Riparian Area Responses to Changes in Management

Michael M. Borman, Christine R. Massingill, and E. Wayne Elmore

Deteriorated riparian areas have been a highly debated topic in recent years. How to achieve recovery of these systems is the question. Many believe that livestock grazing is the most influential human caused impact on western riparian ecosystems (Elmore and Kauffman 1994). Cessation of livestock grazing has been suggested as the single most effective approach to restoring salmonid habitats. Kauffman et al. (1997) stated that livestock exclusion has demonstrably resulted in a rapid recovery of riparian vegetation. However, these same authors noted that appropriate livestock grazing management is important for the proper functioning of many western riparian zones. Elmore and Kauffman (1994) stated that in some areas, stream conditions will improve, even with livestock grazing. They further stated that there are many problems with using exclosures to halt overuse by livestock. Those problems include wildlife access and the cost of fence construction and maintenance.

In the 1970s, livestock exclosures were constructed by a number of researchers and land managers to evaluate the potential for vegetation change following livestock removal. Results were often dramatic. However, grazing management outside the exclosures was generally not changed and the dramatic improvements were compared to inappropriate grazing practices outside the exclosures. The conclusion has been that livestock grazing is not suitable when trying to improve degraded riparian areas. A more accurate conclusion should be that cattle exclusion is an improvement over inappropriate grazing.

Usually inappropriate grazing is growing season or year-long grazing with little or no active management. Growing season and year-long grazing have been described as devastating to riparian conditions (Elmore and Beschta 1987, Platts 1991).

In the late 1970s and early 1980s, the Prineville District of the Bureau of Land Management conducted a qualitative and quantitative survey of the in-stream habitat, riparian vegetation, bank condition, water quality, macro invertebrates, and animals present (via fecal pellet counts) on approximately 400 miles of stream within the Prineville District, Bureau of Land Management. In 1994, 27 of the original 400 miles were resurveyed for riparian vegetation attributes and bank condition. The streams surveyed were 4 sections of Bear Creek and 1 section each of Camp, Paulina, Indian, Roba, Bronco, Beaverdam and Heisler Creeks.

All of the sites included in the study are in Oregon's John Day Ecological Province (Anderson et al. 1998). Physiographically, John Day Province consists of extensive areas of steeply and intricately dissected hills interspersed with buttes and plateaus. The hills are mainly geologically eroded ancient lacustrine materials. Upland soils are highly susceptible to water erosion. Grazing has occurred since the 1800s. Until the late 1970s, it was usually throughout the growing season. Willow-birch and sedge-rush-grass communities dominated the riparian vegetation in presettlement conditions.

Survey Methods

In the 1994 survey, the methods of the previous survey were followed as closely as possible. A member of the original survey team was brought back to Prineville to review the methods of the original survey.

In the original survey, photographs of the stream and riparian vegetation were taken every 1/4 mile. These photographs helped document representative community types and typical features. In 1994, these photographs were retaken where original photo points could be located. Additional photographs were taken of representative community types and defining features.

The riparian survey identified different types of stream vegetation in broad categories (e.g. grass-sedge-rush, forb, shrub). Old and secondary channels, springs, seeps, bare soil, and litter were identified as separate communities, as were communities above large, stable beaver dams and gabions. Actively eroding banks (cutbanks) were recorded. Lengths and widths of the communities were measured by means of a pacing stick calibrated to the surveyor's pace. Riparian zone width was measured with a pacing stick at points of the stream that represented the average width, typically several per 1/4 mile section. As in the original survey, bank damage was defined as bare soil at the water's edge. Bank damage was recorded and classified by source as natural (erosion), trampling (trails, hoof-sheared collapsed banks, etc.), and other (beaver, road fords, logging, etc.). If the stream was dry at the time of the survey, the channel edge was used.

Stream Reach Descriptions

Six of the resurveyed stream reaches were grazed season-long prior to the 1978 survey. Riparian areas in those reaches were in poor condition. Two of the reaches, Sections 3 and 4 of Bear Creek, had been managed appropriately prior to 1978 and the riparian areas were found to be in good condition in 1978. Bronco, Beaverdam, and Heisler Creeks are all in the same pasture which had not been grazed prior to the 1978 survey.

Since 1978, grazing management for most of the pastures has been late winter through early spring. In central Oregon, late winter and early spring grazing work well because of climate and growing conditions. Peak runoff tends to occur during late January or early February when grazing typically begins. Riparian vegetation from the previous year is in place to protect the stream banks when peak flow occurs. When grazing ends during the spring, growing conditions provide the opportunity for riparian vegetation to complete its growth. Then, when summer thundershowers cause flash floods, riparian vegetation has already grown and is able to protect the stream banks.

The pasture that includes Paulina Creek is grazed in a rotation system that results in summer grazing in some years. The pasture including Bronco, Beaverdam, and Heisler Creeks is now in a spring grazing system. However, occasional trespass has been informally noted. Since 1978, cattle have been excluded from Indian and Roba Creeks and Section 2 of Bear Creek.

Sections of the streams were determined to have either low (<2%) or moderate (2–4%) gradient. Lower gradient streams have less stream energy to damage stream banks. Riparian vegetation along low gradient streams is often sedges and rushes which have extensive root systems under them, and they are able to protect the stream banks from the relatively low stream energy. Moderate gradient streams have more stream energy. Willows, alders, or other woody riparian vegetation are generally needed on moderate and higher gradient streams to protect the stream banks from the higher energy.

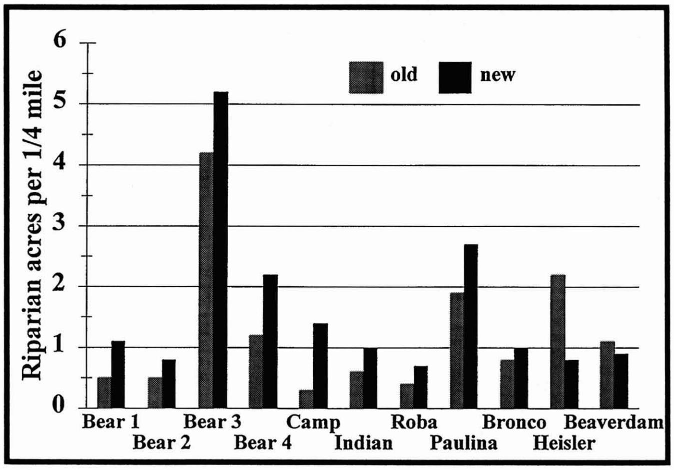

Fig. 1. *Comparison of riparian area per 1/4 mile of stream length in the old survey (1977 or 1978) to those measured in the new survey (1994). Averages are reported for those reaches over 1/4 mile long.*

Changes in Riparian Attributes

Riparian Surface Area

Expansion of riparian surface area is an indicator of riparian improvement. Riparian surface area in all reaches except Heisler and Beaverdam Creeks expanded between the two surveys (Figure 1). Expansion occurred in 3 reaches that were excluded from grazing and in 6 that were grazed (Table 1). Among the 9 reaches that increased in riparian surface area, excluding cattle did not result in a greater increase than an appropriate grazing strategy.

Gradient did appear to have an influence on rate of increase. Low gradient reaches experienced greater increases in riparian surface area than did moderate gradient reaches (Table 1, Figure 1). This would be expected since lower gradient streams generally have lower energy and greater access to a floodplain. The expected result would be more sediment filtering and greater floodplain development which translates to greater riparian surface area.

The allotment containing the 2 reaches in which the riparian surface area was smaller in 1994 compared to

Table 1. Reach characteristics with associated riparian variable changes indicating positive (+) trend or negative (–) trend.

Stream reach	Gradient	Grazed	Beaver status	Riparian area	Bank damage[1]	Cutbank length[2]
Bear 1	low	yes	gained	+	+	+
Bear 2	moderate	no	gained	+	+	+
Bear 3	low	yes	no change	+	+	–
Bear 4	low	yes	gained	+	+	–
Camp	low	yes	gained	+	+	+
Indian	moderate	no	lost	+	+	+
Roba	moderate	no	no change	+	+	+
Paulina	low	yes	no change	+	–	–
Bronco	moderate	yes	no change	+	+	–
Heisler	moderate	yes	lost	–	+	–
Beaverdam	moderate	yes	lost	–	+	–

[1]Bank damage is defined as bare soil at the water's edge. A + indicates a decrease in bank damage between surveys and is an indicator of positive trend. A – indicates an increase in bank damage between surveys and is an indicator of negative trend.
[2]A + indicates a decrease in cutbank length between surveys and is an indicator of positive trend. A – indicates an increase in cutbank length between surveys and is an indicator of negative trend.

1978, Heisler and Beaverdam, may not have had compliance to the grazing plan for at least some of the 16 years between surveys. However, another factor to consider is the possible role of beaver. In the same allotment, riparian surface area expanded along Bronco Creek. Bronco Creek retained its beaver population while Heisler and Beaverdam lost their beaver populations. Downcutting can occur when beaver dams blow out. Unstable beaver dams are more likely to occur on moderate gradient streams than on low gradient streams.

Bank Damage

For the purposes of these surveys, bank damage was defined as bare soil at the water's edge. A decrease in bank damage is a positive indicator of riparian improvement. All of the resurveyed reaches except Paulina Creek had decreases in bank damage (Figure 2). Most of the decreases were substantial. Bank damage decreases occurred in grazed as well as in excluded reaches. Over half of the bank damage on Paulina Creek was attributed to cattle use. Total bank damage on Paulina Creek was approximately 15% in 1994 compared to 13% in 1978.

Cutbank Length

Generally a reduction in cutbank length would be considered a positive indicator of riparian improvement. However, since streams are dynamic, some cutbank length would generally be expected. Five of the reaches surveyed in 1978 had substantial lengths of cutbanks. All five reaches experienced substantial reductions in cutbank length (Figure 3). Of the 5 reaches with reductions in cutbank length, 2 were grazed and 3 were excluded from grazing (Table 1). Of the 6 reaches with no recorded cutbank length in 1978, 5 experienced at least some bank cutting by 1994 (Figure 3). Bear Creek section 3 had the largest increase. Some of that increase was attributed to a cattle crossing, and some of it was attributed to natural stream movement at the toe of a hill slope. Cutbank length recorded for Bear Creek section 4 in 1994 was attributed to downcutting which resulted from beaver dam failures. Likely causes for cutbank lengths recorded in 1994 for Bronco, Heisler and Beaverdam Creeks were not recorded. As mentioned above, some cutbank length should be expected based on natural stream dynamics. Possible lack of compliance with the grazing prescription for the allotment may have been a factor. Beaver dam blow outs may also have been a factor. It is impossible to assign a specific cause. However, it should be noted that bank damage decreased in all three creeks during the interval between surveys (Figure 2).

Vegetation Communities

Community composition changes can reflect trend in riparian condition. Increases in grass-sedge-rush, shrubs, and litter are positive indicators; and decreases in forbs and bare ground are also positive indicators. During both surveys, forbs were generally weedy, upland species.

Differences between 1978 and 1994 were generally positive. The grass-sedge-rush community generally increased and the forb communities generally decreased. Bare ground generally decreased and litter always increased. In a few cases, a vegetation community change suggested a negative trend in riparian condition. Those cases were all represented in both grazed and non grazed reaches, so there was no consistent relationship to grazing.

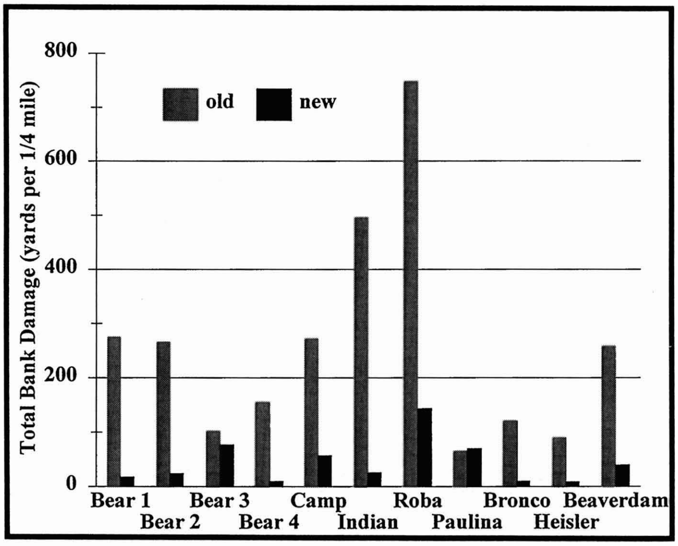

Fig. 2. *Comparison of total bank damage (bare bank) per 1/4 mile of stream length between the old survey (1977 or 1978) and the new survey (1994). Averages are reported for those reaches over 1/4 mile long.*

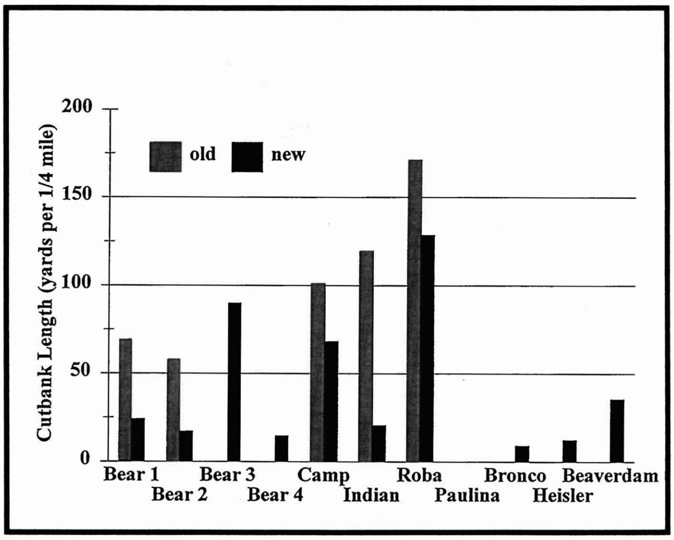

Fig. 3. *Comparison of cutbank length per 1/4 mile of stream length between the old survey (1977 or 1978) and the new survey (1994). Averages are reported for those reaches over 1/4 mile long.*

Fig. 4. *Bear Creek Section 1(a) August 1976 with grazing throughout the growing season since the late 1800s; (b) August 1994 after juniper removal on the lowest bench coupled with initial rest from grazing until 1984, followed by a late winter-early spring grazing prescription.*

Management Implications

Even with the wide array of grazing strategies, topography and communities, most of these streams appeared to be in better condition in 1994 than they were in the late 1970s/early 1980s. Riparian conditions and function improved in reaches with a change to an appropriate grazing management (Figure 4) as well as those excluded from livestock (Figure 5). Those starting in good riparian condition with an appropriate grazing management remained in good condition (Figure 6). The allotment containing Heisler and Beaverdam Creeks, the 2 streams that decreased in riparian area, did not have compliance to the grazing plan for at least some of the 16 years after the original survey.

The diversity of factors contributing to riparian response to appropriate grazing and livestock exclusion serves to illustrate the point that all of these streams are unique. Factors such as climate, landscape setting, soils, and land use history all make a difference and must be factored into determination of an appropriate grazing management prescription. Differences in stream gradient and beaver activity (can be positive where site conditions promote active, stable dams and negative if unstable) appeared to influence rate of improvement in riparian zones. Differences in rate of improvement could not be detected between reaches with an appropriate grazing management and those under exclusion. Exclusion for a period of time might be helpful to jump start a recovery process in some situations, however, that too is site specific and must be considered on a site specific basis.

Results from this study and from observations of numerous grazing management prescriptions evaluated at other locations in the west suggest that grazing can often be compatible with improving deteriorated riparian conditions and with maintaining those functioning prop-

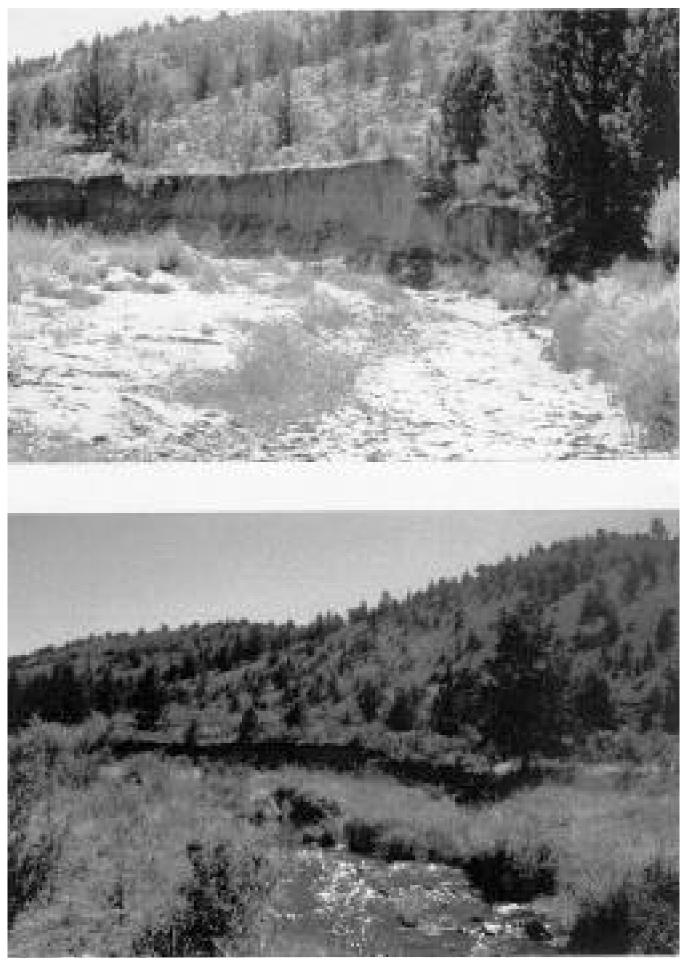

Fig. 5. *Bear Creek Section 2 (a) August 1977 with grazing throughout the growing season since the late 1800s; (b) September 1998 after grazing exclusion since 1977.*

Fig. 6. *Bear Creek Section 4 (a) August 1977 after several years of winter-spring grazing; (b) August 1994 with a continuation of the winter-spring grazing prescription.*

erly (Ehrhart and Hansen 1997, 1998; Masters et al. 1996a, 1996b; Mosley et al. 1997). The key is an appropriate grazing prescription, which must be site and situation specific, and adherence to that prescription.

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Authors are associate professor, Department of Rangeland Resources, Oregon State University, 202 Strand Hall, Corvallis, Oregon 97331; principal of Mainstream Contracting, 2455 Cherry Hills Drive, Alamogordo, New Mexico 88310; and team leader of the National Riparian Service Team, USDI Bureau of Land Management and USDA Forest Service, Prineville BLM District Office, P.O. Box 550, Prineville, Oregon 97754. At the time of the study, Massingill was a graduate research assistant, Department of Rangeland Resources, Oregon State University, Corvallis.

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