

Grazing Management to Improve Riparian Health

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Introduction

Livestock grazing on streams associated mountain meadows in California can negatively impact riparian vegetation, stream stability, water quality, and wildlife habitat. However, we have observed degradation at some grazed meadows but not others. This reflects differences in grazing management and meadow/stream resiliency to grazing. It is our opinion that identifying and promoting sustainable riparian grazing management is dependent upon: 1) working directly with grazing managers to identify grazing practices which maintain riparian health yet are logistically and economically feasible; and 2) conducting research at the management scale to insure the results are relevant at the management scale.



Grazed – Healthy Meadow Stream

Grazed – Unhealthy Meadow Stream



Project Objectives

1. Identify grazing management activities associated with healthy mountain meadow streams.
2. Extend these recommendations to grazing managers, regulators, and policy makers.

	Min.	Mean	Max.
Elevation (ft)	3,400	5,900	8,500
Pasture / Allotment Size (acres)	800	18,000	105,000
Herd Size (Animal Units)	10	150	670
Total Livestock Distribution Effort (days/yr)	0	9	41
Stream Substrate Type (% sites)	Fines	Gravel	Cobble
	53	27	20



Study Sites: Fifty-eight grazed meadow – stream riparian areas were enrolled in this cross-sectional survey. Sites were located on both public and private grazing lands across the Sierra Nevada Range, the southern Cascade Range, and the Modoc Plateau.

Data Collection

Grazing Management Activities: One-on-one, on-site survey of the grazing manager (e.g., number of head, class of livestock, season of use, time spent herding to distribute livestock).

Riparian Health Assessment:

1. A first approximation of riparian health was determined for each site using the U.S. EPA *Habitat Assessment Field Data Sheet* (HAFDS), which assigns a health score of 0 (very poor) to 20 (excellent) based upon an 11 panel questionnaire.

2. A direct measure of riparian health was made by sampling in-stream macroinvertebrate (insect) community, taxonomic ID, and calculation of macro-based indicators of stream health (e.g., % sample composed if taxa intolerant of pollution, richness, diversity).

Site Characteristics: Stream substrate type (silt/sand, gravel, cobble), solar radiation/canopy cover, channel width and depth, streambank erosion/vegetative cover, etc.



Correlation of Grazing Management to Riparian Health

USEPA HAFDS Riparian Health Score:

Linear regression analysis was used to identify grazing management activities and site characteristics which were positively and negatively correlated with U.S. EPA HAFDS health score (0 to 20). P<0.10 for significance.

Health Score	Health Category
0 to 5	Poor
6 to 10	Marginal
11 to 15	Suboptimal
16 to 20	Optimal

In-stream Macroinvertebrate Metrics: Negative binomial regression analysis was used to identify grazing management activities which were positively and negatively correlated with 10 macroinvertebrate metrics sensitive to changes in stream conditions (e.g. water temperature, sedimentation). Independent variables were grazing management, and site characteristics. P<0.10 for significance.

Results: Grazing and EPA Riparian Health Score

Grazing Management Activity	Correlation to Health Score
Time maintaining off-stream attractants (days/yr)	Positive
Herding to reduce time near stream (days/yr)	Positive
Livestock density (AU/ac)	Negative
Frequency of grazing (times/yr)	Negative

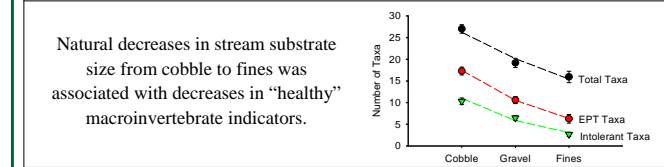
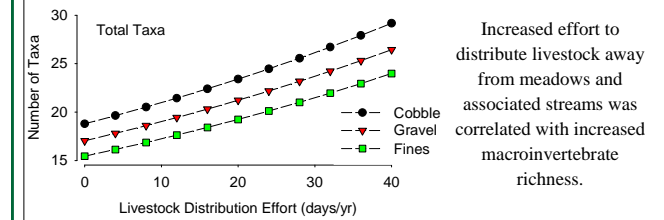
Positive Grazing Management: Riparian health score was positively correlated to the time a manager invests to maintain off-stream livestock attractants such as salt, supplemental feeds, and drinking water (p<0.05). The practice of providing off-site attractants was not significant, rather the time invested to insure the practice is effective. Time spent herding to distribute livestock from meadow to meadow, or into uplands was also positively correlated with riparian health score.

Negative Grazing Management: Livestock density (head/ac) on the pasture or allotment containing the meadow was negatively associated with riparian health score. As was the frequency, or number of times per year, the meadow was grazed during a single year. These variables reflect overall grazing pressure applied to the meadow.

Results: Grazing and Macroinvertebrate Metrics

Livestock Distribution Effort: The overall time invested in activities to distribute livestock away from meadows and associated streams was the only grazing activity correlated with macroinvertebrate metrics. Basically, as the amount of time per year spent herding livestock, placing and regularly moving salt/mineral, and checking the working order of off-stream drinking water sources increased there was an associated increase in the macroinvertebrate metrics indicative of healthy riparian conditions. There was also a reduction in the metrics indicative of riparian degradation.

Macroinvertebrate Metrics	Indicate Riparian Health or Degradation	Correlation to Increased Livestock Distribution Effort (days/yr)
No. Ephemeroptera (mayflies)	Health	Positive (p=0.05)
No. Plecoptera (stoneflies)	Health	Positive (p<0.01)
No. Tricoptera (caddisflies)	Health	Positive (p=0.07)
Tot. No. EPT	Health	Positive (p=0.01)
Total No. Taxa (richness)	Health	Positive (p<0.01)
No. Coleoptera Taxa (beetles)	Health	Positive (p=0.02)
% Intolerant to Pollutants	Health	Positive (p<0.01)
% Dominant Taxa	Degradation	Negative (p=0.03)
% Diptera (true flies)	Degradation	Negative (p=0.10)
% Chironomidae (midges)	Degradation	Negative (p=0.09)



Conclusions: Management of livestock distribution is a critical management activity to enhance and sustain riparian health in mountain meadow grazing systems. Simple distribution tools such as herding, salting, and off-stream water are effective for protecting riparian areas, but management effort must be invested to assure success. Expectations for stream health based upon macroinvertebrate metrics must account for inherent site differences in stream substrate type.