with less than 15 percent canopy cover *OR WITHOUT* the greatest canopy cover in the tallest layer. 11

11. *Tamarix chinensis* (salt cedar) with at least 15 percent canopy cover *AND WITH* the greatest canopy cover in

the tallest layer. . . . . ***Tamarix chinensis* (salt cedar) Community Type (p. 00)**

11. *Tamarix chinensis* (salt cedar) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **12**

    12. *Prunus virginiana* (common chokecherry) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. . . . . ***Prunus virginiana* (common chokecherry) Community Type (p. 00)**

    12. *Prunus virginiana* (common chokecherry) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **13**

13. *Cornus stolonifera* (red-osier dogwood) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. . . . ***Cornus stolonifera* (red-osier dogwood) Community Type (p. 00)**

13. *Cornus stolonifera* (red-osier dogwood) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **14**

    14. *Spiraea douglasii* (Douglas's spiraea) with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. . . . . ***Spiraea douglasii* (Douglas's spiraea) Community Type (p. 00)**

    14. *Spiraea douglasii* (Douglas's spiraea) with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **15**

15. *Rosa woodsii* (woods rose) or *R. acicularis* (prickly rose), individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. . . . . ***Rosa woodsii* (woods rose) Community Type (p. 00)**

15. *Rosa woodsii* (woods rose) or *R. acicularis* (prickly rose), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **16**

    16. *Symphoricarpos occidentalis* (western snowberry) or *S. albus* (common snowberry), individually or in combination, with at least 15 percent canopy cover ***AND WITH*** the greatest canopy cover in the tallest layer. . . . . ***Symphoricarpos occidentalis* (western snowberry) Community Type (p. 00)**

    16. *Symphoricarpos occidentalis* (western snowberry) or *S. albus* (common snowberry), individually or in combination, with less than 15 percent canopy cover ***OR WITHOUT*** the greatest canopy cover in the tallest layer. **16**

17. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

17. Not a riparian or wetland site; refer to following publications for possible fit: Mueggler and Stewart 1980, Hansen and others 1985, Hansen and Hoffman 1988.

KEY TO HERBACEOUS COMMUNITIES

Herbaceous species present with a combined canopy cover of at least 15 percent, or emergent herbaceous species with at least 5 percent cover.

1. Sedge species with a combined canopy cover of at least 25 percent. . . . . **Sedge Key**

1. Sedge species with a combined canopy cover of less than 25 percent. . . . . **Non-Sedge Key (p. 00)**

SEDGE KEY

1. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), or *C. atherodes* (awned sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex rostrata* (beaked sedge) Habitat Type (p. 00)**

   a. *Carex aquatilis* (water sedge), *C. lenticularis* (lentil-fruit sedge), or grass species, individually or in combination, with less than 5 percent canopy cover. . . . . ***Carex rostrata* (beaked sedge) Phase**

   b. *Carex aquatilis* (water sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 5 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Phase**

   c. *Carex aquatilis* (water sedge), or *C. lenticularis* (lentil-fruit sedge) individually or in combination, with less than 5 percent canopy cover; grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with at least 5 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Phase**

1. *Carex rostrata* (beaked sedge), *C. vesicaria* (inflated sedge), or *C. atherodes* (awned sedge), individually or in combination, with less than 25 percent canopy cover. **2**

   2. *Carex aquatilis* (water sedge), *C. aperta* (Columbia sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Habitat Type (p. 00)**

      a. Grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with less than 5 percent canopy cover. . . . . ***Carex aquatilis* (water sedge) Phase**

b. Grass species, or *Juncus balticus* (Baltic rush), individually or in combination, with at least 5 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Phase**

2. *Carex aquatilis* (water sedge), *C. aperta* (Columbia sedge) or *C. lenticularis* (lentil-fruit sedge), individually or in combination, with less than 25 percent canopy cover. 3

3. *Carex limosa* (mud sedge) with at least 25 percent canopy cover. . . . . ***Carex limosa* (mud sedge) Habitat Type (p. 00)**

3. *Carex limosa* (mud sedge) with less than 25 percent canopy cover. 4

4. *Carex lasiocarpa* (slender sedge), *C. lanuginosa* (woolly sedge), or *C. buxbaumii* (Buxbaum's sedge), individually or in combination, with at least 25 percent canopy cover. . . . . ***Carex lasiocarpa* (slender sedge) Habitat Type (p. 00)**

4. *Carex lasiocarpa* (slender sedge), *C. lanuginosa* (woolly sedge), or *C. buxbaumii* (Buxbaum's sedge), individually or in combination, with less than 25 percent canopy cover. 5

5. *Carex simulata* (short-beaked sedge) with at least 25 percent canopy cover. . . . . ***Carex simulata* (short-beaked sedge) Habitat Type (p. 00)**

5. *Carex simulata* (short-beaked sedge) with less than 25 percent canopy cover. 6

6. *Carex scopulorum* (Holm's Rocky Mountain sedge) with at least 25 percent canopy cover. . . . . ***Carex scopulorum* (Holm's Rocky Mountain sedge) Habitat Type (p. 00)**

6. *Carex scopulorum* (Holm's Rocky Mountain sedge) with less than 25 percent canopy cover. . . . . **READ THE FOLLOWING PARAGRAPH**

The following herbaceous communities represent seral or human-caused disturbance communities. Before you use this portion of the key, do the following:

A. Carefully examine the stand and determine if *ANY* shrub species are present. If so, go back through the shrub key (p. 00) and reduce all canopy coverages to "present".

B. If *NO* shrub species are present, then go back through the herbaceous key and reduce all canopy coverages to 5 percent.

C. If the stand still does not key out, then use the following key to *EITHER* major seral or disturbance herbaceous community types *OR* unclassified riparian or wetland sites.

1. *Carex nebrascensis* (Nebraska sedge) with a greater canopy cover than any other individual sedge species. . . . . ***Carex nebrascensis* (Nebraska sedge) Community Type (p. 00)**

1. Other individual sedge species with a greater canopy cover than *Carex nebrascensis* (Nebraska sedge). 2

2. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

2. Not a riparian or wetland site.

NON-SEDGE KEY

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with at least 25 percent canopy cover. . . . . ***Typha latifolia* (common cattail) Habitat Type (p. 00)**

1. *Typha latifolia* (common cattail) or *T. angustifolia* (narrow-leaved cattail), individually or in combination, with less than 25 percent canopy cover. 2

2. *Scirpus acutus* (hardstem bulrush) or *S. validus* (softstem bulrush), individually or in combination, with at least 15 percent canopy cover. . . . ***Scirpus acutus* (hardstem bulrush) Habitat Type (p. 00)**

2. *Scirpus acutus* (hardstem bulrush) or *S. validus* (softstem bulrush), individually or in combination, with less than 15 percent canopy cover. 3

3. *Phragmites australis* (common reed) with at least 25 percent canopy cover. . . . . ***Phragmites australis* (common reed) Habitat Type (p. 00)**

3. *Phragmites australis* (common reed) with less than 25 percent canopy cover. 4

4. *Phalaris arundinacea* (reed canarygrass) with at least 25 percent canopy cover. . . . . ***Phalaris arundinacea* (reed canarygrass) Habitat Type (p. 00)**

4. *Phalaris arundinacea* (reed canarygrass) with less than 25 percent canopy cover. 5

5. *Equisetum fluviatile* (water horsetail) with at least 25 percent canopy cover. . . . . ***Equisetum fluviatile* (water horsetail) Habitat Type (p. 00)**

5. *Equisetum fluviatile* (water horsetail) with less than 25 percent canopy cover. 6

6. *Glyceria borealis* (northern mannagrass) with at least 25 percent canopy cover. . . . . ***Glyceria borealis* (northern mannagrass) Habitat Type (p. 00)**

6. *Glyceria borealis* (northern mannagrass) with less than 25 percent canopy cover. 7

7. *Eleocharis palustris* (common spikesedge) or *E. acicularis* (needle spike-rush), individually or in combination, with at least 25 percent canopy cover. . . . . ***Eleocharis palustris* (common spikesedge) Habitat Type (p. 00)**

7. *Eleocharis palustris* (common spikesedge) or *E. acicularis* (needle spike-rush), individually or in combination, with less than 25 percent canopy cover. 8

8. *Eleocharis pauciflora* (few-flowered spike-rush) or *E. rostellata* (beaked spike-rush), individually or in combination, with at least 25 percent canopy cover. . . . . ***Eleocharis pauciflora* (few-flowered spike-rush) Habitat Type (p. 00)**

8. *Eleocharis pauciflora* (few-flowered spike-rush) or *E. rostellata* (beaked spike-rush), individually or in combination, with less than 25 percent canopy cover. 9

9. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with at least 25 percent canopy cover. . . . . ***Calamagrostis canadensis* (bluejoint reedgrass) Habitat Type (p. 00)**

9. *Calamagrostis canadensis* (bluejoint reedgrass) or *C. stricta* (narrow-spiked reedgrass), individually or in combination, with less than 25 percent canopy cover. 10

10. *Deschampsia cespitosa* (tufted hairgrass) with at least 15 percent canopy cover. . . . . ***Deschampsia cespitosa* (tufted hairgrass) Habitat Type (p. 00)**

10. *Deschampsia cespitosa* (tufted hairgrass) with less than 15 percent canopy cover. 11

11. *Distichlis spicata* (inland saltgrass) with at least 25 percent canopy cover. . . . . ***Distichlis spicata* (inland saltgrass) Habitat Type (p. 00)**

11. *Distichlis spicata* (inland saltgrass) with less than 25 percent canopy cover. 12

12. *Agropyron smithii* (western wheatgrass) with at least 25 percent canopy cover. . . . . ***Agropyron smithii* (western wheatgrass) Habitat Type (p. 00)**

12. *Agropyron smithii* (western wheatgrass) with less than 25 percent canopy cover. . . . . **READ THE FOLLOWING PARAGRAPH**

The following herbaceous communities represent seral or human-caused disturbance communities. Before you use this portion of the key, do the following:

A. Carefully examine the stand and determine if *ANY* tree or shrub species are present. If so, go back through the tree or shrub key (p. 00) and reduce all canopy coverages to "present".

B. If *NO* tree or shrub species are present, then go back through the herbaceous key and reduce all canopy coverages to 5 percent; ignore the presence of the biennial forbs *Melilotus alba* (white sweet-clover) and *Melilotus officinalis* (yellow sweet-clover).

C. If the stand still does not key out, then use the following key to ***EITHER*** major seral or disturbance herbaceous community types ***OR*** unclassified riparian or wetland sites.

1. *Senecio triangularis* (arrowleaf groundsel) with at least 5 percent canopy cover, ***OR*** two of the following species present: *Senecio triangularis* (arrowleaf groundsel), *Parnassia fimbriata* (fringed grass-of-parnassus), angelica species, or *Elymus glaucus* (blue wildrye). . . . . ***Senecio triangularis* (arrowleaf groundsel) Community Type (p. 00)**

1. *Senecio triangularis* (arrowleaf groundsel) with less than 5 percent canopy cover, ***OR*** not as above. . . . 2

2. *Salicornia rubra* (red glasswort) with a greater canopy cover than any other individual herbaceous species. . . . . ***Salicornia rubra* (red glasswort) Community Type (p. 00)**

2. Other individual herbaceous species with a greater canopy cover than *Salicornia rubra* (red glasswort). 3

3. *Poa palustris* (fowl bluegrass) with a greater canopy cover than any other individual herbaceous species. . . . . ***Poa palustris* (fowl bluegrass) Community Type (p. 00)**

3. Other individual herbaceous species with a greater canopy cover than *Poa palustris* (fowl bluegrass). 4

4. *Bromus inermis* (smooth brome) with a greater canopy cover than any other individual herbaceous species. . . . . ***Bromus inermis* (smooth brome) Community Type (p. 00)**

4. Other individual herbaceous species with a greater canopy cover than *Bromus inermis* (smooth brome). 5

5. *Juncus balticus* (Baltic rush) with a greater canopy cover than any other individual herbaceous species. . . . . ***Juncus balticus* (Baltic rush) Community Type (p. 00)**

5. Other individual herbaceous species with a greater canopy cover than *Juncus balticus* (Baltic rush). . . . 6

6. *Agrostis stolonifera* (redtop) with a greater canopy cover than any other individual herbaceous species. . . . . ***Agrostis stolonifera* (redtop) Community Type (p. 00)**

6. Other individual herbaceous species with a greater canopy cover than *Agrostis stolonifera* (redtop). 7

7. *Hordeum jubatum* (foxtail barley) with a greater canopy cover than any other individual herbaceous species. . . . . ***Hordeum jubatum* (foxtail barley) Community Type (p. 00)**

7. Other individual herbaceous species with a greater canopy cover than *Hordeum jubatum* (foxtail barley). 8

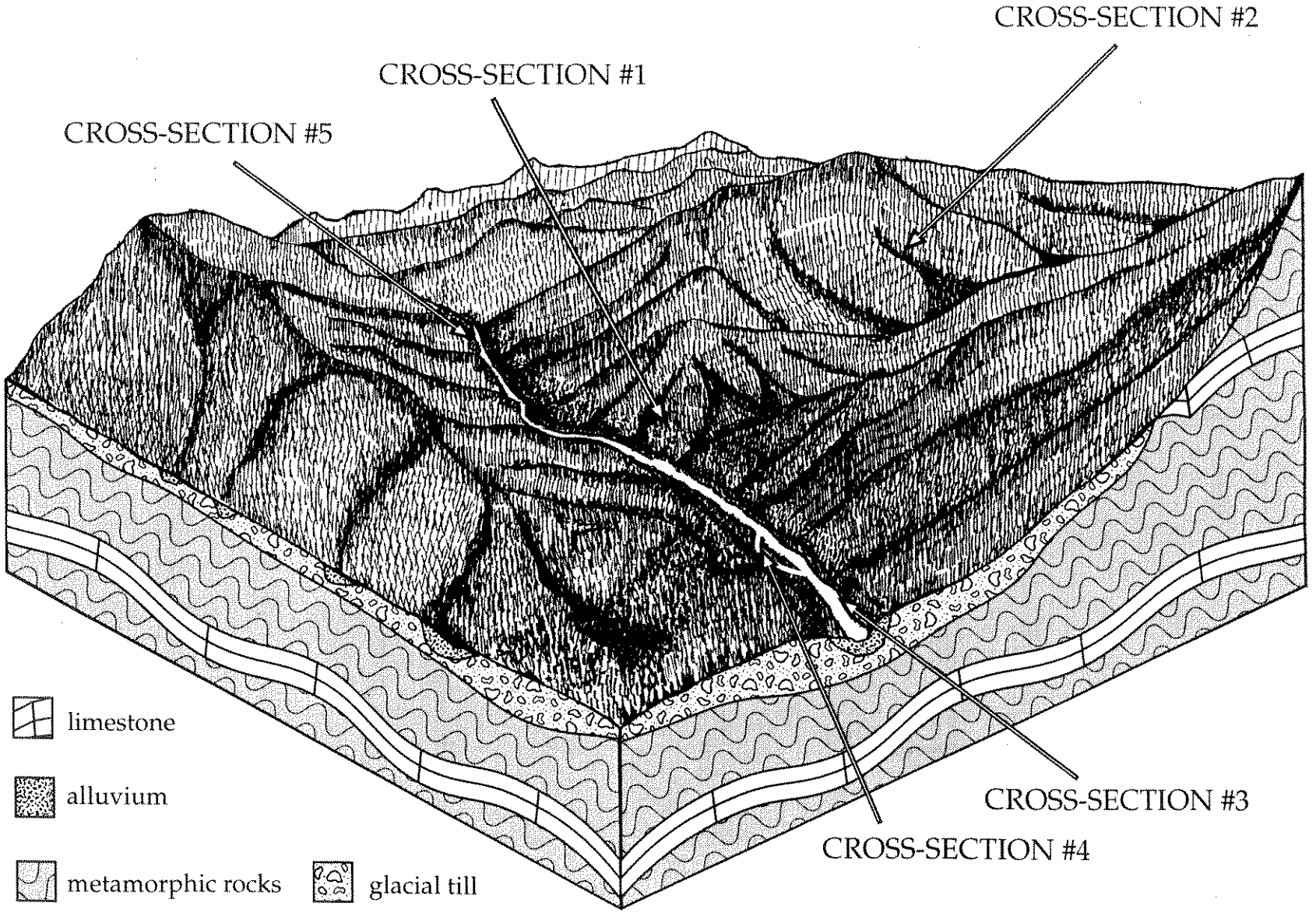
8. *Poa pratensis* (Kentucky bluegrass) with a greater canopy cover than any other individual herbaceous species. . . . . ***Poa pratensis* (Kentucky bluegrass) Community Type (p. 00)**

8. Other individual herbaceous species with a greater canopy cover than *Poa pratensis* (Kentucky bluegrass). 9

9. Unclassified riparian or wetland site. For management purposes, use the Riparian Dominance Types of Montana by Hansen and others (1988), Miscellaneous Publication No. 49, Montana Forest and Conservation Experiment Station, School of Forestry, University of Montana, Missoula, MT, to identify and describe the stand. (Dominance type is named by the species with the greatest canopy coverage in the overstory or upper layer. However, in order for a species to be considered a dominance type, it must have at least 25 percent canopy cover in the stand.)

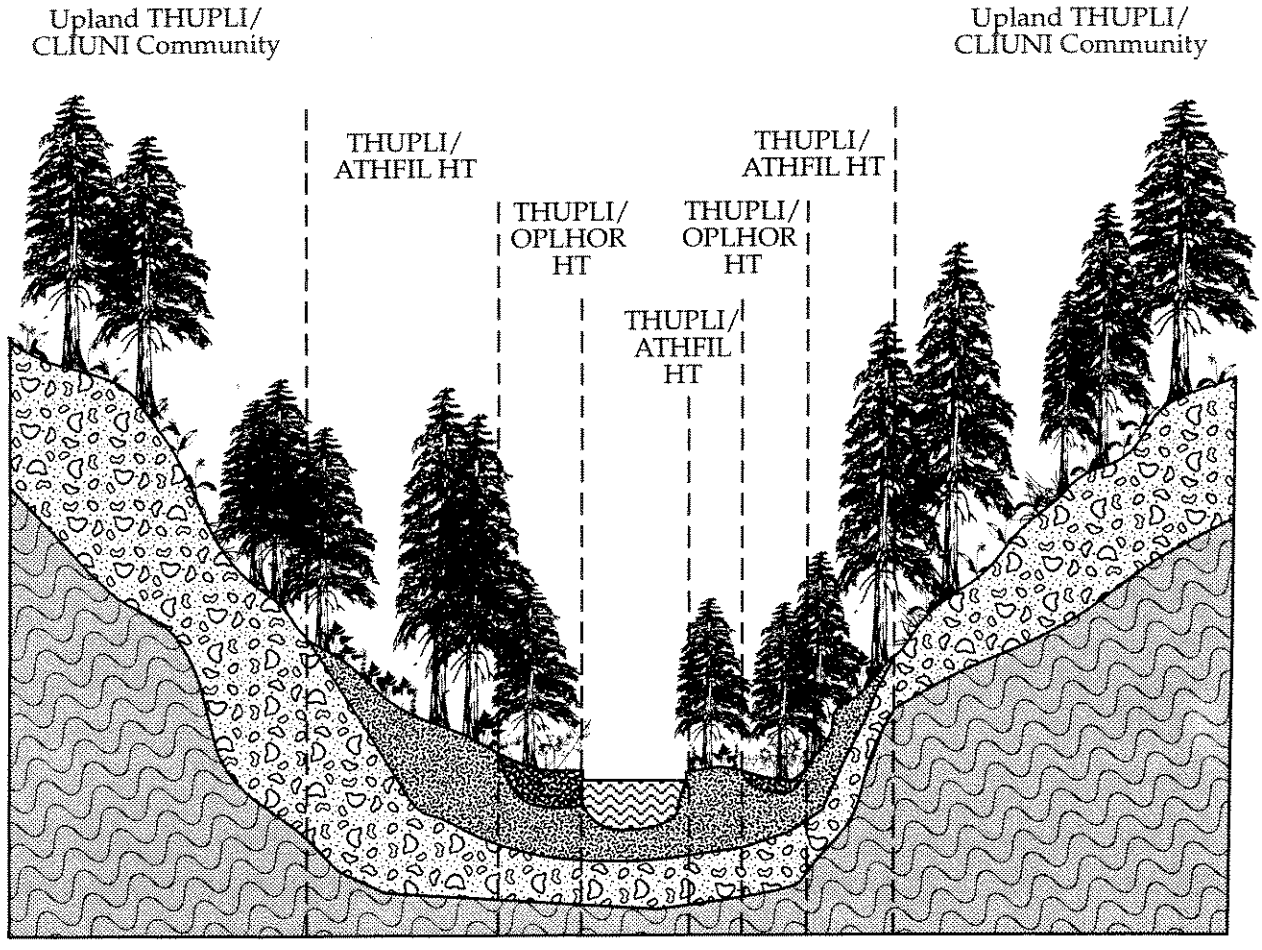
9. Not a riparian or wetland site; refer to the following publications for possible fit: Mueggler and Stewart 1980, Hansen and others 1985, Hansen and Hoffman 1988.

NORTHWESTERN MONTANA



NORTHWESTERN MONTANA

CROSS-SECTION #1. Glacial Fill Riparian Complex
CROSS-SECTION #2. Glacial Till Riparian Complex (Steep)



High water tables and redoximorphic features are common with these soils. Tendencies for soil peds to fall apart easily (weak soil structures and coarse textures) can make close examination difficult.

Water tables are seasonally near the soil surface, but redoximorphic features are not readily identifiable. Highly oxygenated soil water in gravelly, coarse textured soils can limit the formation of redoximorphic features.

These are well drained upland soils derived from glacial till.

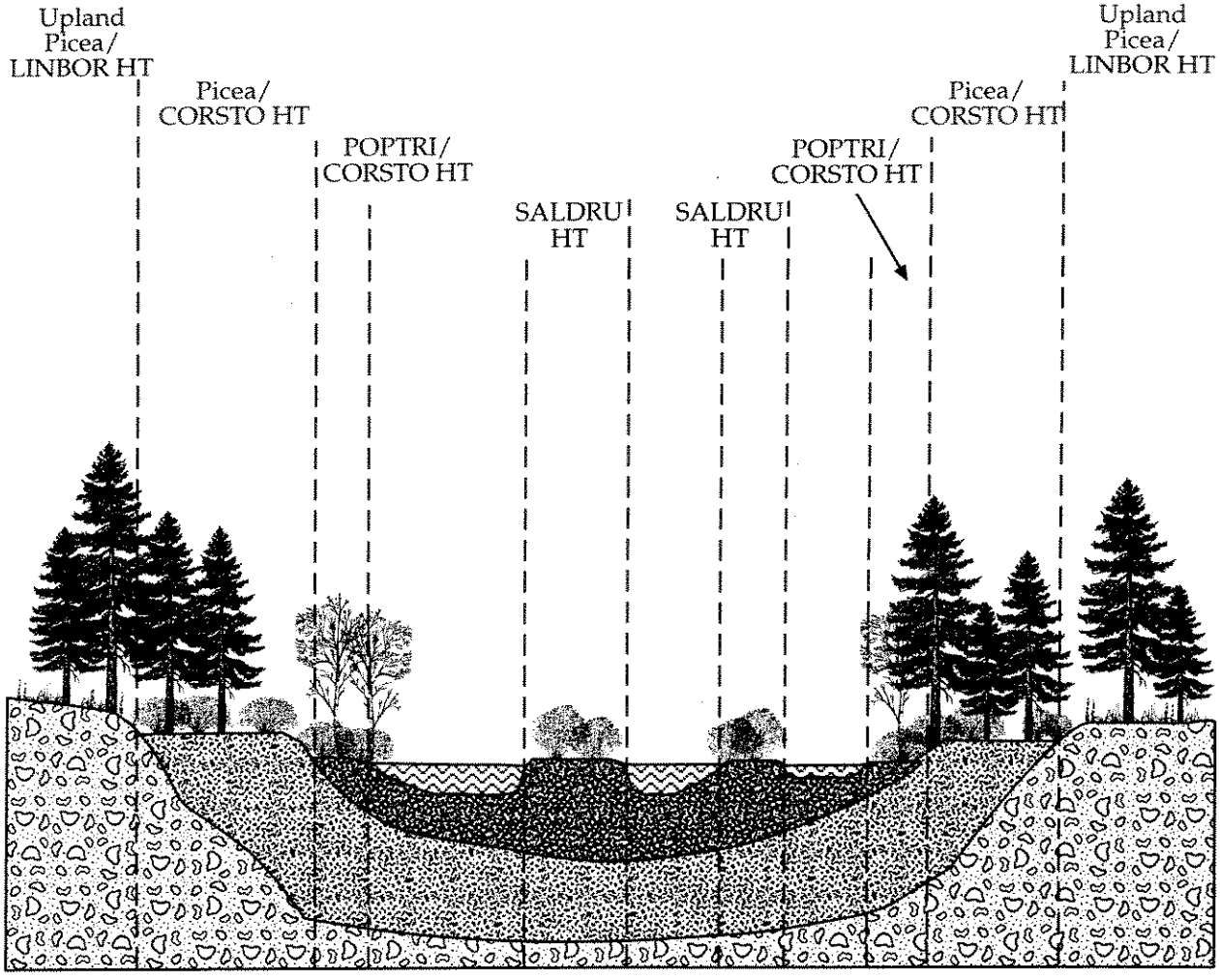
Undifferentiated bedrock parent materials.

Open water

Key: THUPLI/OPLHOR=*Thuja plicata/Oplopanax horridium* (western red cedar/devil's club)
THUPLI/ATHFIL=*Thuja plicata/Athyrium filix-femia* (western red cedar/ladyfern)
THUPLI/CLIUNI=*Thuja plicata/Clintonia uniflora* (western red cedar/queen's cup)

NORTHWESTERN MONTANA

CROSS-SECTION #3. Glacial Till Riparian Complex (Valley)



These soils can be either continuously or periodically saturated during the growing season. Hydric soil and wetland hydrology indicators are common.

These soils are temporarily, seasonally flooded. Redoximorphic features are not always found and can be difficult to identify. Tendencies for soil peds to fall apart easily (weak soil structures and coarse textures) can make close examination difficult

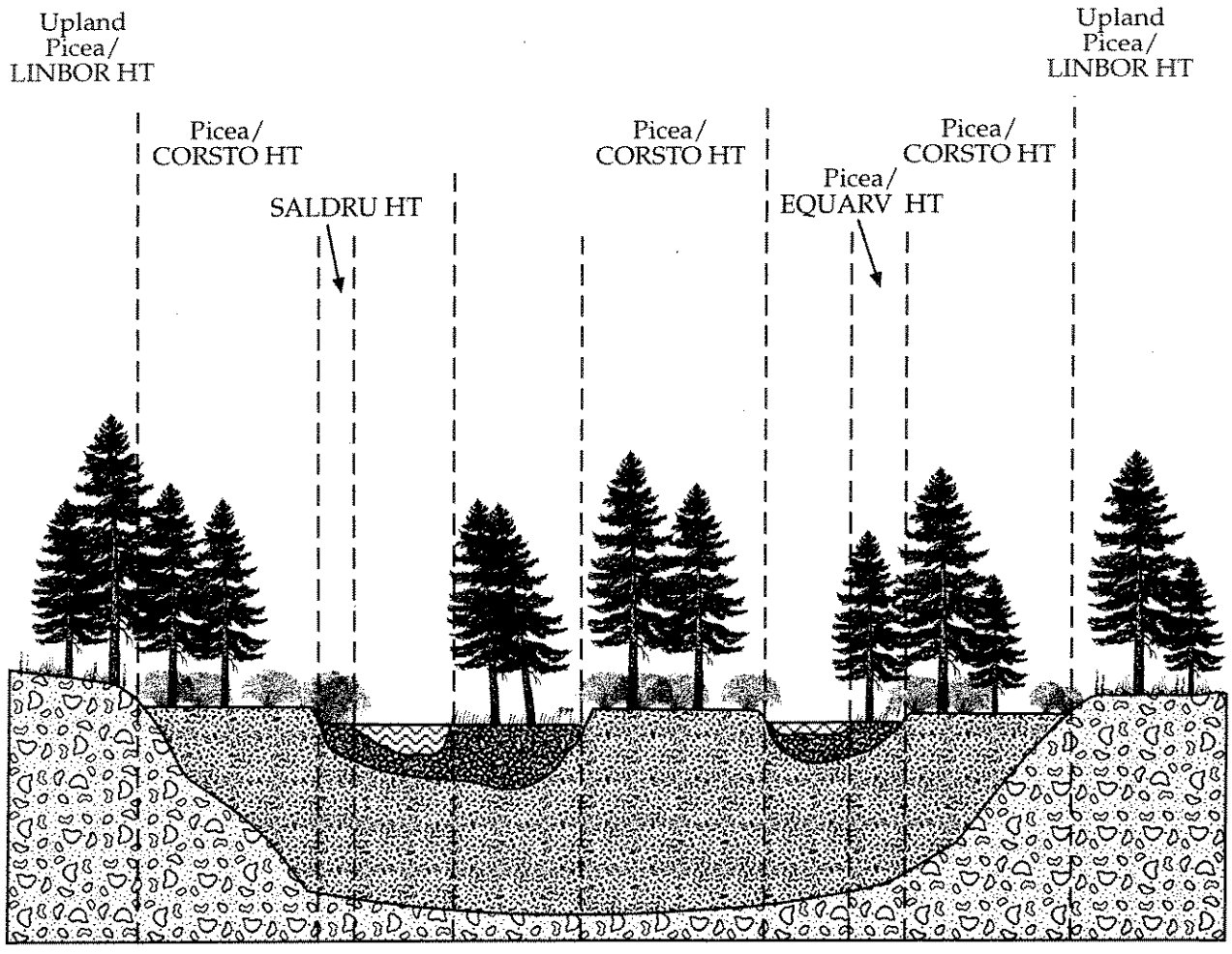
These are well-drained, weakly-developed upland soils derived from glacial till.

Open water

Key: Picea/LINBOR=*Picea/Linnaea borealis* (spruce/twinflower)
Picea/CORSTO=*Picea/Cornus stolonifera* (spruce/red-osier dogwood)
SALDRU=*Salix drummondiana* (Drummond willow)
POPTRI/CORSTO=*Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood

NORTHWESTERN MONTANA

CROSS-SECTION #4. Wet Meadow Complex



These soils can be either continuously or periodically saturated during the growing season. Redoximorphic features are common.

These soils are seasonally saturated during the growing season. Redoximorphic features are variable in amount, size and depth throughout the soil profile.

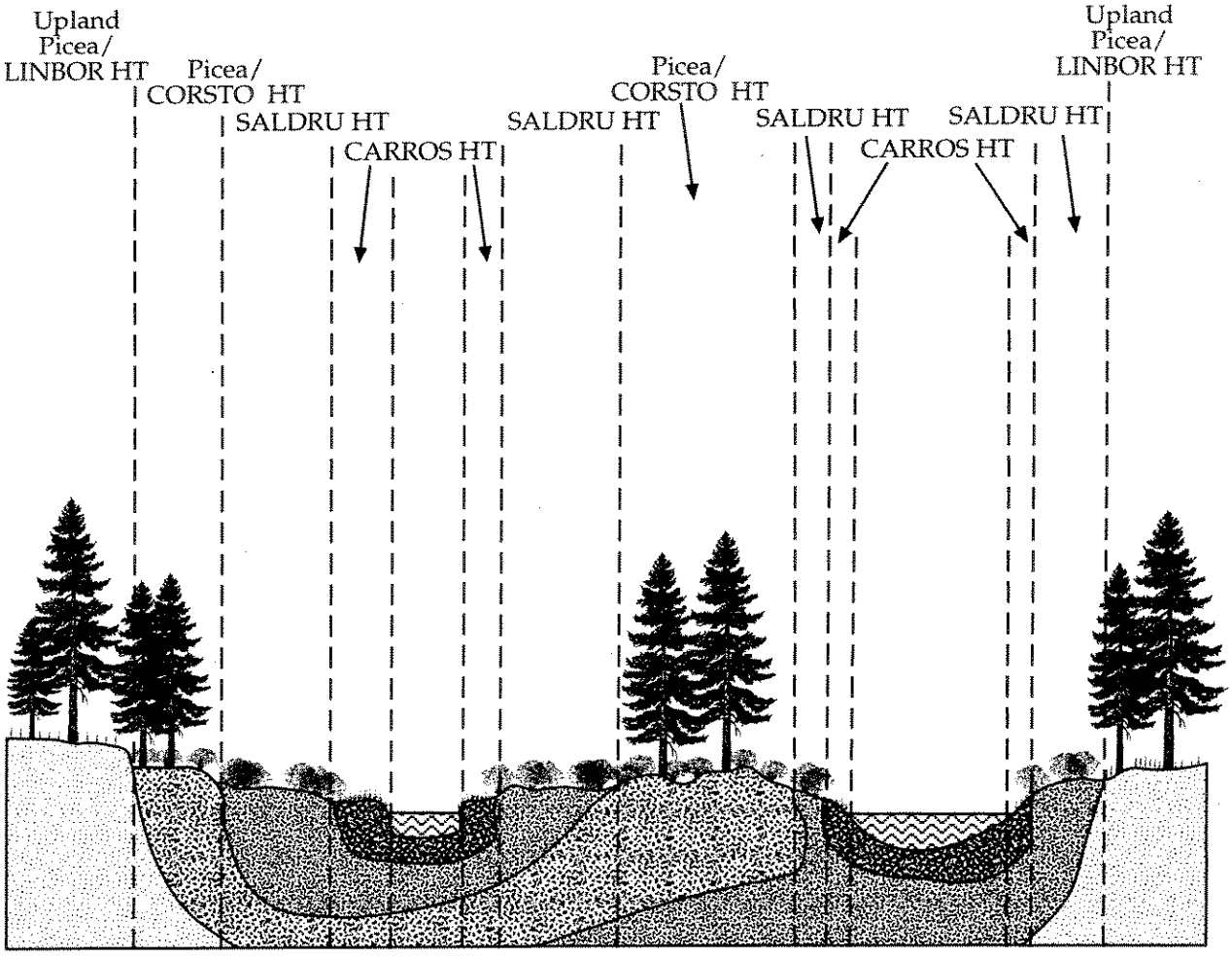
These are well drained weakly developed upland soils derived from glacial till.

Open water

Key: Picea/EQUARV=*Picea/Equisetum arvense* (spruce/field horsetail)
Picea/CORSTO=*Picea/Cornus stolonifera* (spruce/red-osier dogwood)
Picea/LINBOR=*Picea/Linnaea borealis* (spruce/red-osier dogwood)
SALDRU=*Salix drummondiana* (Drummond willow)

NORTHWESTERN MONTANA

CROSS-SECTION #5. ??? Complex



These are most commonly organic soils or mineral soils with organic surface layers and are saturated or inundated either throughout or for part of the growing season. Redoximorphic features are rarely absent.

Theses soils are highly variable having either mineral or organic surface layers. Water table depths can also vary but soils are generally saturated throughout for some part of the growing season. Redoximorphic features are variable throughout the soil.

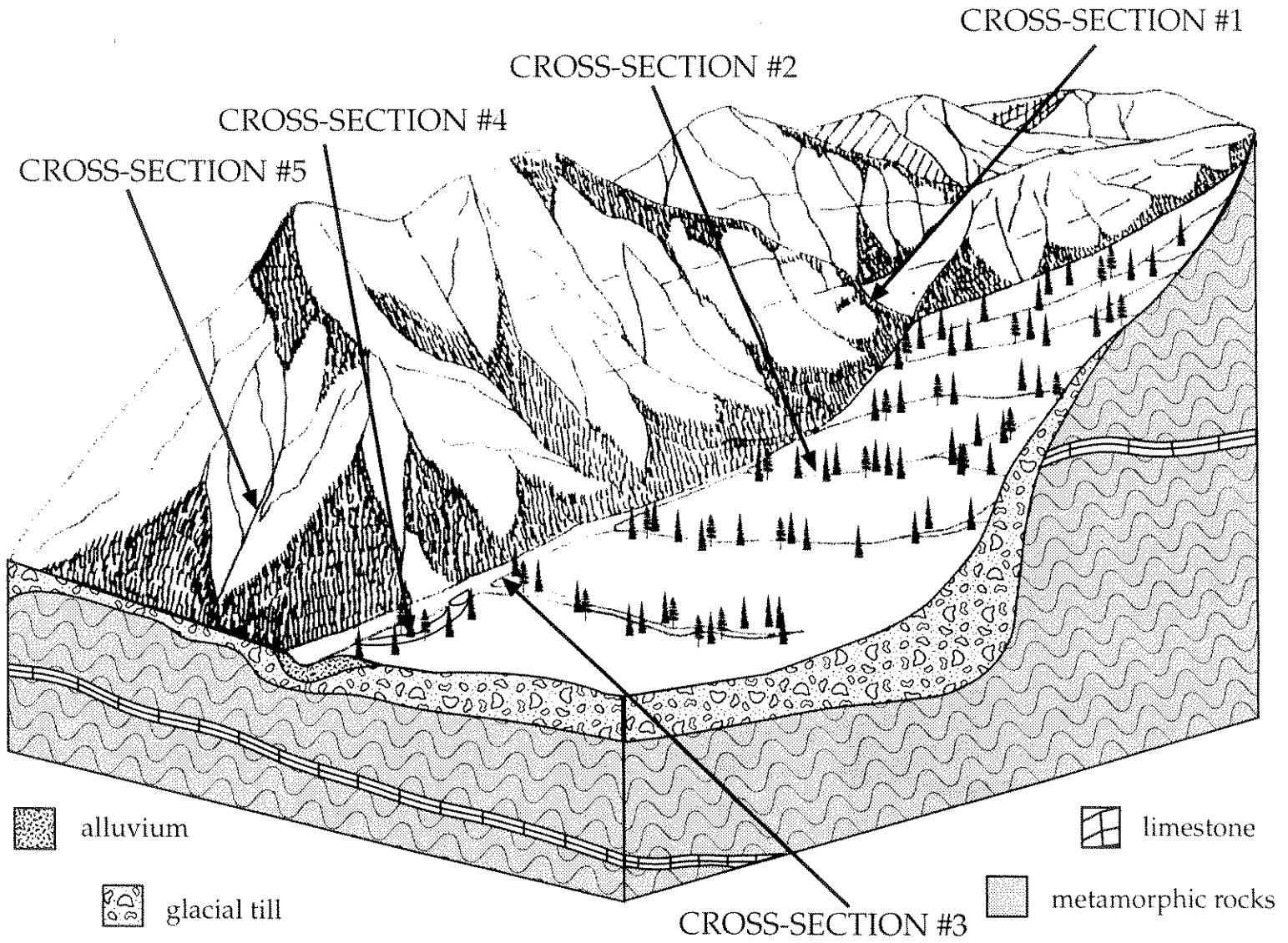
These soils are only temporarily, seasonally flooded. Redoximorphic features are not always found, but when present they are generally found in a subsurface soil layer.

These are well-drained upland soils.

Open water

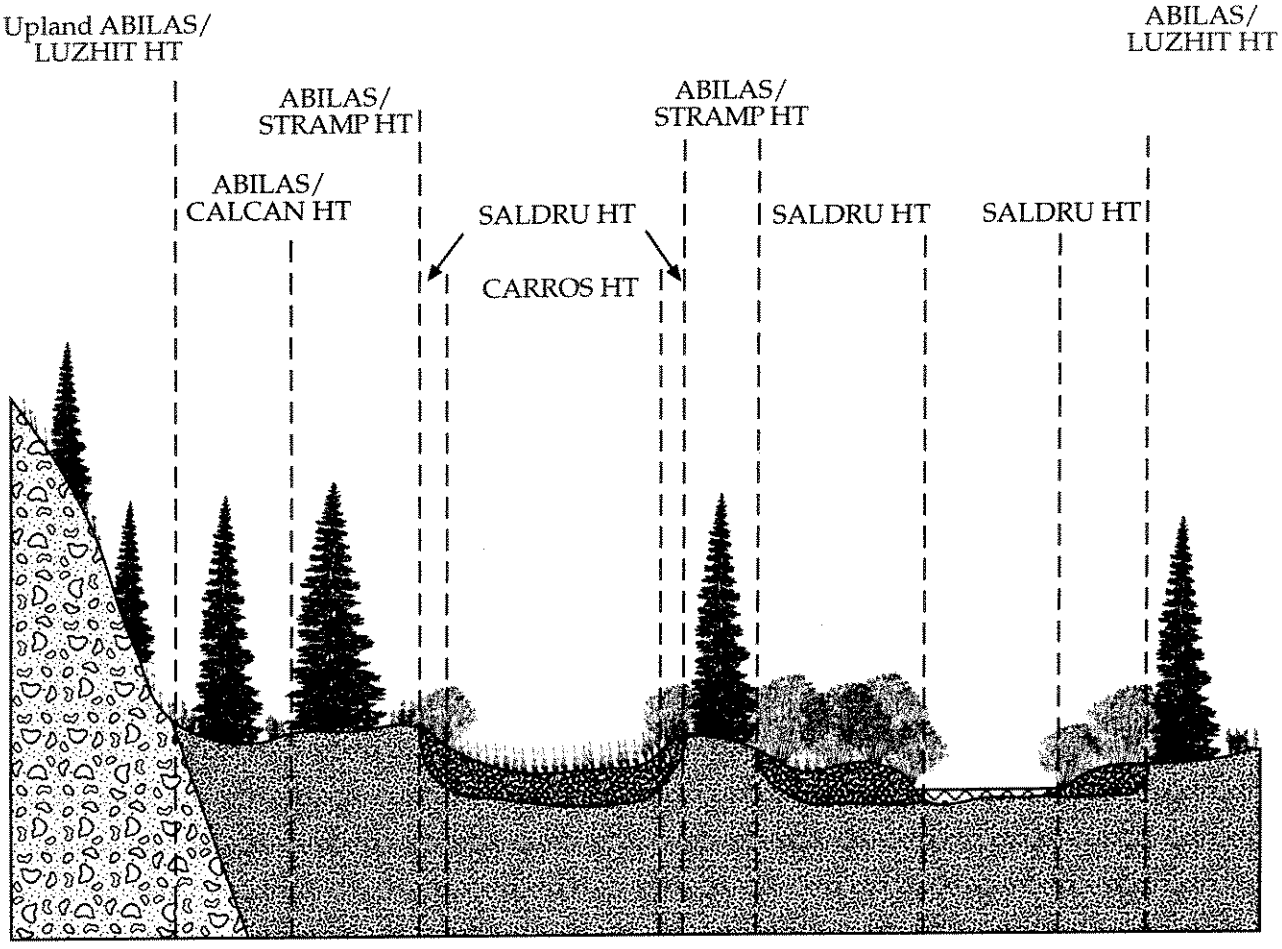
Key: CARROS=*Carex rostrata* (beaked sedge)
SALDRU=*Salix drummondiana* (Drummond willow)
Picea/CORSTO=*Picea/Cornus stolonifera* (spruce/red-osier dogwood)
Picea/LINBOR=*Picea/Linnaea borealis* (spruce/twinflower)

NORTHWESTERN MONTANA
GLACIAL VALLEY



NORTHWESTERN MONTANA GLACIAL VALLEY

CROSS-SECTION #1. Glacial Fill Riparian Complex
CROSS-SECTION #2. Glacial Till Riparian Complex (Steep)



These are most commonly organic soils or mineral soils with organic surface layers and are saturated or inundated either throughout or for most of the growing season. Redoximorphic features are present throughout the soil profile.

Water tables are seasonally near the soil surface, but redoximorphic features are not readily identifiable and are most common to subsurface layers.

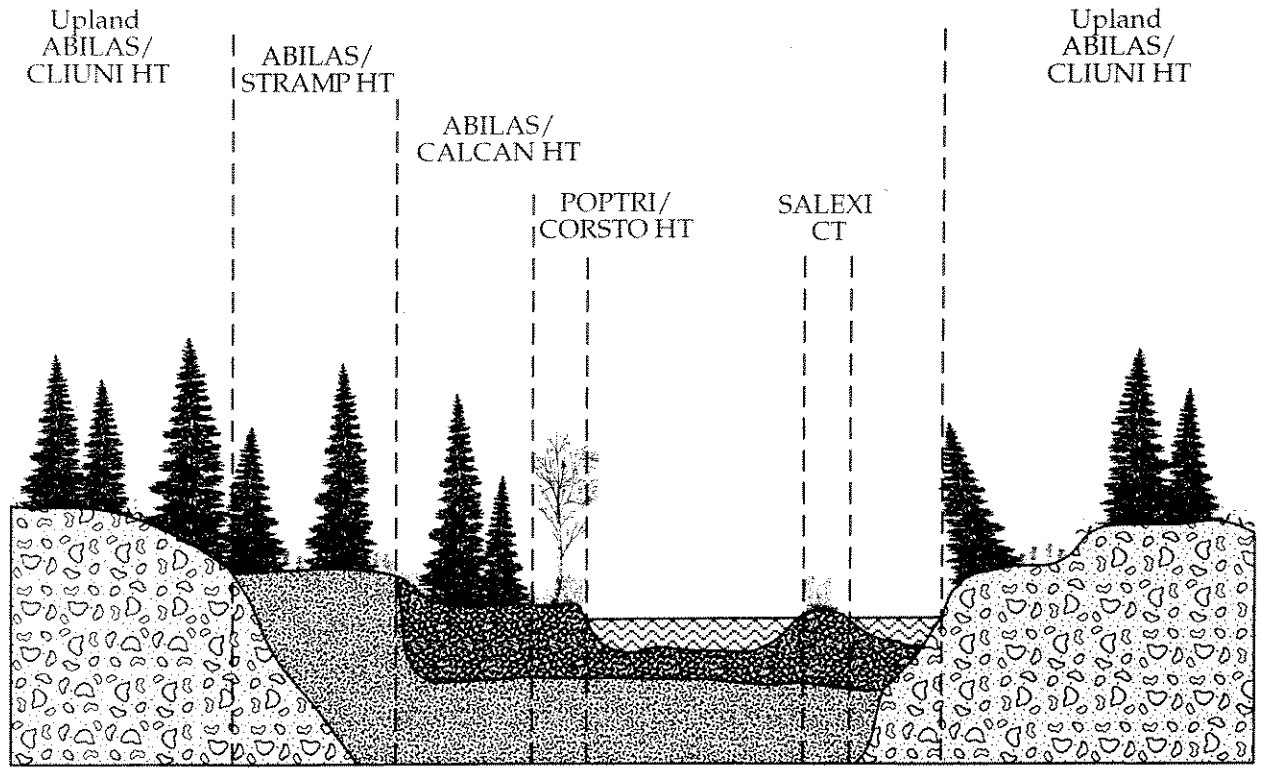
These are well drained upland soils derived from glacial till.

Open water

Key: CARROS=*Carex rostrata* (beaked sedge)
SALDRU=*Salix drummondiana* (Drummond willow)
ABILAS/CALCAN=*Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass)
ABILAS/STRAMP=*Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/clasping-leaved twisted stalk)
ABILAS/LUZHIT=*Abies lasiocarpa/Luzula hitchcockii* (subalpine fir/smooth woodrush)

NORTHWESTERN MONTANA GLACIAL VALLEY

CROSS-SECTION #3. Glacial Till Riparian Complex (Valley)



These soils are seasonally saturated during the growing season. Redoximorphic features are variable in amount, size and depth throughout the soil profile.

Water tables are seasonally near the soil surface, but redoximorphic features are not readily identifiable and are most common to subsurface layers.

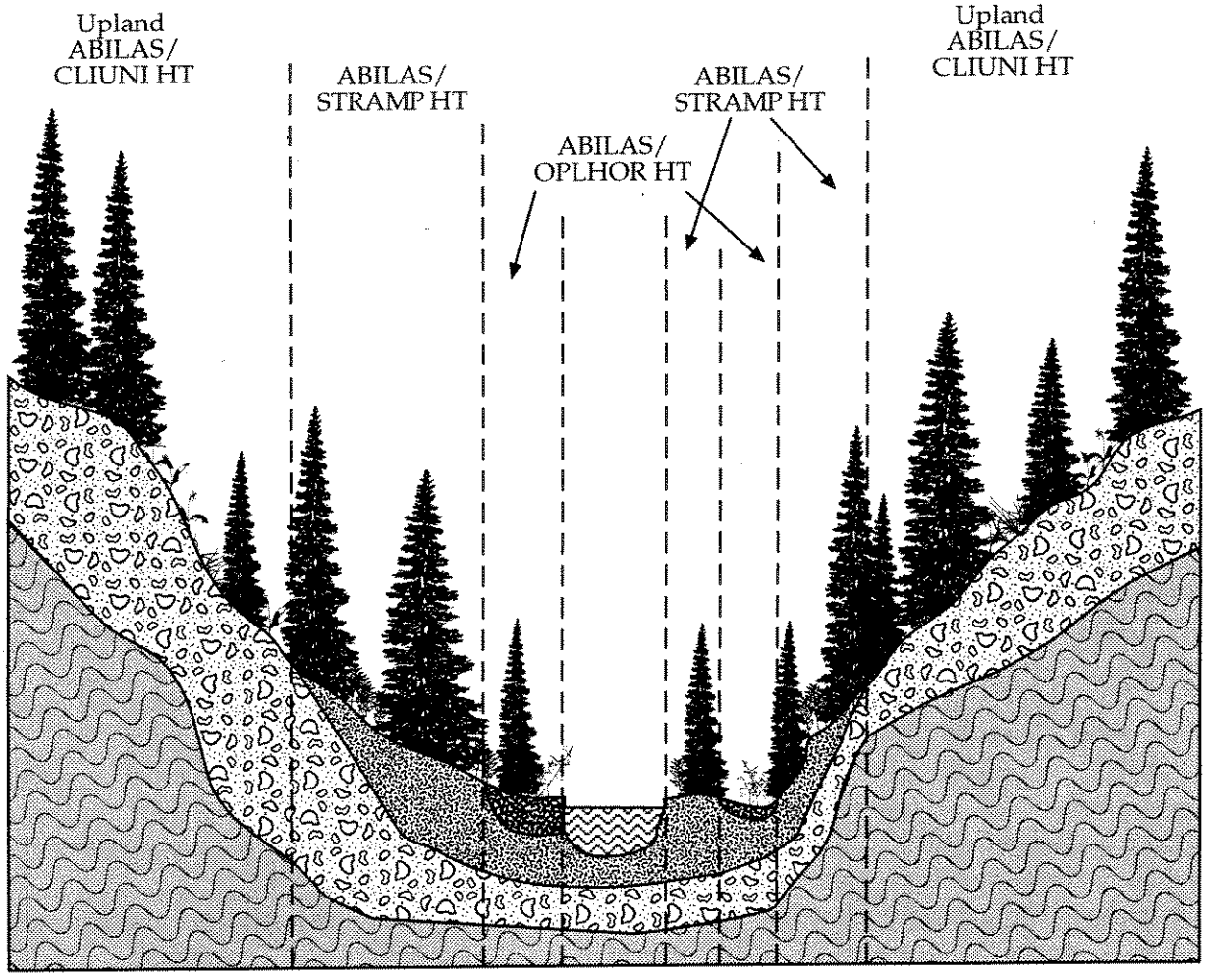
These are well drained upland soils derived from glacial till.

Open water

Key: ABILAS/CALCAN=*Abies lasiocarpa/Calamagrostis canadensis* (subalpine fir/bluejoint reedgrass)
ABILAS/STRAMP=*Abies lasiocarpa/Streptopus amplexifolius* (subalpine fir/clasping-leaved twisted stalk)
ABILAS/CLIUNI=*Abies lasiocarpa/Clintonia uniflora* (subalpine fir/queen's cup)
POPTRI/CORSTO=*Populus trichocarpa/Cornus stolonifera* (black cottonwood/red-osier dogwood)
SALEXI=*Salix exigua* (sandbar willow)

NORTHWESTERN MONTANA GLACIAL VALLEY

CROSS-SECTION #4. Wet Meadow Complex



High water tables and redoximorphic features are common with these soils. Tendencies for soil peds to fall apart easily (weak soil structures and coarse textures) can make close examination difficult.

Water tables are seasonally near the soil surface, but redoximorphic features are not readily identifiable. Highly oxygenated soil water and gravelly, coarse textured soils can limit the formation of redoximorphic features.

These are well drained upland soils derived from glacial till.

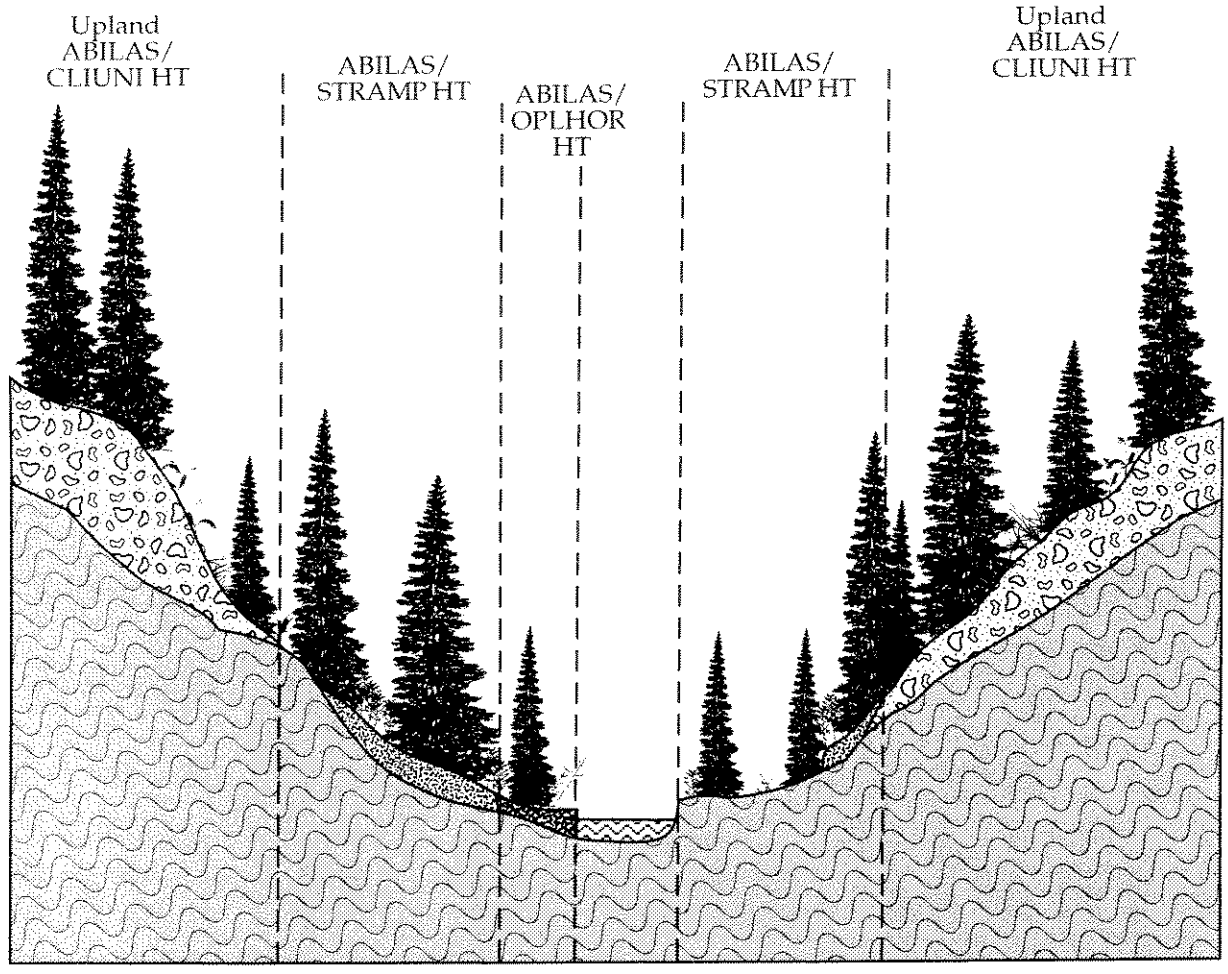
Undifferentiated bedrock parent materials.

Open water

Key: ABILAS/OPLHOR=*Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club)
ABILAS/STRAMP=*Abies lasiocarpa/Streptopus amplexifolius*
(subalpine fir/clasping-leaved twisted stalk)
ABILAS/CLIUNI=*Abies lasiocarpa/Clintonia uniflora* (subalpine fir/queen's cup)

NORTHWESTERN MONTANA GLACIAL VALLEY

CROSS-SECTION #5. ??? Complex



These soils are extremely shallow. Water tables are near the soil surface throughout the growing season, but redoximorphic features are not readily identifiable. Highly oxygenated soil water and gravelly, coarse textured soils can limit the formation of redoximorphic features.

These soils are shallow. Water tables are commonly near the soil surface and soils are saturated for most of the growing season. Redoximorphic features are common to the surface soil layer.

These are shallow, well drained, upland soils derived from glacial till.

Undifferentiated bedrock parent materials

Open water

Key: ABILAS/OPLHOR=*Abies lasiocarpa/Oplopanax horridum* (subalpine fir/devil's club)
ABILAS/STRAMP=*Abies lasiocarpa/Streptopus amplexifolius*
(subalpine fir/clasping-leaved twisted stalk)
ABILAS/CLIUNI=*Abies lasiocarpa/Clintonia uniflora* (subalpine fir/queen's cup)