MOUNTAIN MEADOW RESPONSE TO RIPARIAN GRAZING STRATEGIES IN WESTERN USA

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ABSTRACT
The purpose of this grazing study was to examine the response of a mountain meadow riparian system to different levels of livestock use in late June. Six pastures were used to evaluate three levels of grazing. Over an 8-year period there was a general trend of increased plant species and biomass. The largest increases in species number occurred in pastures receiving the most grazing use. The opposite was true for plant biomass. Total plant cover decreased on all dry meadows, but increased on grazed streamside locations. Shrub cover, including streamside willows, increased under all grazing treatments. Streambank stability increased and stream width decreased in all pastures. Although changes were slow in this cold mountain valley, we concluded that these early season grazing regimes allowed development of increased biomass and cover of herbaceous and woody streamside vegetation and measureable improvements in some stream channel conditions.

KEYWORDS
Riparian, plant cover, plant composition, stream, stream width, fisheries

INTRODUCTION
Riparian areas, prized for their many values, are typically subjected to damaging stresses and impacts. Overgrazing by domestic livestock has been responsible for widespread damage to small stream riparian areas in Western United States (Trimble and Mendel, 1995). There is a critical need for improved grazing strategies that will permit livestock production while simultaneously preserving the characteristics needed for wildlife habitat, native fisheries, and water quality (Waters, 1995).

In 1987 a grazing study was initiated along Stanley Creek located within the Sawtooth National Recreation Area, Sawtooth National Forest, central Idaho, USA. The general objectives were to determine vegetation, small wildlife, fishery, and stream channel responses to grazing management. Preliminary responses of meadow vegetation and the stream channel are reported here.

MATERIALS AND METHODS
The experimental pastures lie within a broad, flat mountain valley with a westerly aspect and are positioned across Stanley Creek, a 3rd order stream. Elevation is 1950 m and average June temperature is 11 °C. Predominant plant species include: Kentucky bluegrass (*Poa pratensis L.*), tufted hairgrass (*Deschampsia cespitosa* (L.) Beauv.), water sedge (*Carex aquatilis* Wahl.), beaked sedge (*C. rostrata* Stokes), Baltic rush (*Juncus balticus* Willd.), thick-stemmed aster (*Aster integrifolius* Nutt.), cinquefoil (*Potentilla* spp. L.), Lemmon's willow (*Salix lemmonii* Bebb), and Drummond willow (*S. drummondiana* Barratt).

Six experimental pastures were established in fall 1986. Two pastures were assigned to each of 3 treatments: medium grazing (average of 2.20 AUM/ha), light grazing (average of 1.27 AUM/ha), and no grazing. Graminoid utilization averaged 35.2% at streamside and 48.8% in the dry meadow for the medium grazing treatment, and 21.4% at streamside and 25.1% in the dry meadow for the light grazing treatment. Grazing was limited to the last half of June over an 8-year period (1987-1994) except for 1993 when concerns about Federal listing of chinook salmon as a threatened species precluded grazing. These utilization levels were less severe and the season of grazing more restricted on the study site than had been the situation for most of this century.

A total of 180 systematically distributed points were located per pasture. At each point a 0.25-m^2 plot was sampled for various attributes. Canopy cover and forage utilization were ocularly estimated for graminoids, forbs, and shrubs. Standing crop biomass was determined by regression predictors in a double sampling procedure. Stream channel characteristics were measured on 31 cross-stream transects per pasture.

Response to grazing treatment was expressed as the difference between initial characteristics and characteristics present 4 and 8 years later. These differences were evaluated by analysis of variance using a General Linear Model. Probabilities of less than 0.05 were considered significant. Differences among means were identified by a protected Fisher's LSD. Responses of streamside locations, adjacent dry meadow locations, and channel transects were analyzed separately.

RESULTS AND DISCUSSION
The exposure of these pastures to different grazing intensities resulted in treatment-related changes of some characteristics, but not others. In some instances a general trend occurred across all treatments. These general responses were largely due to: 1) the current grazing treatments were less severe than the grazing in recent history, thus all pastures had some opportunity to respond to stress relief and 2) a dry weather pattern was present during most of the 8-year study period.

Streamside locations. Shrub cover increased in all pastures, but no differences occurred among treatments (Table 1). This was doubtlessly a reflection of season-of-grazing effects that tended to discourage livestock activity near the stream edge (Clary and Booth, 1993) and because all current grazing was less severe than had occurred previously. Graminoid cover decreased, while forb cover increased in the grazed, but not the ungrazed pastures (Table 1).

Overall there was an increase in average number of species under all treatments. There was a small increase in the number of shrub species across all pastures, but no difference among treatments. Graminoid species increased more in the grazed pastures as could be expected in response to grazing stress (Green and Kauffman, 1995). Mid-summer, post-grazing standing crop of biomass increased through the study period in all treatments for both streamside locations and the dry meadow. The greatest increase occurred in the ungrazed pastures.

Dry meadow locations. Overall, there was a decrease in total plant cover in dry meadow locations under all grazing treatments. Shrub cover increased in the lightly grazed pastures, but increased even more in the ungrazed pastures. Graminoid canopy cover decreased in all treatments. Forb cover increased under all treatments, although the greatest increase occurred with the most grazing. The shift in herbaceous cover composition toward more forbs was likely due to a combination of grazing and moisture stresses. There was an overall

increase in total species per plot. The number of graminoid and forb species increased the most under the moderate grazing treatment, while shrub species increased only under light or no grazing.

Stream channel. Ratings of streambank stability improved under all treatments, although the most improvement occurred under no grazing (Fig. 1). Stream width narrowed under all treatments, but the changes varied with grazing intensity. The width decreased least with moderate grazing and most with no grazing (Fig. 1).

Stream improvement is often slow under grazing management compared to ungrazed situations (Myers and Swanson, 1995). These current results illustrate some improvement in stream channel and fisheries habitat conditions occurred under both early season grazing intensities.

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Table 1

Change in streamside plant cover, 1987-1994

Grazing treatment	Graminoid cover (%)	Forb cover (%)	Shrub cover (%)	Total plant cover (%)
No grazing	+2.6b[1]	-9.0a	+4.7a	-1.7a
Light grazing	-6.2a	+3.8b	+7.1a	+4.7b
Moderate grazing	-4.1a	+2.6b	+5.0a	+3.6b

[1]Values in the same columm with different letters are different, P<0.05, n=479.

Figure 1

Percentage change in streambank stability and stream channel width, 1986-1994. Bars within a characteristic with different letters are different, P<0.05.