BITTERROOT RIVER NATURAL RESOURCE & PHYSICAL FEATURES INVENTORY

U.S. DEPARTMENT OF AGRICULTURE
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PHYSICAL FEATURES INVENTORY

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INTRODUCTION

The Bitterroot River natural resource and physical features inventory was requested by landowners, conservation districts, and resource managers who could see social and economic pressures affecting the Bitterroot River and its associated riparian environments. Pressures created conflicts between the desires of people and the natural functioning of the Bitterroot River.

The rapid population growth of Missoula and Ravalli Counties places an increased demand for land along the Bitterroot River for dwellings, recreation, and livestock. Pressure for development is expected to continue at its present high level. The economic situation forces the farmer and rancher to intensify his agricultural use of lands adjacent to the Bitterroot River.

The inventory provides baseline resource data necessary to assist local conservation districts manage this valuable river resource. It provides a framework for identifying resource problems and developing solutions.

SETTING

The mainstem of the Bitterroot River begins where the East and West Forks join south of Conner, Montana, and ends approximately 85 miles downstream at its confluence with the Clark Fork of the Columbia River in the vicinity of Missoula, Montana. The river is bordered by the Sapphire Mountains to the east and the Bitterroot Mountains to the south and west.

Vegetative types within the watershed range from alpine through ponderosa pine to cropland, pastureland, and riparian along the river course.

Riparian vegetation consists of mixed stands of cottonwood[1] and ponderosa pine overstory with an understory of snowberry, rose, willow, redosier dogwood, grasses, and forbs which occur along the stream corridor. Wildlife of the corridor includes white-tailed deer, mink, muskrat, ruffed grouse, ring-necked pheasant, raptors, and a variety of small mammals, songbirds, and waterfowl. Among the game fishes of the river are mountain whitefish and a variety of trout--rainbow, cutthroat, brook, brown, and Dolly Varden. In the lower reach largemouth bass and pumpkinseed sunfish occur. Peamouth, northern squawfish, longnose dace, redside shiner, and longnose and largescale sucker are also found in the river. Land adjacent to the river is used for livestock grazing, agriculture, and urban development.

Climate within the watershed varies significantly with elevation. Frost-free period ranges from about 30 days at the higher elevations to as much as 120 days along the lower river. At Hamilton and Missoula, the 30-year average annual precipitation is 13 inches.

The U.S. Geological Survey established a streamflow gaging station on the Bitterroot River in April 1937 near Darby, Montana. The maximum discharge record was 11,500 cubic feet per second (cfs) on May 9, 1947. The minimum discharge was 71 cfs on February 9, 1939. The average discharge for the period 1937-1977 was 931 cfs. Average discharge during the days of the inventory--September 19, 20, 21, and October 30, 1978--was 536, 524, 436, and 282 cfs, respectively.

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[1]Common and scientific names for all plants and animals mentioned in this report are given in Appendix A.

The Bitterroot River is a braided stream. Its gradient ranges from 0.34 percent in Reach I, 0.20 percent in Reach II, to 0.08 percent in Reach III (Figure 1). The overall gradient is 0.21 percent. The average width is about 250 feet. This dynamic river system moves every year with high spring flows. Total channel length is 446,383 feet and total streambank length (east and west banks) is 892,766 feet.

Although water quality data for the Bitterroot River are limited, the quality is sufficient to support a trout fishery, wildlife, and water-based recreation.

According to the Montana Department of Fish, Wildlife and Parks 1965 Classification of Montana Fishing Streams, the Bitterroot River is a Class 2 stream from the confluence of the East and West Forks downstream for a distance of approximately 25 miles (Figure 1). The remainder of the river is considered Class 3 for a distance of 60 miles. Class 2 streams are streams of statewide value. Class 3 streams are streams of value to large districts of the state.

METHODS AND PROCEDURES

The Bitterroot inventory was conducted by both walking and floating. Observations were recorded on large-scale (1" = 250') aerial photographs of the river corridor. Seventy-eight percent of the photographs were taken in March 1976 while the remainder were taken in August 1978. Before field work began, aerial photographs were indexed. Following field work, features identified during the inventory were recorded on the aerial photographs for future reference.

Aerial photographs, field sheets, and symbol legends for that portion of the Bitterroot River in Ravalli County are located at the Soil Conservation

Service Field Office in Hamilton, Montana. The Soil Conservation Service Field Office at Missoula, Montana, has the inventory materials for that portion of the Bitterroot River in Missoula County.

Channel alterations and identified problem areas were measured using the aerial photographs, then compiled by stream reach for analysis. Data for each reach were then added to obtain totals for the entire river.

The Bitterroot River was divided into three reaches based on gradient and level of human impact. Reach I begins at the junction of the East and West Forks of the Bitterroot and extends downstream 23.0 miles to the U.S. Highway 93 bridge north of Hamilton near Anglers Roost. Reach II begins at the end of Reach I and extends 38.1 miles to the East Side Highway bridge due east of Florence. Reach III begins at the end of Reach II and ends 23.4 miles downstream at the confluence of the Bitterroot and the Clark Fork of the Columbia Rivers (Figure I).

Physical features recorded on aerial photos during the inventory:

1. Visible man-caused channel alterations
2. Streambank alterations
   a. rock riprap
   b. jetties
   c. car bodies
   d. river gravel
   e. other (concrete wall and dikes)
3. Irrigation takeoffs
4. Eroding banks
5. Critical sediment sources
6. Streambank vegetation
   a. woody trees and shrubs
   b. herbaceous

7. Streambed materials

8. Pools and riffles

9. Obstructions

10. Trash

In 1978--September 19, 20, 21, and October 30--the Bitterroot River was inventoried from the junction of its East and West Forks to its confluence with the Clark Fork of the Columbia River. Four biologists conducted the field inventory: the authors and Marjorie Josline, Montana Department of Fish, Wildlife and Parks.

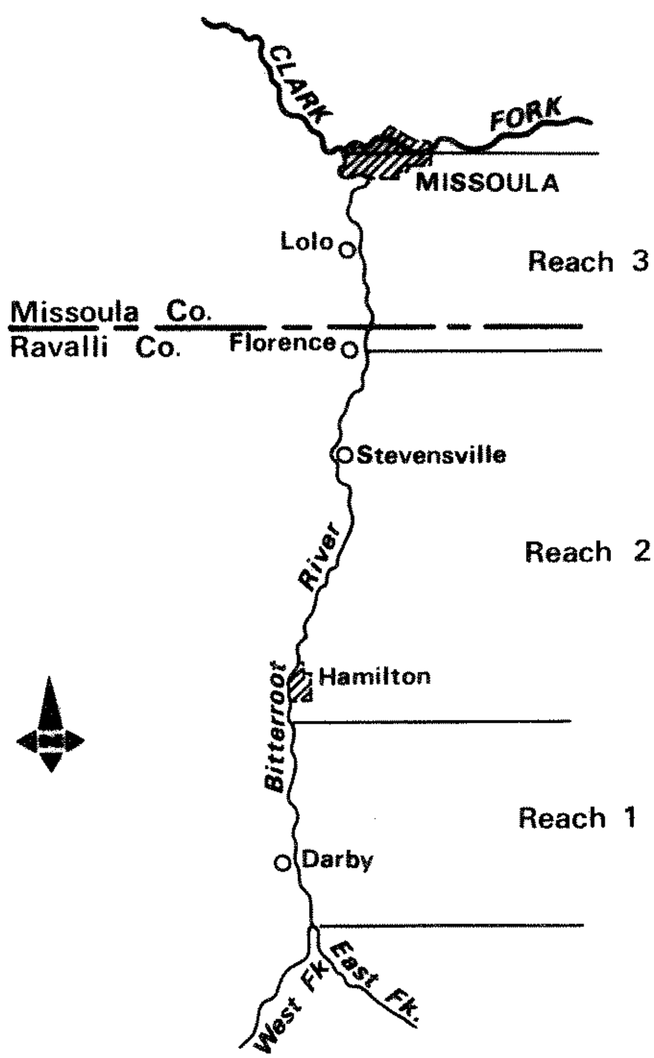
Streambed materials were classed into the following groups for ease of identification:

Class	Diameter
Rubble/Boulder	3 to 8 inches/greater than 8 inches
Gravel/Rubble	0.1 to 3 inches/3 to 8 inches
Gravel	0.1 to 3 inches
Sand or silt	less than 0.1 inch
Mixed	composed of sand/silt, plus one or more of the other types

Pools and riffles were identified by flow and depth of water. Pools are characterized by deeper, quiet water. Runs are moderately moving water with the surface not turbulent to the extent of being broken. They are intermediate between pools and riffles. Riffles are shallow, fast-moving water where the surface is turbulent and broken. The boundaries of pools and riffles change to some degree according to flow conditions. Runs are a major component of the term "pool" as used in this inventory.

Trash included any unnatural objects (excluding car bodies) placed in the river system. Items recorded included box springs, tires, and sunken boats.

Figure 1
BITTERROOT RIVER
REACH DIVISION AND LOCATION MAP
MONTANA



Scale: 1"=16 Miles

FINDINGS

Inventory data for each of three designated reaches are compiled in Table 1. The three reaches are separated by differences in gradient and level of human impact. Reach I has the highest gradient (0.34 percent) and the least amount of human impact of the three reaches. Reach II has a moderate gradient (0.20 percent) with moderate to high human impacts. Reach III has the lowest gradient (0.08 percent) with moderate to high impacts.

Two percent of the Bitterroot stream channel has been altered or realigned by man. Many of the alterations appeared to have occurred in the distant past. Channel alterations are usually associated with road construction or flood control.

Streambank alterations in the Bitterroot River include the use of rock riprap, rock and timber jetties, car bodies, river gravel, dikes, and a concrete wall as bank stabilization measures.

Blanket rock riprap has long been a preferred method for streambank protection and stabilization in this river. Riprap covers 80,000 feet or 9 percent of the total streambanks.

Car bodies used in the past to protect streambanks were found in Reaches I and II of the river. In several areas car bodies had been placed along the streambank and cabled into position as a streambank protection device. Forty-six car bodies were noted in the river and on the streambanks during the inventory.

River gravel has been pushed up or dumped over the streambanks in an attempt to stabilize them. High spring flows easily wash inherently unstable gravels downstream, making these alterations short-term and often requiring annual maintenance.

The total number of irrigation takeoffs was not determined because many pump-out facilities in sloughs were not visible from the river. Twenty-three gravity diversions and pumping facilities were noted, however.

Eroding banks were recorded during the inventory. Many of these were aggravated by man's activities. Eroding banks made up 86,000 feet or 10 percent of the total streambanks.

Critical sediment sources, originating from severely eroding banks, generally are devoid of vegetation and contribute large amounts of sediment to the river system. A number of the critical sediment sources inventoried were caused or aggravated by man's activities, including overgrazing and breakdown of streambanks by livestock or cropping too close to the streambanks. Critical sediment sources comprise 4 percent of the total streambanks or approximately 33,000 feet.

Streambank vegetation was classified as either woody or herbaceous. Agricultural lands were classed as a component of herbaceous vegetation. Where streambanks were devoid of vegetation, the first vegetation encountered beyond the bank was recorded. Of the total herbaceous vegetation inventoried, about half consisted of agricultural cropland or pastureland.

The extent of sand/silt and mixed classes of streambed material increase downstream. The decrease in gradient downstream allows sands and silts from critical sediment sources farther upstream to settle out, filling the spaces between gravels or completely covering the gravel and rubble.

Obstructions to recreational river floating were limited to three irrigation diversions. With two of these, an easy portage eliminates the problem. If the west channel were used for recreational boating or floating, the third diversion could be avoided completely. Two of the obstructions are located in Reach I and the third in Reach II.

Trash in the stream channel increased downstream.

Table 1.--Bitterroot River Inventory

Physical features	Reach I	Reach II	Reach III	Total	Percentage of total
Length, ft	121,564	201,091	123,728	446,383	-----
Channel alterations, ft	2,150	4,430	2,440	9,020	2
Streambank alterations:					
Rock riprap, ft	21,445	38,663	19,954	80,062	9
Jetties, number	10	7	5	22	-----
Car bodies, number	9	14	23	46	-----
Car bodies, as riprap, ft	0	3,040	0	3,040	0.3
River gravel, ft	4,180	2,415	2,735	9,330	1
Other (dikes and walls), ft	675	2,080	1,450	4,205	0.5
Trash sites, number	2	7	9	18	-----
Eroding banks, ft:					
West bank	3,435	14,899	16,436	34,770	-----
East bank	7,775	26,550	16,990	51,315	-----
Both banks	11,210	41,449	33,426	86,085	10
Critical sediment sources, ft:					
West bank	0	3,510	8,056	11,566	-----
East bank	1,060	11,926	8,070	21,056	-----
Both banks	1,060	15,436	16,126	32,622	4
Streambank vegetation, ft:					
Woody:					
West bank	103,601	154,169	97,625	355,395	-----
East bank	92,813	149,202	82,776	324,791	-----
Both banks	196,414	303,371	180,401	680,186	76
Herbaceous:					
West bank	17,963	45,841	24,591	88,395	-----
East bank	28,751	52,970	42,464	124,185	-----
Both banks	46,714	98,811	67,055	212,580	24
Stream bottom materials, ft (%):					
Rubble/boulder	80,265 (66)	50,605 (25)	13,156 (11)	144,026	32
Rubble/gravel	29,436 (24)	84,672 (43)	40,663 (33)	154,771	35
Gravel	5,483 (5)	32,250 (16)	21,665 (17)	59,398	13
Sand/silt	0	6,728 (3)	1,150 (1)	7,878	2
Mixed	6,380 (5)	26,836 (13)	47,094 (38)	80,310	18
Pools and riffles:					
Pool length, ft	70,882	117,240	92,164	280,286	-----
Riffle length, ft	50,682	83,851	31,564	166,097	-----
Pool/riffle ratio	1.4/1	1.4/1	2.9/1	1.7/1	-----

CONCLUSIONS AND RECOMMENDATIONS

The inventory provides local conservation districts with baseline resource data for developing management strategies for the Bitterroot River corridor with the assistance of an interdisciplinary team. The local conservation districts can use this to update their long-range plans.

The Bitterroot River has many of the esthetic, ecological, and economic attributes that make it a valuable resource. The inventory is intended to provide a broad baseline of data for selected natural and physical features to apply a systems approach to management of the river.

Channel and bank alterations have long been considered acceptable measures for controlling rivers according to man's needs. But these alterations are expensive, often of short duration, and at times have caused additional problems upstream and downstream from the point of installation.

Because of the Bitterroot River's changing and dynamic nature, it is neither possible nor practical to treat all eroding banks. Efforts should be directed toward solving man-caused or -aggravated erosion problems. Critical sediment sources should be examined and opportunities for treatment determined. To treat problem areas, both vegetative and structural measures and management plans are needed. Solution of many of the river's problems will require a team effort, using such resource specialists as conservationists, fishery biologists, engineers, and conservation district supervisors working in cooperation with local landowners.

Streambed materials are adequate in most areas to provide the necessary habitat for aquatic life. Where silt and/or sand deposition have become a problem, there is need for better stabilization and management of streambanks.

The existing pool/riffle ratio appears to be adequate to provide the habitat diversity needed by trout.

The inventory team developed eight recommendations for managing the Bitterroot River corridor:

1. Maintain existing riparian environments from further encroachment or destruction.

2. Where riparian zones will be grazed, management plans should be developed that recognize the value riparian vegetation has in protecting streambanks from erosion.

3. Develop livestock watering sites away from the river for both safety and streambank protection. Where this is not possible, develop specific livestock watering sites along the river in place of free access to entire stream reaches.

4. Where natural streambank vegetation has been removed or destroyed, it should be replaced with a combination of native woody and herbaceous plant materials wherever possible.

5. Use structural streambank protection measures such as blanket rock riprap only where the loss of life or valuable property is imminent. Do so with the consultation of experienced resource conservationists, engineers, local conservation districts, and fishery biologists.

6. Montana law forbids the use of car bodies as riprap. Many of the car bodies observed should be removed from the channel and properly disposed of. Those car bodies emplaced along embankments and effective as riprap should be left in place, particularly if their removal would likely cause further damage to streambanks.

7. Safety signs could be placed along the river alerting recreationists to the presence of obstructions.

8. All trash should be removed from the river. Besides detracting from scenic values, trash can be dangerous to recreationists and other stream users.

Since qualitative and quantitative data for the Bitterroot River are not available, it was not possible to evaluate water quality. A limited number of samples were analyzed by the Montana Department of Fish, Wildlife and Parks. Although quality is adequate for aquatic and wildlife habitat, lack of water quality data indicates a need for baseline information.

Because of the dynamics of stream systems, inventories should be updated periodically. The purpose should be to determine further needs and to recognize accomplishments.

APPENDIX A

Common and Scientific Names

Plants	
Cottonwood	*Populus* sp.
Ponderosa pine	*Pinus ponderosa*
Snowberry	*Symphoricarpos* sp.
Willow	*Salix* sp.
Redosier dogwood	*Cornus stolonifera*
Mammals	
White-tailed deer	*Odocoileus virginianus*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethica*
Birds	
Ruffed grouse	*Bonasa umbellus*
Ring-necked pheasant	*Phasianus colchicus*
Fishes	
Rainbow trout	*Salmo gairdneri*
Cutthroat trout	*Salmo clarki*
Brown trout	*Salmo trutta*
Brook trout	*Salvelinus fontinalis*
Dolly Varden	*Salvelinus malma*
Mountain whitefish	*Prosopium williamsoni*
Largemouth bass	*Micropterus salmoides*
Pumpkinseed	*Lepomis gibbosus*
Peamouth	*Mylocheilus canrinus*
Northern squawfish	*Ptychocheilus oregonensis*
Longnose dace	*Rhinichthys cataractae*
Redside shiner	*Richardsonius balteatus*
Longnose sucker	*Catostomus catostomus*
Largescale sucker	*Catostomus macrocheilus*