Livestock Management in the Riparian Ecosystem[1]

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Abstract.--Intensive, long-term livestock grazing has occurred along most streams in the western United States. Although most livestock grazing on public lands is now under some form of management, many riparian areas are below "good" in ecologic condition, with forage production considerably below potential. Eight years of research at Meadow Creek; Starkey Experimental Forest and Range, Wallowa-Whitman National Forest, in northeastern Oregon, indicates that herbage production was increased 1- to 4-fold through timing and intensity of grazing. Rest-rotation, deferred rotation, and season-long grazing systems were tested. Although there were no statistically different changes in plant composition, the production of both graminoids and forbs increased dramatically.

INTRODUCTION

There is no question that riparian areas have been severely abused historically. Livestock grazing, logging, roads, railroads, gold dredging, and numerous other activities have all had their impacts. Few riparian areas in the western United States have not been influenced by one or more of these factors. There is little profit now in discussing what should have been done 20, 50, or 100 years ago to prevent degradation. We must deal with today's conditions.

Total exclusion of all human activities from riparian areas, is unlikely to return those areas to pristine condition, and could be unacceptable socially, economically or both. Although it will require intensive management. Alternatives to total exclusion of human uses to renovate riparian areas exist. Total exclusion of human uses or continued unchecked degradation of riparian areas are the extremes of management alternatives. Some "middle ground" in management seems a likely way to satisfy some of the desires of the parties concerned while improving condition of the resource. These goals and objectives can be best accomplished through cooperation and coordination among user groups rather than through polarized infighting.

Fisheries biologists are to be commended for focusing attention on riparian and floodplain area and for making all resource managers more aware of not only the sensitivity but also the productivity--present and potential--of these areas.

Since 1974, numerous cooperators and I have carried out a case history study on the influence of grazing on riparian and aquatic habitats in the central Blue Mountains. Because of space constraints, I can only discuss the floodplain vegetation response to grazing by cattle.

At the onset of the study, we chose the 70 percent level of utilization of annual production on floodplain herbage as the maximum grazing limit. We established stocking levels from the 1975 production data at which we anticipated would achieve 70 percent utilization. In 1976, the first year of grazing, we achieved that level of grazing. In subsequent years utilization was consistently less than 70 percent. Meadows were in "good" condition in 1976 and we did not anticipate that the floodplain vegetation would respond dramatically to the treatments.

We also tested different grazing systems (deferred rotation, rest-rotation, and season-long grazing) commonly used on cattle allotments on National Forest land in the Blue Mountains. In addition, in other pastures we allowed grazing exclusively in riparian areas after plant maturation with 80 to 90 percent

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utilization, in a deferred rotation sequence. We called this the short-duration, high intensity (SDHI) grazing. Mule deer (Odocoileus hemionus) and elk (Cervus elaphus) are common in the area so a portion of the area was fenced to exclude their use through the grazing season.

STUDY AREA

The study area was a 4,000-acre block encompassing Meadow Creek, a perennial stream flowing west to east across the 30,000-acre Starkey Experimental Forest and Range, which is located 30 miles southwest of La Grande, Union County, Oregon. Prior to study implementation, the area was grazed in a deferred rotation grazing system. The season of use ran from mid-June to mid-October depending on range readiness.

Elevations range from 3,500 ft (1067 m) to 5,000 ft (1524 m). Annual precipitation averages 20 in (50 cm) of which 90 percent falls as spring and autumn rains and winter snow. The growing season is about 120 days but frost may occur in any month.

The upland vegetation is typical of mountainous rangeland throughout the Blue Mountains of Oregon and Washington and has been described by Strickler (1965) and Driscoll (1955).

The floodplain plant communities are defined by Ganskopp (1978). There are 44 plant communities occurring on approximately 121 acres (49 ha) with 9 of those communities occupying 80 percent of the floodplain area. The dominant communities are:

1. Woolly sedge (Carex lanuginosa)/ water sedge (C. aquatilis).
2. Meadow foxtail (Alopecurus pratensis)/ smooth brome (Bromus inermis).
3. Northwest cinquefoil (Potentilla gracilis)/ Kentucky bluegrass (Poa pratensis), Canada bluegrass (P. compressa).
4. Common timothy (Phleum pratense)/ Kentucky bluegrass (Poa pratensis), Canada bluegrass (P. compressa).
5. Kentucky bluegrass (Poa pratensis), Canada bluegrass (P. compressa)/ western yarrow (Achillea millefolium), common dandelion (Taraxacum officinale).
6. Gravel bar.

Meadow Creek fluctuates between 3 ft^3/s to over 300 ft^3/s. Peak flows result from snowmelt and usually occur in late April. Low flows occur from late July through August and, sometimes, in September. Steelhead (Salmo gairdneri) are the only anadromous fish using the stream. Rainbow trout (Salmo gairdneri) and a variety of other fish are year-round residents.

MATERIALS AND METHODS

Pasture Configuration and Grazing Systems

The study area was divided into four phases plus a control area. Each phase was subdivided into five units (figure 1). Each unit within a phase contained approximately the same length of stream. Each unit within a phase received a different grazing treatment.

Phase I was corridor fenced to include about 95 percent of the floodplain area. The treatment was a simulated season-long grazing system where no more than 70 percent of the herbage was removed by grazing within each unit (figure 1). Starting in 1976, unit 5 was grazed at this intensity; in 1977 units 4 and 5; in 1978 units 3, 4, and 5; in 1979 units 2, 3, 4, and 5; and 1980 all units were grazed. This part of the study was designed to determine how long willow slip[3] plantings had to be protected from grazing before they became established.

Phase II was cross fenced and included the uplands of both north and south aspects to the top of the ridge on both sides of the creek (figure 1). Units 1 and 4 were grazed with a rest-rotation system, unit 2 was deferred rotation grazing, unit 3 was season-long grazing, and unit 5 was not grazed with cattle although mule deer and elk had access to the pasture.

Phase III was a scaled-down replicate of the grazing treatments of Phase II (figure 1). No south aspect, and only a small portion of the north aspect was included. Big game animals were excluded from all units from late May through October. Because of flow fluctuations, ice floes, and migrations of big game up and down the stream channel during the winter months the water gaps were removed after the grazing season and put back in the spring. Any big game animals found on the inside were removed at that time.

Phase IV included two pastures each of north and south aspects and two pastures confined to a corridor along the stream in the riparian area that included all floodplain

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[3] Willow slip is a cutting (20-30-in [51-76-cm] long) from the previous year's shoot growth of a mature willow plant and is usually planted before bud break.

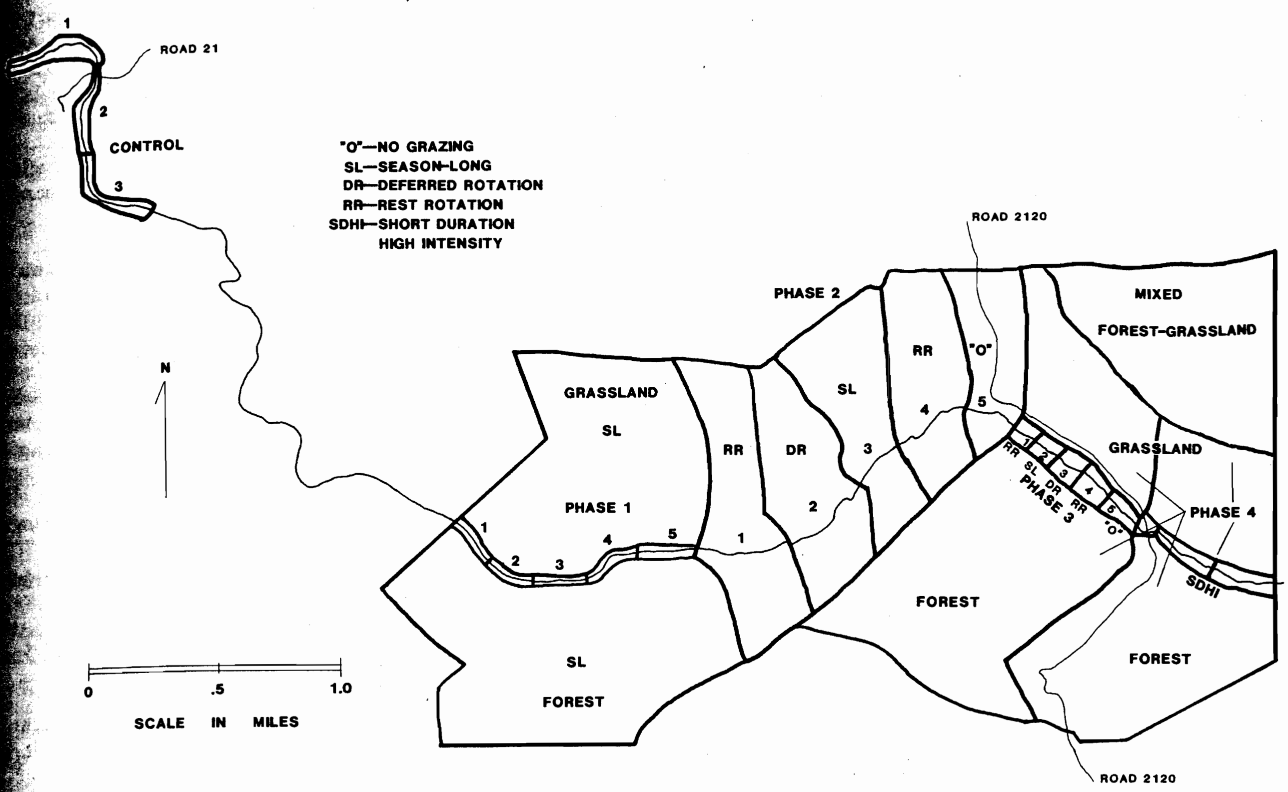

Figure 1.--Outline of Meadow Creek Study area.

plant communities (figure 1). The two riparian area pastures were grazed with a late season deferred rotation--short-duration, high intensity system. The two south aspect (grassland) pastures and the two north aspect (timbered) pastures were grazed with a rest-rotation system.

Vegetation Sampling

Each unit in every phase had paired plots, one fenced and ungrazed, the other unfenced and grazed, that were read in 1975, 1978 and 1981. Belt transects of 100 Daubenmire microplot frames (20 cm x 50 cm) were laid out in both plots for plant frequency and basal area studies. Frequency data were collected from both the 20- x 50-cm plot and a microplot of 10 x 10 cm. The 1- x 2-ft plot was used in vegetation production monitoring. Production data were collected from clipping every 10th plot along the belt transect and then dried for 24 hours at 60°C. In conjunction with the permanent plots, each unit had five caged plots ($1\ m^2$) on the representative plant communities for monitoring annual production and utilization. Both production and utilization were determined from plots clipped to a 1-in (2.54-cm) stubble height, a day or two after livestock were removed from the pasture.

RESULTS AND DISCUSSION

Preliminary results indicate production of floodplain vegetation can be improved within several grazing regimes without causing negative impacts on the aquatic system.

When utilization of annual herbage was limited to not more than 70 percent, vegetation in the riparian area responded favorably. Established water standards were met throughout the experiment in all treatments (Buckhouse et al. 1979).

While plant composition did not change appreciably, annual production of herbage increased from 1- to 5-fold. These changes can be attributed to grazing systems and level of utilization (table 1).

The season-long grazing system pastures had the least amount of improvement (1.2-fold) or 1,570 lb/acre (1758 kg/ha) in 1975 versus 3,489 lb/acre (3908 kg/ha) in 1981. On the ungrazed portions of these pastures the improvement was 1.25-fold (table 1).

The short-duration, high-intensity pastures' response has been similar to the season-long pastures' response. Grass production increased 3.0-fold in the grazed part and 3.1-fold in the ungrazed portion.

Changes are more noticeable between the grazed and ungrazed portions of the rest-rotation and deferred-rotation pastures (tables 1 and 2). There was a 3.5-fold increase of grass production in the grazed portion and only a 1-fold increase in the ungrazed portion of rest-rotation pastures.

The deferred-rotation system showed the largest increase in grass production. In the grazed portion there was a 4.4-fold increase compared to 1.6-fold in the ungrazed portion. Production on the grazed area in 1975 was 555 lb/acre (622 kg/ha) compared to 3,011 lb/acre (3372 kg/ha) in 1981.

The nongrazed pastures also contained fenced and unfenced plots although neither was grazed except by mule deer and elk. The unfenced plots had a 3.6-fold increase while the fenced plots had a 5.6-fold increase of grass production (tables 1 and 2).

It appears the vegetative response of the grazed plots in the deferred-rotation and rest-rotation systems were similar to the control in the nongrazed system. However, the ungrazed plots, regardless of grazing system (with the exception of the short-duration, high-intensity pastures), did not follow the response in the ungrazed pastures (tables 1 and 2). One explanation is nonuniformity of plant communities. That, of course, is one of the reasons the split plot design was implemented. It was easier to measure changes in vegetative response to treatments on homogeneous plant communities within pastures than to extrapolate plant community response from other pastures.

This problem should be considered when designing monitoring systems and research programs for riparian areas. Plant communities in riparian areas are not so discrete nor as large as those occurring in forest and rangeland plant communities. Not only are riparian communities smaller but they occur more as a continuum making identification more difficult.

Forb response to protection and grazing was erratic with increases and decreases occurring in both grazed and ungrazed plots within pastures (tables 1 and 2). There was, however, a trend toward decreasing forb production with deferred rotation and short-duration, high-intensity systems.

When forb and grass production in both grazed and ungrazed plots were combined, large

Table 1.--Grass and forb production response by <u>grazing</u> systems from 1975 through 1981 (lb/acre).

Vegetative class	1975					1981				
	SL	DR	RR	SDHI	NG	SL	DR	RR	SDHI	NG
Grasses	1570	555	243	447	461	3489	3011	1103	1779	2127
Forbs	279	511	265	523	170	605	353	455	259	202

SL = Season-long grazing
DR = Deferred grazing
RR = Rest-rotation grazing
SDHI = Short-duration, high-intensity
NG = No grazing, control pasture

Table 2.--Grass and forb production response from <u>nongrazing</u> from 1975 through 1981 (lb/acre).

Vegetative class	1975					1981				
	SL	DR	RR	SDHI	NG	SL	DR	RR	SDHI	NG
Grasses	843	1056	759	394	271	1897	2766	1517	1645	1798
Forbs	480	288	369	401	339	315	401	882	706	461

...ses in plant biomass production were ...s. With the exception of short-...on, high-intensity grazing, all other grazing systems produced almost twice as much ...ge as the ungrazed plots (table 3). With vegetation responding this dramatically to grazing treatment and the objective being improvement of biomass production in the riparian area, it appeared that this can best be accomplished or accelerated with grazing instead of protection.

Table 3.—Net changes in total production between grazing and ungrazed plots from 1975 through 1981 as a percentage.

	SL	DR	RR	SDHI	NG
Ungrazed (fenced)	67.2	135.6	112.7	195.7	270.3
Grazed (unfenced)	121.4	215.6	206.7	110.1	269.1

The annual fluctuation of precipitation certainly has compounding effects on herbage production. What these effects have been, whether annually or cumulatively on production response of floodplain vegetation in this study, were undetermined. Weather data collected on the study site indicated, as a whole, above average precipitation (for the surrounding area) during the study period. In 1977 there was, however, below average precipitation. On the other hand, because of soil and moisture conditions found in the riparian area, production response to annual precipitation may be negated. Although this is a pitfall in vegetation production research, there is also no way to control this variable.

CONCLUSION

In this study, productivity of riparian zone and floodplain vegetation was rapidly enhanced when no more than 70 percent of the herbage was removed annually. And, in the case of the floodplain, vegetative production was accelerated with grazing.

The riparian area is complex and proper management is critical. The aquatic system, riparian zone, and floodplain areas may react more or less independently of one another. Because the riparian area is disproportionately important to a variety of users, conflicts are sure to arise and acceptable solutions are difficult. I believe cooperation and coordination between user groups are preferable to conflict and apt to provide better, longer lasting answers.

When developing management plans for the riparian areas, it is important to identify limiting factors before establishing the objectives. Approaches can be unnecessarily expensive and, sometimes, socially and economically inappropriate.

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