RIPARIAN COMMUNITY AND BANK RESPONSE TO MANAGEMENT:
A **Comparison of Old and New Surveys in the Prineville District, Bureau of Land Management.**

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Preface

The following report was prepared by University scientists through cooperative agreement, project science staff, or contractors as part of the ongoing efforts of the Interior Columbia Basin Ecosystem Management Project, co-managed by the U.S. Forest Service and the Bureau of Land Management. It was prepared for the express purpose of compiling information, reviewing available literature, researching topics related to ecosystems within the Interior Columbia Basin, or exploring relationships among biophysical and economic/social resources.

This report has been reviewed by agency scientists as part of the ongoing ecosystem project. The report may be cited within the primary products produced by the project or it may have served its purposes by furthering our understanding of complex resource issues within the Basin. This report may become the basis for scientific journal articles or technical reports by the USDA Forest Service or USDI Bureau of Land Management. The attached report has not been through all the steps appropriate to final publishing as either a scientific journal article or a technical report.

RIPARIAN COMMUNITY AND BANK RESPONSE TO MANAGEMENT:

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INTRODUCTION

In the late 1970s and early 1980s, Wayne Elmore (currently BLM's National Riparian Specialist) and others under his direction conducted a qualitative and quantitative survey of the in-stream habitat, riparian vegetation, bank conditions, water quality, macro-invertebrates and animals present (pellet counts) in over 400 miles of stream. All streams are contained within and managed by the Prineville District of the Bureau of Land Management. For this project, only 15 miles of stream were reevaluated, with only the riparian vegetation and bank damage portions of the survey repeated. The streams re-surveyed were: four sections of Bear Creek, and one section each on Camp, Paulina, Indian, Roba, Bronco, Beaverdarn and Heisler Creeks.

Most of these streams were in poor condition in 1978, with little riparian vegetation, incised channels, and large movements of sediments. After the initial surveys, some of the streams were exclosed from grazing, or the type and season of use were modified. In several reaches, juniper

trees were removed from the floodplains and placed within the stream for bank stabilization. Shrubs and trees were also planted in some reaches while juniper trees were thinned in parts of the uplands.

In the years since the surveys and alterations, the response in the low gradient streams has been dramatic. Grazing has typically been in winter or spring with little trespass. Photographs and data reveal the changes in type and vigor of vegetation, the expanding riparian zone, and the recovering banks. In these sections, the channel is aggrading and is now functioning within a floodplain.

The purposes of this report and of the field surveys on which this report is based, are to describe and quantify, to the extent possible, changes in riparian conditions due to changes in management, as described above.

In the moderate gradient streams, the response has been mixed. The grazing schedule has been varied from total exclosure, exclosure with trespass, winter/spring grazing with trespass, and a rotation pattern with occasional heavy summer use. In all but two of the streams, the total riparian area increased. Vegetation composition has generally increased in the grass-sedge-rush and litter components. Composition percentages for forbs, shrubs varied. In locations where forbs and shrubs were noted in the original survey, percent composition decreased in the new survey. The drop in forb composition may reflect an increase in seral stage with a shift from

weedy forbs to native grasses, sedges and rushes. However, in new or expanded meadows, in old and second channels, and in cobble areas, forbs and shrubs were typically identified in the new survey where they had not existed in the old survey. Bare ground typically decreased.

Actively eroding cutbanks also showed a mixed response. In the streams with originally extensive cutbanks, lengths are considerably reduced. In five streams, however, there were low to moderate lengths of cutbanks in 1994 where none were recorded in 1978. Some of the new cutbank lengths were due to natural stream processes, while the others seem to be due to land use practices.

In all sections but Camp Creek, bank damage surveys were completed in 1976, while riparian surveys were completed in 1978. For Camp Creek, riparian vegetation was surveyed in 1978, but the bank damage survey was not completed until 1988.

METHODS

In this year's survey, the methods of the previous survey were followed as closely as possible. Mike Henderson, BLM - Natural Resources Specialist in Lake Havasu, Arizona, was an original crew member on all of the streams re-surveyed. Before the start of this year's survey, he spent two days in Prineville reviewing the methods of the survey with this year's crew members. Also, Wayne Elmore, BLM - National Riparian Biologist,

mentioned above, was available for answering questions regarding the survey.

The riparian survey identifies different types of stream vegetation in broad categories (e.g. sedge-grass, willow-sedge, grass-forb). Old and secondary channels, and springs and seeps were identified as separate communities, as were communities above large, stable beaver dams and gabions. Actively eroding banks (cutbanks) were also measured as a community, but only as lengths. Although there is typically no vegetation, and widths are very near zero, they are a factor in determining riparian health.

Lengths and widths of the communities were measured by means of a pacing stick, and some visual estimates. Widths were measured periodically at points of the stream that represent the average width, typically, several per quarter mile. The lengths of the communities are not related to the total length of the stream, as communities often appeared parallel to each other or as isolated spots within another community. In the original survey, recorded widths represented one half of the community width and lengths were doubled. In this year's survey, the recorded width represents the total width and lengths are not doubled. The area by either method is the same. Stream length, for identifying quarter miles, was done separately, but simultaneously.

Communities are located in relation to the stream only by quarter

miles. In the repeated survey, although the starting and ending point is the same, the quarter miles within a section often differed from the old quarter miles. While this was predictable for the low gradient streams where sinuosity may have increased or decreased, it is less explainable in the sections of moderate gradient.

In each community (except cutbanks), a step-toe composition measurement was conducted. For at least 220 points in each community, the object under a point marked on the left toe of the surveyor's boot (a hit) was identified as either a grass, sedge-rush, forb, bare ground, litter, wood, rock, or shrub-tree. In the original survey, composition hits were identified as grass-rush-sedge, forb, bare ground, shrubs, and litter (including wood). If the hit was a plant, the mark on the boot had to be over the point where the plant emerged from the ground. If a tipped over grass leaf was stepped on, the hit was identified by what was growing under the grass leaf. The same is true for the shrub-tree communities. Although a full canopy may exist, only a few hits may be recorded as shrubs or trees. Woody species were identified to common name and heights in both surveys.

If the community was too small to obtain 220 hits, the crews identified as many as possible. After 220 hits, the length of the community was simply paced for length. If the community extended for more than a quarter mile after the 220 hits, or the community had changed slightly, another 100 hits were taken to insure representation of the true

composition.

The path of the step-toe was designed to follow the center of one side of the riparian zone, if the whole riparian width was a single community. If more than one community exists within the riparian width, the step-toe path follows the center of the community. If the community was wider than 12 feet (3.7 meters), the step-toe path follows a zig-zag pattern across the community so that the wetter and drier portions were included.

In the low gradient stream sections of Bear Creek and Camp Creek, a community situation occurred that the previous surveyors did not encounter. The community was identified as a sedge-grass-forb community. In this community, sedges and rushes inhabit the closest margin of the riparian zone, wetter grasses and forbs inhabit the middle zone (e.g. canary reed grass and mint), while drier grasses and forbs (e.g. Kentucky bluegrass, equiseturn and clover) are on the outer margin. In this community, the step toe-path missed the sedge-rush band almost entirely. In order to compensate for this, community widths were recorded as sedge-rush and grass-forb bands. When the final composition hits were added up, the widths of the sedge-rush band were averaged and taken as a percentage of the total riparian width. That percentage of the total composition hits was added to the sedge-rush hits. For example; total composition hits = 400, sedge-rush band is 10% of the riparian width, 40 sedge-rush hits are added

to the composition hits, new total = 440. This compensation is based upon the assumption that the sedge-rush band was 100% sedges and rushes, which it was.

Bank damage was classified to natural (erosion), trampling (trails, hoof-sheared collapsed banks, etc ...), and other (beaver, road fords, logging, etc ...). As in the original survey, bank damage was interpreted as bare soil at the water's edge. If the stream was dry at the time of the survey, the channel edge was used. Lengths of bank damage and rip-rap were visually estimated. Juniper rip-rap was classified as effective or ineffective based on the criteria of burial in sediment and the presence of enduring plants. If the rip-rap was high and dry, it was labeled ineffective.

This year's crews were very careful to follow the protocol left by the 1978 surveyors. Though there were some written records of the surveys, most of the protocol was verbal, coming from Mike Henderson and Wayne Elmore. Some of the finer points of the survey may have been lost during the last 16 years. For instance, the community compositions (Table 1) show some dramatic changes in some of the categories, while the photographs show little change, or change in the opposite direction. These variations may be due to the step-toe path occurring in a different place this year (due to changes in width and area), the community occurring in a different place, or the crews identifying hits differently (is a dead grass leaf still attached to the plant considered to be a hit of litter, or the bare ground

beneath it?). This type of disparity illustrates the need for thoroughly written methods.

STREAM SURVEY SUMMARIES

Bear Creek

Bear Creek is a tributary of the Crooked River feeding into Prineville Reservoir. Grazing in the area has occurred since the 1800s and was typically summer-season long use until the late 1970s. Willow-birch and sedge-rush-grass communities probably dominated the riparian vegetation in prior to intensive summer-season-long livestock use.

Juniper rip-rap were placed against selected actively eroding banks in 1982 to stimulate bank healing and aggradation. Upland juniper trees were cut from parts of the Bear Creek Watershed in 1985.

In all of the sections re-surveyed, old channels comprised a significant portion of the riparian area. In 1978, old channels were reported only in the small section of 13.25.

River mile 4.25 - 7.75 (Bear 1)

History

This section of stream was in poor condition at the time of the original survey, with very little riparian vegetation, extensive bank cutting, bank damage due to cattle, channel incision, and high sediment loads. The

stream was rested for 6 years followed by the implementation of a winter/spring three pasture system in 1985.

In June of 1987, a small, intense thunder storm occurred in this stretch of stream. Two tributaries on the west, and Salt Creek on the east contributed considerable amounts of sediment to Bear Creek between river mile 4.5 and 5.5. The high waters affected only the bottom 6 miles of the stream. Juniper rip-rap is extensive in this section due to the large amount of erosion, and has been very successful at stabilizing banks during normal spring runoff and during heavy runoff flows like in 1987.

A grass, forb, sedge-rush community presently dominates the riparian zone (Table 2). Sedges and rushes occur at the innermost margin of the riparian width, and grasses and forbs ranging from Reed's Canary grass and yellow Lotus flowers close to the water, to yellow and white clover and equisetum at the driest edge. Appearing in stretches of stream with larger substrate or more disturbance (e.g. downstream from tributary junctions), the second most common community, grass-forb, has sedges and rushes either in very small patches, or missing altogether.

Results

The riparian area in this section increased from 7.78 acres in 1978 to 15.88 acres in 1994 (Fig. 1). The total bank damage dropped 94 percent, from 3772 meters in 1978 to 242 meters in 1994 (Fig. 2). The largest drop was in natural bank damage (3653 meters to 199 meters) with a large

decrease in trampling damage (107 meters to 40 meters).

The sedge-grass-forb community comprises 11.24 acres of the new total (Table 2). The grass-forb-bare ground community comprises 4.19 acres of the new total, and is located throughout the reach, but most commonly below river mile 6.0.

The forb component of the vegetation composition dropped over 15 percent, and the litter component rose over 10 percent (Table 1). Of the 1212 meters of juniper rip-rap that were placed within this section, only 57 meters were judged not effective (95 percent success rate).

Conclusions

After walking the stream and working with the data and old photographs, this stretch seems to have recovered dramatically. The increase in riparian area is very positive, as are the decreases in bank damage and length of cutbanks. The new riparian area is likely a conservative estimate. Deep rooted clover plants with cheat grass at their bases could be construed as riparian vegetation by some, but were excluded from the area in the recent survey. The increase of litter on the ground suggests a grazing schedule that provides an opportunity for re-growth of herbaceous vegetation.

Nearly all of the juniper rip-rap has been buried to some extent, some almost entirely, making a statement about the aggradation occurring in this stretch of stream, as well as the sediment loads coming from upstream.

River mile 10.0 - 12.5 (Bear 2)

History

Being constrained by hillslopes for a large portion of the length, this section has a steeper gradient and coarser substrate than the other sections surveyed on Bear Creek. A corridor exclosure fence was built around this section of stream in 1978 and has had very good compliance. Beaver activity is common throughout the reach, with several small dams and many beaver cut juniper trees. Juniper rip-rap was placed on selected cutbanks in 1982.

Results

The riparian area increased from 5.42 acres in 1978 to 9.00 acres in 1994 (Fig. 1). Bank damage is only 9 percent of what it was in 1978, a drop from 2678 meters to 245 meters (Fig. 2). The 30 meters of bank damage due to livestock in the present survey occurred immediately downstream of the exclosure in a water gap. Of the 152 meters of juniper rip-rap placed, 39 meters were exposed and dry at the time of this year's survey (success rate of 73 percent).

The most dramatic change in plant composition was the 17.4 percent increase in the litter component (Table 1). Forbs dropped from 40 percent of the total in 1978 to 25 percent in 1994 (Table 1). A stand of large willows was present in this section at the time of the previous survey, and

were mere skeletons this year. According to Wayne Elmore, an infestation of caterpillars has decimated the willow population in all of Bear Creek for several years.

Conclusions

The topography of this stretch and the land uses upstream are probably the dominant factors controlling the recovery of this stream. The sedges and rushes that are so desirable in the lower section of Bear Creek, may not be sustainable in the often heavy substrates of this section. The propensity for this stream to dry up in late summer may preclude growth of hydrophilic plants. Immediately upstream of the exclosure (on private property) is a wide meadow-like section that is difficult to distinguish from the exclosure itself. Beavers are common both within and above this reach, often catching sediments before they arrive in the exclosure. For several miles upstream, the land management is such that there is little active erosion occurring, curtailing aggradation and riparian expansion.

River mile 13.25 - 13.5 (Bear 3)

History

This unconstrained, meadow-like section was in good condition in the 1978 survey and has changed little in 16 years. The grazing schedule has been one of deferred rotation in winter/spring since approximately 1978.

Results

The total riparian area increased in this section from 4.15 acres in 1978 to 5.22 acres in 1994 (Fig. 1), an increase of 20 percent. Bank damage decreased from 93 meters in 1978 to 70 meters in 1994 (Fig. 2). The biggest decrease was in the natural bank damage, as it fell from 93 meters to 21 meters in 16 years. While there was no trampling damage in 1978, 49 meters are recorded for 1994 due to the collapse of wellvegetated overhanging banks. No cutbanks were recorded in 1978, but 82 meters were reported this year (Fig. 3). Part of this length was at the upper end of the section where cattle cross frequently. Another portion of the cutbank length, toward the bottom of the section, was at the toe of the hillslope, and may be due to natural stream movement.

The forb component of the vegetation composition dropped 25 percent and the grass-sedge-rush component increased 26 percent (Table 1). The other components showed only minor variation.

Conclusions

As was mentioned above, this section of stream has changed very little. The bank damage was low to begin with, as this stretch had been grazed appropriately prior to the original survey. Bank erosion occurring in the lower portion may be due to natural lateral movement.

The changes in plant composition (yellow lotus and clover existing beneath a canopy of sagebrush) are indicative of an expanding riparian zone. The change from forbs to grass-sedge-rush is occurring in the old

channel community type, where equisetum is being replaced by grasses and drier rushes.

River mile 15.0 - 16.25 (Bear 4)

History

In the original survey, this reach of stream was in very good shape. Winter/spring grazing had been in place for years previous to 1978, and damage was minimal. No beaver activity was noted in 1978.

Results

The riparian acres in this reach increased from 6.05 in 1978 to 11.04 in 1994 (Fig. 1). Bank damage was 609 meters in 1978, and is down to 46 meters in 1994 (Fig. 2). Only 6 meters of rip-rap were observed on this stretch of stream. The grass-sedge-rush component of the vegetation increased by 17.8 percent, and the forb component dropped 14.4 percent (Table 1).

In this year's survey, the riparian area was much greater. Beavers have moved into the area, cutting juniper trees, flooding juniper and sage plants, and impounding water and sediment . One beaver dam at river mile 15.75 reaches nearly from hillslope to hillslope (48 meters), and has been maintained for several years. No cutbanks were recorded in 1978, but 68 meters were recorded in 1994 (Fig. 3).

Conclusions

The activities of beaver have greatly altered this section of stream. In several locations, the floodplain was ringed with dead juniper either drowned-out or chewed by beaver. Several headcuts observed in this stretch may also be due to beavers. After a dam is abandoned and it washes out, the stream headcuts through accumulated sediments, and continues to cut upstream. This downcutting is responsible for the some cutbank lengths recorded this year. This stretch of Bear Creek continues to be in good condition.

Camp Creek River mile 5.1 - 6.1

History

Four gabions were, installed in Camp Creek in the fall of 1985-86, with two contained in the section re-surveyed in 1994. The riparian corridor was fenced to facilitate grazing management in the same year. In February of 1986, a large event washed out all four gabions with repairs made two years later on only one. Eroding banks downstream of the gabions were rip-rapped with juniper.

Beaver activity occurs in the upper portion with small unstable dams built of sage and juniper. Livestock have grazed in the spring of the year since 1987. Prior to 1987, grazing occurred during the late summer for 8 years, preceded by 5 years of spring grazing.

The bank damage portion of the Camp Creek survey was not

completed until 1988, after the 1986 storm event, and was done by a different crew than the rest of the surveys.

Results

The total riparian area of Camp Creek increased from 1.43 acres in 1978 to 6.95 acres in 1994 (Fig. 1). A large portion of the area increase is due to sediments captured by the gabions. The communities upstream and immediately downstream of the gabions comprised 3.2 acres of the total riparian area for the mile-long reach. The total bank damage decreased from 1244 meters to 261 meters (Fig. 2). In the 1988 survey, bank damage was not broken into natural, trampling and other causes. Approximately 170 meters of juniper rip-rap were placed in this section of stream (not all of it below gabions), 8 meters of which were labeled ineffective. This rip-rap was probably placed the same year as the fencing and gabions. The length of cutbank community dropped from 463 meters in 1978 to 312 meters in 1994, a 33 percent decrease (Fig. 3).

The gabion communities are still catching large amounts of sediment, and in some places, bank vegetation is being inundated. For the recent survey, this was considered to be natural bank damage. This section of stream had the tallest eroding banks of any of the others surveyed this year.

The vegetation composition showed a 15 percent increase in the grass-sedge-rush component, a 9 percent increase in the litter component, and a 19 percent decrease in bare ground (Table 1). As with most of the

other sections surveyed, a secondary/old channel community was recorded in 1994 where none were recorded in 1978 (Table 2).

Conclusions

This section of stream seems to be recovering, but has farther yet to go. Assessing the degree and causes of improvement is difficult. Lack of a report of type of bank damage during the 1988 survey, the extreme damage caused by the 1986 storm, and the Gabion construction, subsequent washout with only a single gabion repaired are all confounded with a change in grazing management from summer to spring use. However, the changes in vegetation composition, the diversity of community types and the presence of secondary channels are encouraging.

Indian Creek River mile 0.25 - 1.25

History

Indian Creek is higher in elevation, being surrounded by Ponderosa pine and juniper, and flows into upper Paulina Creek, north of Paulina, Oregon. BLM fenced one mile of the riparian corridor in 1981-82 and two large springs in 1977. Cattle have not legally grazed the riparian zone since the riparian fence was built, but trespass may have occurred (Wayne Elmore, personal communication).

In 1978, beavers resided around river mile 1.0, and were damaging aspen clones and an old cottonwood stand. After the survey, the

cottonwood grove was fenced, and individual trees were wrapped with chicken wire. Now there are no beavers in this section of stream though there is the willow to support them. According to Wayne Elmore, they were trapped out a number of years ago.

The riparian community of Indian Creek is dominated by willow, alder, and grass, with isolated groves of aspen and cottonwood. Cobble and boulders dominate the substrate for the length of the stream. The canopy of ponderosa pine, willow and alder provides a moderate to high amount of shade.

Results

The total riparian area for Indian Creek has increased from 4.9 acres in 1978 to 8.00 acres in 1994 (Fig. 1). Bank damage (Fig. 2) is much less now than it was in the previous survey, only 5 percent of the original (from 3625 meters to 191 meters), and cutbank lengths (Fig. 3) dropped by 83 percent (from 876 meters to 151 meters). Composition of the riparian zone changed considerably since the original survey (Table 3). The grass-sedge rush component increased 17 percent, the litter component increased 11 percent, percentage of bare ground dropped 11 percent, and percentage of the riparian zone composed of shrubs and trees dropped 22 percent (Table 1). Flow is intermittent, as it was in the original survey. Secondary and old channels make up significant portions of the new riparian area, and were not recorded at all in the old survey (Table 3). Trout of appreciable size

were observed in remnant pools and flowing portions of the stream.

Conclusions

Several species of willows are thriving, as well as other species of woody plants, grasses and forbs. Sedges and rushes are rare in the stream, but dominate the seeps and springs. After reviewing the photographs from 1978 and comparing them with this year's photographs, the dramatic drop in shrub composition is suspect. Differing methods of splitting communities and determining the step-toe paths are likely reasons for the decrease. Ground cover is much better now with increases in the herbaceous and litter components.

Despite no grazing within the exclosure, neither the cottonwood grove nor the aspen stand that was recorded with it is doing well. There are no young cottonwood trees to replace the 20 decadent trees, and the aspen stand is reduced to downed wood and one or two live trees.

Above and below the exclosure and in water gaps, shrubs are hedged, and herbaceous cover is very closely cropped. Cattle were present in the allotment (outside the exclosure) at the time of this year's survey, but were being removed by the rancher.

Roba Creek River mile 2.0 - 3.6

History

Roba Creek also flows into upper Paulina Creek, neighboring Indian Creek on the East. While ponderosa pine and juniper surround both streams, the riparian communities are vastly different. Willows, alders and cottonwoods are rare to non-existent in this part of Roba Creek. Portions of this stream are in poor condition with extensive cutbanks and active erosion.

Two large springs at approximately river mile 3.0 were fenced in 1978. The riparian corridor fencing was done in 1983. No grazing has been permitted since that time, but at least one instance of significant trespass was recorded in October of 1991. Between 1975 and 1978, the area was thinned and slash burned with debris cleaned out of the channel. Instream structures and juniper rip-rap were installed in 1979 above the road ford at river mile 3.16 to 3.25. In 1982, structures were modified and strengthened, and rip-rap placed on cutbanks up to the forest boundary. One structure washed out in the winter of 1982-83 and was repaired the following year. Another washed out in 1983-84, and had not been repaired by the following summer. In this year's survey, the only portions of the stream that support sedge-rush communities are immediately upstream of drop structures.

Results

The total riparian area of Roba Creek increased from 2.39 to 4.07 acres since the original survey (Fig. 1). While this stream has the highest amount of bank damage reported this year (791 meters), this number is less than one-fifth of the 1978 reported damage (4103 meters) (Fig. 2). In the original survey, a significant portion of the bank damage was due to logging activities. Cutbank lengths have decreased little over the years, from 940 meters in 1978 to 706 meters this year (Fig. 3).

The channel of Roba Creek consists predominantly of cobble and boulders. In significant portions of the stream length, then and now, the channel is made up of sand and gravel. The area of the two springs fenced in 1978 changed little over the 16 years, but the area of all springs and seeps expanded.

The composition of the riparian zone has decreased in bare ground (12%) and forbs (11 %), and increased in litter (10%) and the grass-rushsedge component (13%) (Table 1).

Conclusions

Despite livestock exclosure, except for 1991, portions of this section are still in poor shape. Sediment loads are still quite high, due to the extensive cutbanks, and stream bank vegetation is not of the type effective for maintaining banks. The shade provided by the ponderosa pine canopy in Roba Creek is considerably higher than in Indian Creek. While Indian Creek

is in the next drainage over, the soils are much different. The cobble layer that makes up most of Indian Creek is also present in Roba Creek, but it is buried under several feet of much lighter soil. The high sediment loads might explain why the deciduous community so common in Indian Creek, does not exist on this section of Roba Creek.

Paulina Creek River mile 0.0 - 0.25

History

This reach of Paulina Creek is low to moderate gradient and feeds directly into the North Fork of Beaver Creek, just northeast of Paulina, Oregon. The substrate is predominantly cobble, with some gravel and sand. This small stretch of stream has a wide active floodplain (approximately 20 meters), and a considerable community of willows in the upper portion.

When surveyed in July of this year, cattle were present, and shrubs were damaged. Summer use occurs in this allotment occasionally. It is in a rest-rotation system with several other pastures, and has no riparian fencing. From 1988 to 1992, cattle grazed in the spring, and were taken out by mid-June. Last year the pasture was rested. This year, cattle graze from the mid-June to mid-October. Prior to 1987, the stream had been grazed summer, fall, or spring, in consecutive years.

Results

The total riparian area in this quarter mile has increased from 1.85 acres to 2.69 acres in 16 years (Fig. 1). No cutbanks were recorded for either survey (Fig. 3).

Bank damage this year (64 meters) is higher than in the previous survey (59 meters) (Fig. 2). In the old survey, all of the bank damage was reported as being natural (cutbanks). In this year's survey, bank damage is predominantly due to cattle. The natural bank damage recorded is associated with a headcut moving up from the mouth of the stream.

Composition of the vegetation dropped 19 percent in the grass-sedgerush component and increased 27 percent in the litter component (Table 1). The willow community increased from 0. 12 to 1. 61 acres (Table 3).

Conclusions

Except for the very heavily hedged willow stand, this section is in reasonable shape. The change in vegetation composition is due to reporting differences such as calling a terminated sedge plant a hit of litter this year as opposed to calling it a hit of sedge in 1978. The composition is nearly identical to the original survey with slight changes in the percentages of bare ground, forbs and shrubs. The willow community would suffer if continually subjected to summer grazing pressure like this year.

Bronco. Beaverdam and Heisler Creeks

History

These streams are located northeast of Paulina, Oregon, near the Rager Ranger Station. They are higher in elevation than any other streams re-surveyed, and are surrounded by ponderosa pine, fir and juniper forests. All three of these streams are contained within the Bronco pasture of the Humphrey allotment and have the same grazing management. Within a restrotation pattern with other pastures, spring grazing has been the management plan for years. Trespass was informally reported for this pasture in 1991. Since the trespass was never officially recorded, verification of length and intensity is impossible. Several years of summer-season-long use are suspected. When the original surveys were done in 1978, the area had been rested for several years.

All three streams have similar topography. Starting from the mouth they are moderate to high gradient with boulder and bedrock substrate. The valleys are narrow and, consequently, so are the riparian zones. Vegetation is quite thick in these areas and is composed of an assortment of dogwood, alder, willow, currant, rose, mock-orange, snowberry and occasional aspen and cottonwood. Some of the surrounding ponderosa pine and fir trees, sometimes within the riparian zone, are very large. Roughly a quarter of a mile into each of the streams, the gradient is lower and the valley wider. Portions of Bronco and Heisler are quite wide and were called willow-grass

meadows in the new survey.

Cutbank community occurred in all three streams, where it was not recorded at all in the old survey (Table 4). All of the cutbanks were at the upper, lower gradient ends of the surveyed length, and on Heisler and Beaverdam, became more severe nearing the forest boundary.

Beaver activity had been recorded for all three streams in the old survey but by 1994 remained only on Bronco Creek. Evidence of old dams, lodges and side channels occurred in the upper portions of Heisler and Beaverdam.

Logging evidence (stumps and cut woody debris) occurred only in the uppermost portions, adjacent to the forest boundary. Over 100 meters of bank damage due to logging was reported on both Beaverdam and Heisler in the 1978 survey.

At the time of the survey in August 1994, herbaceous vegetation in all but the steepest and narrowest portions of the streams was cropped very closely. According to the grazing plan, cattle were removed in spring, but dry conditions persisting all summer may have prevented re-growth. The grass-rush-forb component may be under-represented due to this fact. Springs and seeps in all three streams were damaged by trampling. Occasionally, the crews observed small areas of hedged willows, but wildlife is suspected rather than cattle.

At the time of the original survey, light utilization was recorded for all

three streams. In several of the old photos, a vigorous herbaceous cover is apparent. Then, as now, the streams were intermittent or dry at the time of the survey.

Bronco Creek River mile 0.0 - 1.25

Results

The survey of Bronco Creek extends to a quarter of a mile past a major tributary. Above this tributary, the stream is dry, and a cobble-silver sage-grass community dominates the riparian zone. Bronco Creek has numerous willows as well as alders, and all of the trees and shrubs listed above. The spring-seep community is smaller in the present survey, but second/old channel communities are recorded where they were not before. Several small, active beaver dams are located above river mile 0.5.

The riparian area of Bronco Creek increased from 3.79 acres in 1978 to 5.11 acres in 1994 (Fig. 1). Total bank damage decreased from 551 meters to 48 meters (Fig. 2). In the original survey, no cutbank community was recorded, but in this year's survey, 42 meters were recorded (Fig. 3).

The grass-sedge-rush component of the riparian vegetation increased by 10 percent, bare ground increased by 7 percent, and forbs dropped by 12 percent (Table 1).

Conclusions

Although the pasture containing all three streams was apparently

trespass summer grazed for an unknown number of years, this stream seems to have held up the best of the three. The maintenance of the beaver population may have played a part, as well as the lack of bank damage due to logging noted in the 1978 survey.

Beaverdam Creek River mile 0.0 - 1.5

Results

There are fewer communities found in Beaverdam Creek than either Bronco or Heisler Creeks. Willow, alder and dogwood are common, and a considerable length of secondary/old channel community was found. The total riparian area this year, 5.16 acres, is less than it was in 1978, 6.43 acres (Fig. 1). The spring-seep community area expanded dramatically, from 0.03 acres in 1978 to 1.48 acres in 1994 (Table 4).

Composition of the riparian vegetation changed significantly. The grass-sedge-rush component increased 9 percent, the forbs 21 percent, and litter 8 percent (Table 1). The bare ground component dropped 17 percent, and shrubs 21 percent (Table 1).

Cutbanks in this stream were the most severe of the three, with almost 200 meters this year, and none recorded before (Fig. 3). Bank damage has decreased from 1415 meters to 219 meters (Fig. 2). Bank damage due to logging activities (1133 meters) was reported in the original survey.

Conclusions

The riparian area of this section has not changed dramatically since 1978, however, other factors such as the increase in cutbanks, the loss of beaver, and the variations in the riparian community suggest that this stream has been set back in condition. At the time of the survey this year (early August 1994), the shrubs were in good condition, but the herbaceous cover was cropped very closely. The forb component of the composition may have been overestimated due to this condition. Short, spread out forbs are much easier to see than closely cropped grasses and rushes.

Heisler Creek River mile 0.0 - 1.25

Results

The total riparian area of Heisler Creek dropped from 13.3 acres in 1978 to 4.7 acres in 1994 (Fig. 1). In the old surveys, groves of chokecherry and cottonwood were recorded. In the new survey, the groves were located, but they are no longer part of the riparian zone.

Bank damage dropped from 494 meters in 1978 to 52 meters in 1994 (Fig. 2), while the length of cutbank community increased from zero to 69 meters (Fig. 3). Over 100 meters of the original bank damage was due to logging activity.

The fewer numbers of community types found this year compared to 1978 (Table 4) may be attributed to an increase in the number of willows

which serves to merge community types. The spring-seep and secondary/old channel communities are significant portions of the total riparian area, and were not recorded in the old survey. While alders were common in Bronco and Beaverdam, there were none in this section of Heisler Creek.

Conclusions

The drastic drop in total riparian area may be related to the loss of beaver, incision into portions of the floodplain, and a very dry summer. Several wide portions of the valley bottom were high and dry, with recent cutbanks at the stream's edge. The 40 percent drop in shrub composition is hard to believe looking at the old photographs. Depending on where the composition hits were taken with respect to the stream length, and the location of the step-toe path with respect to the riparian width, compositions can be quite variable. Unquestionably, some event or series of events has spurred the decline of this stream.

DISCUSSION

Even with the wide array of grazing strategies, topography and communities, most of these streams appear to be in better condition now than they were in the late 1970s. The lengths of cutbanks, the composition of riparian vegetation and the total riparian areas are a mixed response. In the sections where cutbank lengths had originally been extreme, lengths

have improved (i.e. decreased). In streams with no cutbanks in the original survey, lengths increased (except Paulina Creek), In terms of bank damage and ground cover, recovery is well on its way. The measurements of total riparian area generally reflect recovery. The apparent loss of shrubs (Table 1) may be a function of aggrading stream beds which is reflected in the expanded riparian areas. It may also be an artifact of sampling methodology. I suspect a combination of the two factors. A notable reduction in forb composition most likely reflects improving condition with a succession from weedy forbs on degraded sites to native grasses, sedges, and rushes on aggraded sites.

In Heisler and Beaverdam, suspected non-compliance to the grazing plan may have worked in conjunction with loss of beaver and logging activity to cause a decline in total riparian area and increase in cutbank lengths. Upstream and upland land use histories are not known. Although the total riparian area of Roba Creek increased, recovery seems to be less than in the other streams surveyed. The considerable lengths of cutbanks and bank damage are still contributing more sediment than the stream is capable of capturing. Also, like Bronco, Beaverdam and Heisler, upstream landuses within Forest Service management are not known.

Significant portions of the total bank damage in 1978 were recorded as due to logging for Roba, Beaverdam and Heisler: Old logging evidence was present in all three but was most obvious in Roba with very large,

burned stumps immediately adjacent to the stream.

In all of the sections except for Paulina Creek and Bear Creek section 3, bank damage this year is a small fraction of what it was in the original survey. Paulina Creek and Bear Creek section 3 are both small sections (a quarter mile) and had minimal bank damage in the original survey.

The diversity of responses to appropriate grazing and exclosure of grazing serves to illustrate the point that all of these streams are functioning in way that is unique. Factors such as beaver, climate, topography, soils, land use history, compliance with grazing plans, and community changes make interpretation of the results difficult.

The importance of biological and topographical factors could be determined more definitively with a larger number of re-surveyed streams with given characteristics. With the pool of quality data provided by the old surveys, we could gain a better understanding of the effects of changes in grazing management, changes in beaver populations, logging, road building, adding drop structures etc.... as well as the importance of abiotic factors such as gradient, soil, climate, and valley width. Once these factors are examined, management strategies can be more accurately determined and applied with more effective results.

In spite of the numerous confounding factors making it difficult to make definitive statements about cause and effect of changes in riparian conditions in the streams resurveyed for this report, improvement did occur

in conjunction with appropriate grazing management. Where appropriate grazing management plans are known to have been adhered to, improvement in ripairan condition has been very notable. Where noncompliance with an appropriate grazing plan is suspected, results were less notable or were negative. Unfortunately, other factors were confounding and absolute cause and effect can not be determined. Noncompliance to an appropriate grazing plan is likely to have been a contributing factor to lack of positive results in those cases.

This report supports the contention of the Kindschy report that improvement of riparian condition can and will occur with a change to an appropriate grazing management plan if grazing was instrumental in causing the deterioration.

Figure descriptions

Figure 1. A comparison of the old and new total riparian acres per section of stream. Note that only Heisler and Beaverdam have lower total areas in the present survey than in the original survey. Bear 1 = River mile 4.25- 7.75; Bear 2 = River mile 10.0 - 12.5; Bear 3 = River mile 13.25 - 13.5; Bear 4 = River mile 15.0 -16.25.

Figure 2. A comparison of the total bank damage, old and new, per surveyed section of stream. Bear 1 = River mile 4.25 - 7.75; Bear 2 River mile 10.0 - 12.5; Bear 3 = River mile 13.25 - 13.5; Bear 4 = River mile 15.0 - 16.25.

Figure 3. A comparison of old and new total lengths of cutbank community for all sections except Paulina Creek. Bear 1 = River mile 4.25 - 7.75; Bear 2 = River mile 10.0 - 12.5; Bear 3 = River mile 13.25 - 13.5; Bear 4 River mile 15.0 - 16.25.

Figure 1

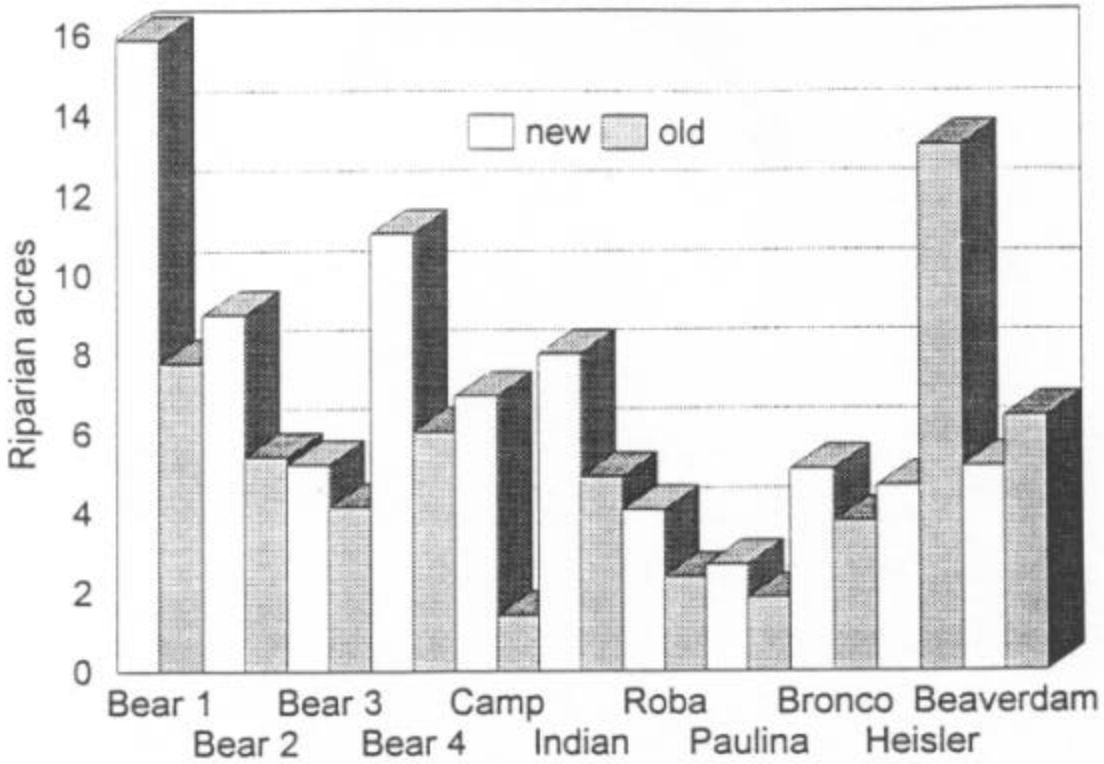
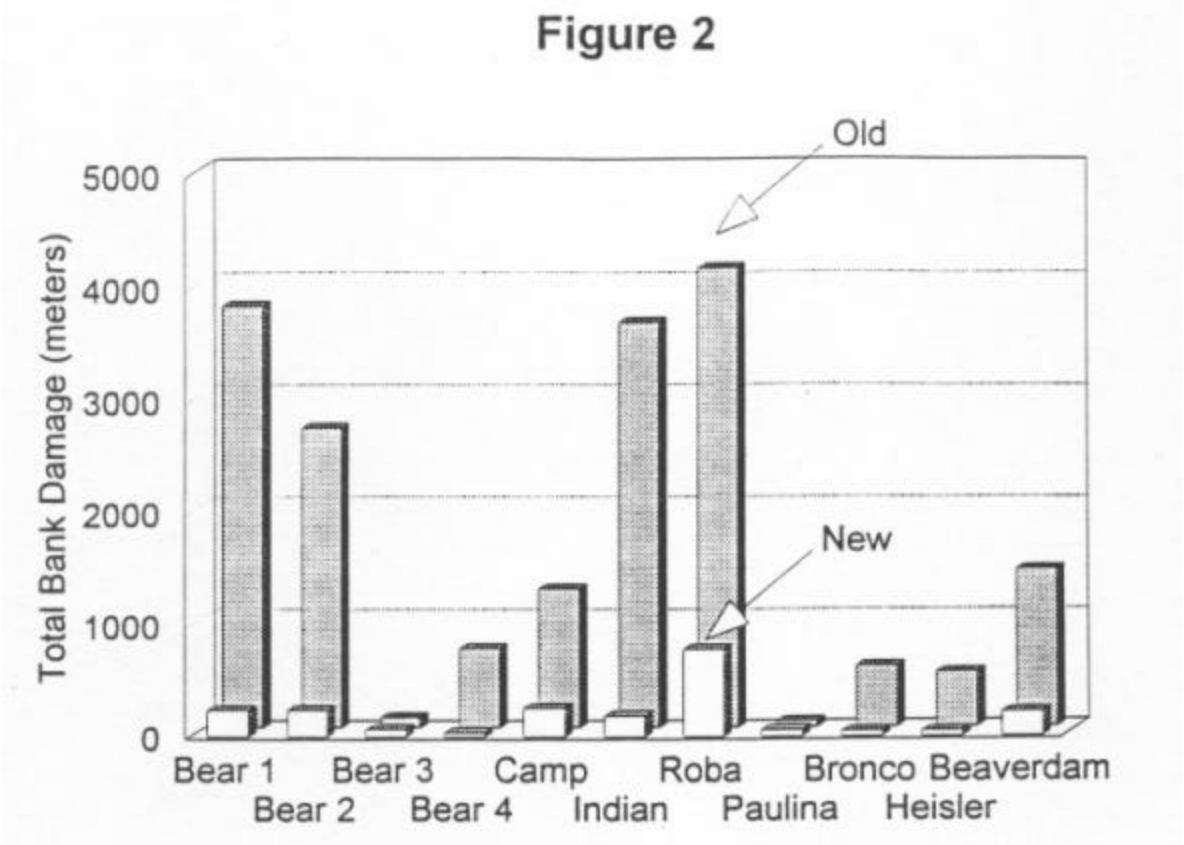

Riparian acres
16
14
12
10
8
6
4
2
0
new
old
Bear 1
Bear 2
Bear 3
Bear 4
Camp
Indian
Roba
Paulina
Bronco
Heisler
Beaverdam

Figure 2


Old
New
Total Bank Damage (meters)
5000
4000
3000
2000
1000
0
Bear 1
Bear 2
Bear 3
Bear 4
Camp
Indian
Roba
Paulina
Bronco
Heisler
Beaverdam

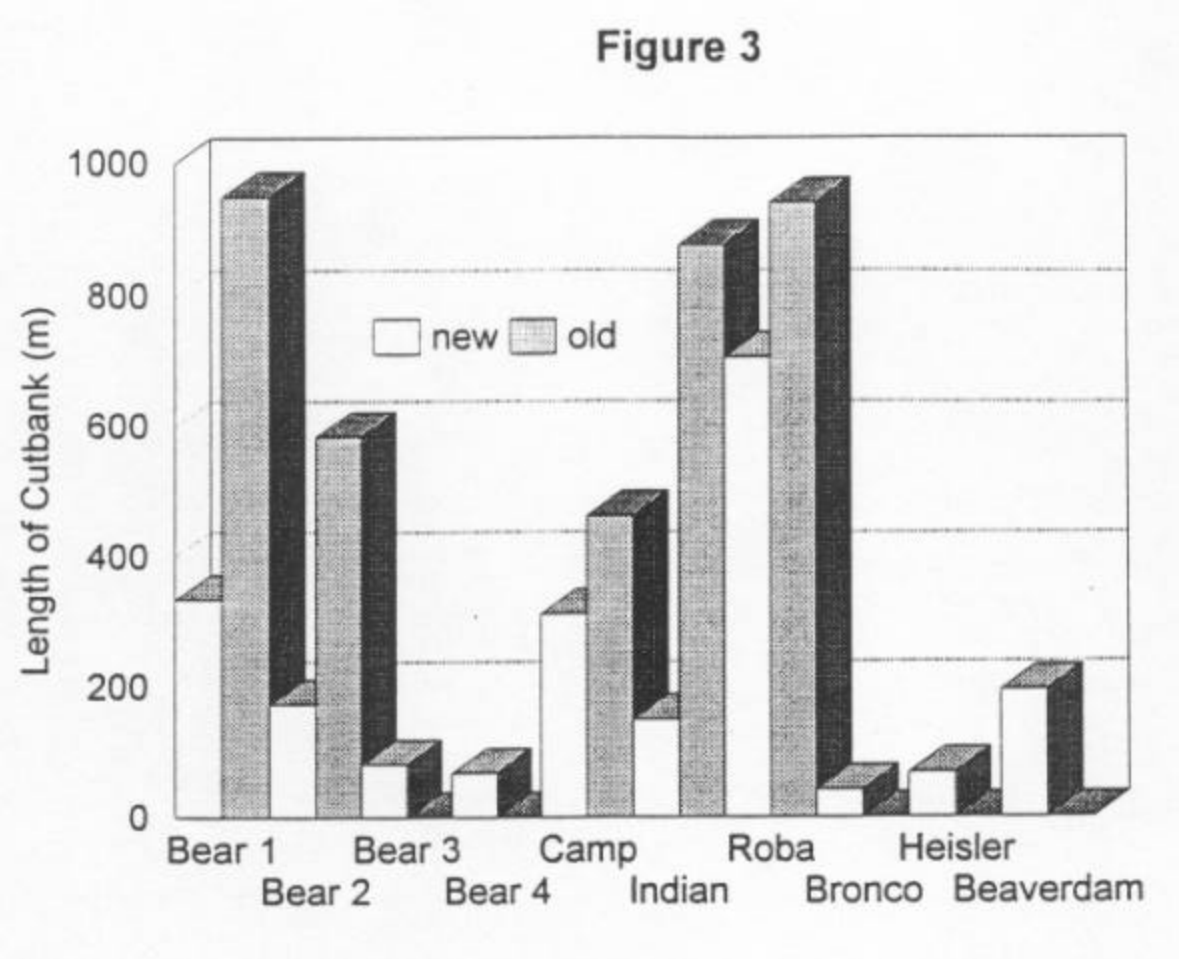


Figure 3
1000
800
600
400
200
0
Length of Cutbank (m)
new
old
Bear 1
Bear 2
Bear 3
Bear 4
Camp
Indian
Roba
Bronco
Heisler
Beaverdam

Table 1. The composition of the total riparian area broken into the classes of grass-sedge-rush, forb, shrub-tree, bare ground and litter. Also shown is the difference between the original and present percentages.

				Percent of total riparian area									
Creek	Graze	Area	Time	G-S-R	Diff. G-S-R	Forb	Diff. Forb	Shrub	Diff. Shrub	Bare Ground	Diff. Bare ground	Litter	Diff. Litter
Bear 1	Yes	15.88	new	53.6		20.4		0.7		12.8		12.4	
Bear 1		7.78	old	53.0	0.6	36.0	-15.6	2.0	-1.3	7.0	5.8	2.0	10.4
Bear 2	No	9.00	new	48.7		24.8		0.1		6.4		19.6	
Bear 2		5.42	old	53.9	-5.3	40.1	-15.3	0.7	-0.5	3.1	3.3	2.2	17.4
Bear 3	Yes	5.22	new	71.0		17.8		0.1		5.5		5.3	
Bear 3		4.15	old	44.6	26.4	43.1	-25.3	1.8	-1.7	7.0	-1.5	3.4	1.9
Bear 4	Yes	11.04	new	64.5		30.0		0.0		2.6		2.6	
Bear 4		6.05	old	46.7	17.8	44.4	-14.4	0.3	-0.3	6.5	-3.9	2.0	0.7
Camp	Yes	6.95	new	62.4		15.3		0.5		11.8		10.0	
Camp		1.43	old	47.4	15.0	18.1	-2.8	3.1	-2.6	30.4	-18.6	1.0	9.0
Indian	No	8.00	new	31.9		29.0		8.7		12.5		18.6	
Indian		4.90	old	14.8	17.1	23.7	5.2	30.6	-21.9	23.2	-10.7	7.5	11.1
Roba	No	4.07	new	36.2		26.1		0.4		19.7		17.9	
Roba		2.39	old	23.6	12.6	36.7	-10.6	0.0	0.4	31.6	-11.9	8.1	9.8
Paulina	Yes	2.69	new	61.5		2.8		3.8		4.8		27.1	
Paulina		1.85	old	80.9	-19.4	8.3	-5.5	0.7	3.1	10.1	-5.3	0.0	27.1
Bronco	Yes	5.11	new	46.5		14.8		9.4		21.0		8.7	
Bronco		3.79	old	36.3	10.2	27.0	-12.3	15.7	-6.3	13.9	7.0	7.1	1.6
Heisler	Yes	4.68	new	40.9		23.9		7.8		17.3		9.4	
Heisler		13.25	old	27.4	13.5	5.6	18.3	49.1	-41.3	13.2	4.1	4.7	4.7
Beaverdam	Yes	5.16	new	26.2		28.0		11.4		17.1		18.3	
Beaverdam		6.43	old	16.9	9.3	6.6	21.4	32.7	-21.3	34.3	-17.2	10.4	7.9

Bear 1 = River mile 4.25 - 7.75
Bear 2 = River mile 10.0 - 12.5
Bear 3 = River mile 13.25 - 13.5
Bear 4 = River mile 15.0 - 16.25

Table 2. A summary of the community types for Bear Creek and Camp Creek.

Stream	Sect.	Comm. Type	New length (m)	Old length (m)	New avg width (m)	Old avg width (m)	New total area (ac)	Old total area (ac)		Composition G-S-R	Forb	Shrub/ Tree	Bare ground	Wood	Litter
Bear Creek	1	GRSF	3617	10462	12.6	3.0	11.24	7.78	new	59	19	1	7	1	13
									old	53	36	2	7	2	0
Bear Creek	1	Cutbank	334	950					new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Bear Creek	1	GF-BG	1396		12.2		4.19		new	37	25	0	28	2	6
									old	–	–	–	–	–	–
Bear Creek	1	Old chnl	192		5.7		0.27		new	73	6	1	4	0	17
									old	–	–	–	–	–	–
Bear Creek	1	GWS	41		17.9		0.18		new	60	3	7	3	0	27
									old	–	–	–	–	–	–
Bear Creek	1	All					15.88	7.78							
Bear Creek	2	SRGF	2141	6957	12.1	2.8	6.40	4.76	new	50	24	0	2	0	24
									old	53	42	1	3	3	0
Bear Creek	2	Old chnl	323	192	8.1	14.0	0.65	0.66	new	45	22	0	17	0	10
									old	64	26	2	8	0	0
Bear Creek	2	GF	1027		7.5		1.89		new	45	30	0	17	8	0
									old	–	–	–	–	–	–
Bear Creek	2	Cutbank	174	584					new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Bear Creek	2	Gap	18		12.0		0.05		new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Bear Creek	2	All	3683	7733			8.99	5.42							
Bear Creek	3	SR	289		1.5		0.11		new	71	11	0	14	0	4
									old	–	–	–	–	–	–
Bear Creek	3	GF	274		26.8		1.81		new	63	22	0	10	0	4
									old	–	–	–	–	–	–
Bear Creek	3	Old chnl	230	222	32.9	47.5	1.87	2.60	new	69	21	0	2	0	7
									old	27	63	3	3	4	0
Bear Creek	3	SGR	138	1073	41.9	14.6	1.43	1.55	new	84	8	0	3	0	5
									old	74	10	0	14	2	0
Bear Creek	3	Cutbank	82						new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Bear Creek	3	All	1013	1295			5.22	4.15							
Bear Creek	4	GRF	1545	1670	19.1	8.4	7.26	3.47	new	60	36	0	1	0	1
									old	36	60	0	5	0	0
Bear Creek	4	Old chnl	228		11.8		0.67		new	43	45	0	10	0	1
									old	–	–	–	–	–	–
Bear Creek	4	SR	119		51.4		1.51		new	74	16	0	3	0	7
									old	–	–	–	–	–	–
Bear Creek	4	Bvr Pond	135		47.9		1.60		new	86	8	0	0	4	1
									old	–	–	–	–	–	–
Bear Creek	4	Cutbank	68						new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Bear Creek	4	SG		2266		4.6		2.58	new	–	–	–	–	–	–
									old	61	24	1	9	5	0
Bear Creek	4	All	2095	3936			11.04	6.05							
Camp Creek	1	GRF	1295	1073	10.3	5.4	3.30	1.43	new	64	15	1	8	1	9
									old	47	18	3	30	1	0
Camp Creek	1	Cutbank	312	463					new	–	–	–	–	–	–
									old	–	–	–	–	–	–
Camp Creek	1	Gabion	523		24.7		3.19		new	62	16	1	8	1	10
									old	–	–	–	–	–	–
Camp Creek	1	Old chnl	119		8.4		0.25		new	67	13	0	3	0	14
									old	–	–	–	–	–	–
Camp Creek	1	GF	74		11.5		0.21		new	41	28	0	28	0	3
									old	–	–	–	–	–	–
Camp Creek	1	All	2323	1536			6.95	1.43							

F=forb, G=grass, S=sedge, R=rush, W=willow, Gap=water gap, BG=bare ground

Table 4. A summary of the community types for Beaverdam, Bronco and Heisler.

Stream	Sect.	Comm. Type	New length (m)	Old length (m)	New avg width (m)	Old avg width (m)	New total area (ac)	Old total area (ac)		Composition G-S-R	Forb	Shrub/ Tree	Bare ground	Wood	Litter	Rock
Beaverdam	1	Willow (rocky)	1898	3461	6.7	6.6	3.14	5.60	new	19	25	15	3	4	15	20
									old	18	5	34	33	11	--	--
Beaverdam	1	Alder	200	618	4.4	4.2	0.22	0.64	new	10	28	9	3	6	24	20
									old	6	20	29	37	8	--	--
Beaverdam	1	Dogwood	23	86	3.4	2.0	0.02	0.04	new	0	18	35	0	0	35	12
									old	10	15	25	50	0	--	--
Beaverdam	1	Rocky Gvl bed		313		1.5		0.12	new	--	--	--	--	--	--	--
									old	12	8	0	80	0	--	--
Beaverdam	1	Spr seep	480	76	9.8	1.8	1.48	0.03	new	44	34	4	3	5	9	2
									old	63	6	0	25	6	--	--
Beaverdam	1	Cutbank	196						new	--	--	--	--	--	--	--
									old	--	--	--	--	--	--	--
Beaverdam	1	2nd chnl	285		4.3		0.30		new	27	30	10	3	2	20	9
									old	--	--	--	--	--	--	--
Beaverdam	1	All					5.16	6.43								
Bronco Creek	1	Willow (rocky)	684	1631	9.5	2.6	1.61	1.04	new	26	17	12	3	1	7	34
									old	0	28	43	19	10	--	--
Bronco Creek	1	Willow (meadow)	463		15.8		1.80		new	67	12	7	4	2	7	1
									old	--	--	--	--	--	--	--
Bronco Creek	1	Alder	154	518	9.5	2.4	0.36	0.30	new	65	17	5	2	1	8	3
									old	14	9	26	46	5	--	--
Bronco Creek	1	Spr. seep	277	139	7.9	150.0	0.54	0.75	new	66	24	2	2	4	2	2
									old	53	33	0	3	11	--	--
Bronco Creek	1	R F		1010		6.9		1.70	new	--	--	--	--	--	--	--
									old	55	27	4	10	4	--	--
Bronco Creek	1	Old chnl	130		4.4		0.14		new	42	23	13	4	1	4	14
									old	--	--	--	--	--	--	--
Bronco Creek	1	Cutbank	42						new	--	--	--	--	--	--	--
									old	--	--	--	--	--	--	--
Bronco Creek	1	2nd chnl	65		4.7		0.08		new	19	10	11	25	0	15	21
									old	--	--	--	--	--	--	--
Bronco Creek	1	Cbbl S.Sage G	317		7.4		0.58		new	15	6	18	8	1	11	41
									old	--	--	--	--	--	--	--
Bronco Creek	1	All					5.11	3.79								
Heisler Creek	1	Willow (rocky)	1237	1158	5.7	6.9	1.74	1.97	new	26	18	14	4	2	13	24
									old	10	14	33	35	8	--	--
Heisler Creek	1	Willow (grass)	579	1680	7.6	22.8	1.09	9.46	new	47	32	5	1	0	3	12
									old	30	1	56	9	4	--	--
Heisler Creek	1	Willow (meadow)	74		34.0		0.62		new	46	20	7	4	4	7	13
									old	--	--	--	--	--	--	--
Heisler Creek	1	Grass S Rush G	100	309	9.2	6.9	0.27	0.52	new	59	18	0	4	3	8	10
									old	56	39	0	5	--	--	--
Heisler Creek	1	F G		282		2.3		0.16	new	--	--	--	--	--	--	--
									old	53	26	0	16	5	--	--
Heisler Creek	1	Snwbrry Chkchrry		60		49.0		0.73	new	--	--	--	--	--	--	--
									old	28	6	56	2	8	--	--
Heisler Creek	1	Willow Mckornge		274		2.4		0.16	new	--	--	--	--	--	--	--
									old	0	26	33	33	9	--	--
Heisler Creek	1	Mckornge Snwbrry		122		3.5		0.11	new	--	--	--	--	--	--	--
									old	5	39	39	17	--	--	--
Heisler Creek	1	Mckornge		187		1.8		0.08	new	--	--	--	--	--	--	--
									old	10	0	33	48	10	--	--
Heisler Creek	1	Willow Cttnwd		73		3.0		0.06	new	--	--	--	--	--	--	--
									old	0	0	54	46	--	--	--
Heisler Creek	1	Spr. seep	274		9.5		0.76		new	55	31	2	4	1	4	3
									old	--	--	--	--	--	--	--
Heisler Creek	1	Old/2nd chnl	169		4.7		0.20		new	44	25	4	3	2	4	18
									old	--	--	--	--	--	--	--
Heisler Creek	1	Cutbank	69						new							
									old							
Heisler Creek	1	All					4.68	13.25								

F=forb, G=grass, S=sedge, R=rush, Gvl=gravel, Spr=spring, chnl=channel, Cbbl=cobble, Snwbrry=snowberry, Chkchrry=chokecherry, Mckornge=mockorange, Cttnwd=cottonwood