Grazing and Riparian Management in Southwestern Montana

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Abstract.—A subjective analysis of riparian vegetation response in 34 grazing systems was completed. Most traditional grazing systems developed for uplands did not accommodate riparian recovery. Grazing systems that do not improve riparian vegetation must be documented to avoid their future misapplication. Common denominators to both poor and good riparian management are discussed and recommendations are provided.

The purpose of this paper is to document management observations on long-term livestock grazing management systems where stream riparian resources occur. As is typical of most management situations, data on riparian parameters are somewhat limited, consisting of permanently monumented photographic transects on woody species. Positive woody species response was interpreted as indicative of a successful grazing system. Select grazing system characteristics were compared on successful and unsuccessful systems. Though not a research endeavor, the author believes that management experience, combined with limited monitoring, has value both in providing potential grazing research topics and better insight for both managers and researchers in developing riparian grazing guidelines.

Study Area

The Dillon Resource Area of the Butte District, Bureau of Land Management, is located in southwestern Montana. Landform is largely foothill and mountain. Climate is typical semi-arid intermountain. Elevation varies from 1,585 to 3,350 m, with most grazing allotments ranging between 1,800 to 2,300 m.

Precipitation in study allotments ranges from 30 to 50 cm per year; however, precipitation in the mountain areas is much greater (120 cm or more). Peak precipitation occurs in May and June. The growing season is short, averaging about 90 days.

Temperatures range from -40° C in winter to 38° C in summer. Freezing temperatures occur as late as mid-June and as early as the first of September.

Most streams are first order through third order tributaries to the Red Rock, Big Hole, and Ruby rivers. Stream gradients are moderate (1-3%).

Upland vegetation is dominated by sagebrush steppe, foothills prairie, Douglas-fir forest, and western spruce-fir associations (Kuchler 1964).

The vegetative aspect of riparian communities is dominated by shrubs, including willows *Salix* spp., alder *Alnus sinuata*, birches *Betula* spp. and dogwood *Cornus stolonifera*. Aspen *Populus tremuloides*, cottonwoods *Populus angustifolia*, *P. trichocarpa*, and juniper *Juniperus scopulorum* occur on small portions of the streams. Riparian herbaceous communities are diverse, with a variety of sedges *Carex* spp., rushes *Juncus* spp., grasses Gramineae, and forbs.

Methods

Stream riparian vegetation response was evaluated on 34 grazing allotments which had grazing management systems of 10 to 20 years' duration. Class of livestock was cow-calf pairs or yearling cattle.

Initial condition of stream riparian sites was established through inventories of deciduous woody species and their vigor, age-classes and utilization using procedures described by Myers (1987). Woody species characteristics on comparison areas plus judgment were used in deriving riparian condition.

Trend in riparian vegetation response was assessed by recording the response of deciduous woody species on permanently established photographic transects using procedures described by Myers (1987). Emphasis was placed on interpretation of photo records duplicated over time. Twelve fenced livestock exclosures were also established in 1981 on a variety of riparian sites. Exclosure sites served as comparison area data sources with which to characterize vegetation recovery and to correlate woody species response with total plant community response.

On one allotment, regrowth and utilization of sedge species was assessed by measuring heights of all plants on paired, 1-m² plots, with one being ungrazed (caged) and the other being grazed.

Successful grazing systems were defined as those with good or excellent riparian condition or, if in fair condition, an upward trend and a high rate of woody riparian vegetation response was demonstrated in the photographic transects.

Successful and unsuccessful grazing systems were statistically compared using a two-tailed student's *t*-test for the following characteristics: (1) stocking rates, (2) average number of days provided for regrowth following grazing treatments, (3) average percentage of grazing treatments providing residual herbaceous cover through rest or sufficient regrowth, (4) average days duration of hot season grazing treatments, (5) average days duration of all grazing treatments, and (6) average days duration of fall grazing treatments.

Results

Of the 34 grazing systems evaluated, 25 (74%) were unsuccessful in accommodating a positive riparian vegetation response within a 10- to 20- year period. Upland areas (watersheds) did show positive responses on most of these systems.

Successful systems had lower average stocking rates (4.9 acres/AUM) than unsuccessful systems (3.8 acres/AUM) though the difference was not statistically significant. This 21% difference in stocking rate would not be expected to appreciably influence riparian vegetation response to a grazing system.

The success or failure of livestock grazing systems in providing for stream riparian site recovery evolves largely around riparian plant phenology, floodplain function, and livestock use behavior in riparian areas.

TABLE 1.—Grazed and ungrazed heights plus regrowth for two sedge species on paired 1-m^2 plots.

Dates grazed	Dates measured	Plant height and grazed height as percentage of ungrazed height			
		Grazed[a] (cm)	Ungrazed (cm)	Grazed[b] (cm)	Ungrazed (cm)
8-15 June	27 June	20.3 (48%)	46.7	25.9 (29%)	89
	8 July	32.5 (63%)	51.6	34.3 (39%)	89
	28 July	41.7 (78%)	53.6	50.5 (54%)	94
	8 Sept.	48.0 (86%)	55.9	59.2 (75%)	79[c]
6 Aug. — 7 Sept.	8 Sept.			8.9 (13%)	65
	29 Sept.			13.7 (24%)	58[c]

[a]*Carex aquatilis*

[b]*Carex rostrata*

[c]Light utilization by big game since last date.

Riparian Plant Phenology

Riparian plants sustain a notably longer growing season than do upland plants due to the availability of water. On the study area, upland plants do not provide significant new growth after early July. Limited studies on one allotment showed that sedge species in a riparian site sustained some growth into late September (Table 1). Where a sedge species was grazed to 48% of ungrazed height then rested after 15 June, it regained 86% of ungrazed height by 8 September through regrowth (Table 1). A sedge grazed to only 13% of ungrazed height then rested after 8 September was still able to approximately double its height within 21 d, though this was probably too late in the season to provide significant regrowth (Table 1). Providing for herbaceous regrowth may also extend the growing season rest needed to sustain plant vigor.

Floodplain Function

Stream channels change over time in order to reach equilibrium with varying flow characteristics. Concurrently, streams also have the capability of developing new floodplains (banks) fairly quickly when riparian vegetation slows flood waters and allows suspended sediment to settle.

In Oregon, Elmore and Beschta (1987) documented restoration of major stream banks following 8-15 years of protection. Livestock exclosures in the Dillon study area have also shown major bank building responses since their construction in 1981. Paramount to this function is the presence of dense vegetation on the floodplain during spring flooding events plus vigorous plant growth to stabilize these alluvial deposits. Periodic flooding recharges alluvial deposits and they become a major water storage area supporting riparian plant communities (Elmore and Beschta 1987; Brinson et al. 1981).

Grazing systems must accommodate this critical function by providing residual cover for sediment filtering and good vegeta-tive vigor for stability. Residual cover is a function of both utilization level and for herbaceous species, post-grazing reg-rowth. Removing livestock by early August to accommodate at least 30 d of regrowth probably meets floodplain function needs on the study area, though more data are needed (Table 1).

On the study area, successful grazing systems were found to provide for more ($P = 0.05$) post-grazing herbaceous regrowth (34.9 d), compared to only 20.8 d in unsuccessful systems (Table 2). Also, through a combination of both regrowth and rest treatments, successful systems provided post-growing season residual riparian cover 75% of the years, as compared to only 38% of the years in unsuccessful systems (Table 2).

Successful systems provided for floodplain function during most years, plus the residual cover benefited fish habitat through cover, moderation of water temperature, and improvement in the aquatic food chain. Terrestrial wildlife species using riparian sites also benefit from residual cover.

TABLE 2.—Characteristics of successful and unsuccessful grazing systems with means and 95% confidence intervals ( ).

Characteristics	Grazing systems	
	Successful	Unsuccessful
Number of grazing systems	9	25
Stocking rates (Acres/AUM)	12.1 (5.6)	9.5 (2.6)
Days of post-grazing regrowth (up to 9/15)	34.9 (17.8)	20.8 (7.3)
Percentage of grazing treatments providing residual cover through rest or regrowth	74.9 (12.8)	37.8 (13.2)
Duration (days) of hot season (7/1-9/15) treatments	12.5 (10.5)	33.4 (10.4)
Duration (days) of all grazing treatments	28.2 (3.7)	59.3 (8.1)
Duration (days) of fall grazing treatments (8/15-1/10)	21.0 (9.1)	36.5 (8.1)
Percentage of grazing treatments with fall use	31.1 (20.7)	51.1 (9.8)

Livestock Use Behavior in Riparian Areas

Livestock utilize riparian sites much more intensively than uplands (Skovlin 1984). Riparian areas provide water, shade, forage diversity, rubbing sites, and sources of succulent forage that uplands provide only seasonally or not at all. In south-western Montana range-lands, riparian areas sustain almost all of the livestock use during July through early September. Refer to this as the hot season. Marlow (1985) documented similar cattle response on small, fenced research pastures in southwestern Montana. Bryant (1979) observed the opposite response in the Blue Mountains of Oregon, with heavy use of riparian areas early in the grazing season and dispersal to uplands slopes during late summer and fall.

Observations in the study allotments showed good dispersal of cattle and use of uplands during spring through early summer and until upland forage plants became less succulent, approximately 1 July. Some dispersal of stock occurred in September in response to cooler temperatures and especially in response to precipitation and fall green-up. However, fall dispersal was not as significant as that of spring-early summer.

On the study area, successful grazing systems were found to have significantly ($P = 0.01$) less grazing during the "hot season" (12.5 d) than unsuccessful systems with 33.4 d (Table 2). Likewise, the duration of all livestock treatments was significantly ($P = 0.001$) shorter in successful systems (28.2 d) compared to 59.3 d in unsuccessful systems. Given the reluctance of cattle to disperse from riparian areas, the duration of grazing treatments becomes a key factor in determining the severity of impacts such as trampling and mechanical damage, soil compaction, and utilization. In a rest-rotation system Platts (1981) noted significant riparian habitat alterations at 65% utilization levels, but no detectable impacts at 25% utilization.

Utilization of deciduous woody species appeared to increase sharply as duration of grazing treatments increased, possibly in response to declining herbaceous forage availability. On one allotment with July and August grazing, utilization of willow species increased greatly after 36 d of use (Table 3). This documents the need to adjust the duration of grazing treatments based upon site-specific monitoring results. Each management pasture will likely differ and a few days' difference in utilization could be significant.

Observations of cattle indicated that utilization of deciduous woody species increased about late August and remained heavy through the fall period. A similar observation was made in Oregon (Kinch 1987). Woody species dominate the aspect of study area streams and have critical roles in riparian site stability and productivity.

On the study area successful grazing systems were found to have significantly ($P = 0.10$) less grazing during the fall period (20.8 d) than did unsuccessful systems with 36.5 d (Table 2). Fall grazing treatments also occurred less frequently (31.3%) in successful systems than in unsuccessful systems (51.1%). A combination of longer duration and more frequent fall grazing deteriorated woody species vigor and regeneration, contributing to diminished floodplain function and reduced riparian dependent values.

TABLE 3.—Relationship between duration of July-August cattle use and utilization of willows, Sourdough Creek, Montana.

Year	Days use	Days use/ acre	Utilization[a] *Salix geyeriana*	Utilization[a] *Salix boothii*
1984	26	4.0	Trace	1-5%
1986	36	5.7	5-10%	20-25%
1987	38	6.4	30%	45

[a]Ocular estimates on 75 shrubs

Discussion

In the past few years, fisheries biologists have questioned whether grazing systems, especially certain forms of rest-rotation, are providing adequate maintenance or improvement of the aquatic habitat (Skovlin 1984). In southwestern Montana, grazing systems which consider only upland plant growth requirements will generally not meet stream riparian site requirements. The 73% failure rate documented here may be attributed largely to excessive duration in grazing treatments leading to greater physical damage plus deterioration in vegetation vigor, failure to provide residual cover (through regrowth or nonuse) during most years, and excessive use during the hot season and fall periods.

Riparian site needs were provided for on successful systems through provision of residual riparian cover and by minimizing the potential adverse impacts resulting from cattle behavior through the design of grazing treatment season and duration.

At the time these grazing systems were developed, the importance of riparian areas was often not recognized and most managers believed that a single grazing system would meet the needs of all rangeland resources. These "upland grazing systems" were not designed to be responsive to floodplain function, riparian area livestock behavior, nor riparian plant phenology.

Management of riparian sites within a multiple use mandate is one of the most difficult tasks in resource management. Findings here suggest that it can be done, however. Present managers are deeply concerned with answers to the riparian-grazing challenge. Researchers alone cannot provide the answers. Managers must provide insight and practical advice based upon experience with multiple use management situations, which often differ from carefully controlled research environments. Managers must implement riparian monitoring programs and document both successes and failures in riparian management.

Approaches to riparian management must differ from the traditional approaches to management of uplands, which generally include deferred and rest-rotation principles with long duration grazing treatments and frequent "hot season" and fall grazing. Some well-meaning managers are still implementing "upland grazing systems" in hopes of attaining riparian site recovery.

It is recognized that this analysis is an oversimplification of a complex set of both natural and man-controlled factors. Other factors not considered here also influence the riparian response to a grazing system. These include, but are not limited to:

(1) kind and class of stock
(2) learned behavior of livestock social groups
(3) non-riparian water and shade sources
(4) terrain and weather influences
(5) herding, riding, and salting practices
(6) fencing locations
(7) grazing system compliance
(8) wildlife use, especially beaver and big game
(9) soils
(10) bank and channel vulnerability to detachment
(11) stream gradient and sediment load

Recommendations

Many factors must be considered in managing grazing on stream riparian sites. Some stream systems may be too frail or unstable to warrant grazing use either temporarily or permanently. Special riparian management pastures give the manager much more control in meeting recovery needs, while still allowing livestock use and simplifying management of upland sites.

The following are recommendations for the development of grazing systems where sites are similar to those in southwestern Montana and where stream riparian maintenance or recovery is an objective. Hopefully, research will provide more definitive recommendations in the future.

Provide for residual vegetative cover either through regrowth or rest treatments during at least 75% of the years, or annually if possible. Residual cover needs will vary on different streams. Vigorous woody growth plus at least 15.25 cm of residual herbaceous growth was used with this study.

Through on-site studies, determine how much time is required to provide adequate herbaceous regrowth to meet floodplain function needs and incorporate this into the grazing prescription. Removing stock by about early August was required at the 6,000 ft elevation in the study area.

Reduce the duration of grazing treatments to the greatest extent practical. Grazing treatments averaged 28 d in successful systems and 59 d in unsuccessful ones. Many rest-rotation and deferred grazing systems prescribe 60-75 d of use per treatment and are generally unsuitable. Establish suitable length of grazing treatments by monitoring trampling impacts, utilization of woody species, particularly regeneration, plus sufficient time to provide necessary regrowth of herbaceous species.

To the greatest extent practical, design grazing treatments to take advantage of favorable seasonal livestock dispersal behavior. This will vary regionally, based on precipitation patterns and plant phenology. Good dispersal of stock was noted in the study area from early May through early July and the poorest dispersal was noted during the "hot season" (early July to mid-September). Hot season grazing averaged 13 d in successful systems, compared to 33 d in unsuccessful ones.

Incorporate sufficient growing season rest to provide for good vigor and regeneration in all riparian plants. This does not mean that a full year of nonuse is required. Often, growing season rest can be increased by using pastures more frequently with shorter duration use.

Where deciduous woody species are important in the composition, limit the frequency of fall grazing treatments to about one year in four. Duration of fall treatments should be limited to the greatest extent practical. Fall grazing averaged 21 d in successful systems and 36.5 d in unsuccessful ones. Close monitoring is required to avoid excessive use on woody species during this period.

Insist upon strict grazing system compliance. A few cattle remaining in a pasture after the prescribed use period can negate the benefits of a good system. Stray animals invariably spend the bulk of their time in stream bottoms. Ninety percent compliance with a grazing system is not adequate.

Standardized approaches to riparian grazing management are not practical. Riparian areas differ in their potential for response and in various unique site factors. These other variables must be considered in the design of a grazing system.

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