Cattle Grazing Strategies That Limit Stream Bank Degradation

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SUMMARY

This report summarizes our two published studies that test whether altering timing of grazing (McInnis and McIver 2009) or providing cattle with off-stream drinking water and mineral supplements (McInnis and McIver 2001) can lessen grazing-induced damage of stream banks. In each 2-year study, grazing treatments were replicated along a mountain stream in northeastern Oregon. Estimates of stream bank cover and stability were taken before and after each grazing period. The first study compared early summer to late summer grazing, and found that cattle spent more time in uplands earlier in the year when green forage was available, resulting in development of just 3 percent uncovered stream banks compared to 8 percent late season. Similarly, early summer grazing resulted in 13 percent unstable stream banks compared to 31 percent later in summer. Our second study compared stream banks in pastures provided with off-stream water and mineral supplements to pastures lacking those amenities. Off-stream water and supplements attracted cattle into the uplands enough to reduce development of ncovered/ unstable stream banks from 9 percent in non-supplemented pastures to just 3 percent in supplemented pastures.

INTRODUCTION

Riparian areas are critical components of western rangelands and function to store water, recharge aquifers, moderate flood intensity, maintain water quality by filtering chemical and organic wastes, trap sediments, and provide habitat for wildlife. Cattle are naturally attracted to riparian areas because of shade, drinking water, and forage. Roath and Krueger (1982) estimated 81 percent of forage used by cattle came from a streamside meadow representing only 2 percent of the grazing area. Such disproportionate use, especially under conditions of *heavy* cattle grazing, can lead to a cascading loss of riparian vegetation, breakdown of stream banks, stream widening, impairment of water quality, and loss of wildlife habitat. Our studies were part of larger projects that compared cattle distribution in riparian pastures during early versus late summer (Parsons et al. 2003) and with versus without off-stream water and mineral supplements (Porath et al. 2002). Those studies successfully altered distribution of cattle and resulted in increased use of uplands. The objective of our research was to determine whether such grazing strategies would limit cattle-induced degradation of stream banks.

METHODS

Research was conducted on the Hall Ranch Unit of Oregon State University's Eastern Oregon Agricultural Research Center near Union, Oregon. Nine pastures (averaging about 28 acres; range 22-37 acres) were delineated along a 1.5-mile reach of Milk Creek (Fig. 1). Grazing treatments were randomly assigned to pastures within each of three blocks. Cow-calf pairs were introduced into the grazed pastures to achieve moderate stocking rates averaging about 1.7 acres/Animal Unit Months (range 1.2-2.2 acres/AUM). Stocking rates and length of grazing bouts were chosen to achieve a

moderate grazing intensity of about 50 percent utilization of key forage species. Actual utilization was measured and averaged less than 50 percent in every case.

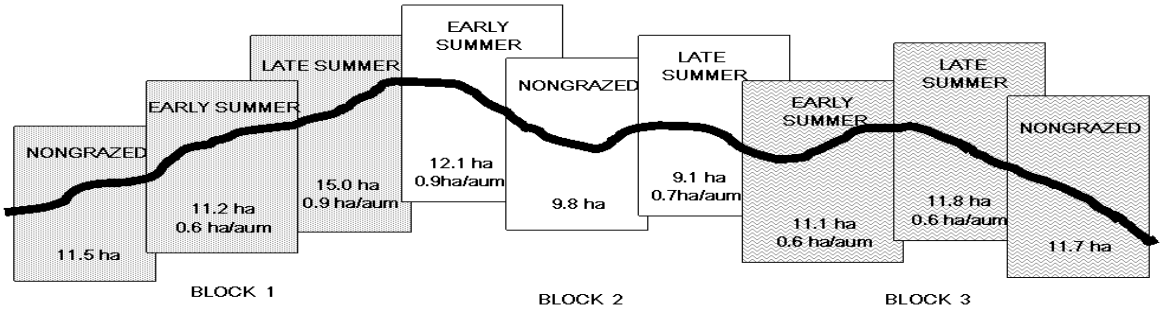

Figure 1. Schematic diagram (not to scale) showing experimental pastures on Milk Creek in northeastern Oregon. Each of three blocks contained three grazing treatments (study no. 1 described in text): (1) nongrazed; (2) early summer grazing (mid-June to mid-July); (3) late summer grazing (mid-August to mid-September). Black line represents Milk Creek, which flows from Block 1 in the south through Block 3 in the north. Pasture arrangement was identical in study no. 2, but grazing treatments differed (see text).

Study No. 1: Altering Timing of Grazing

During 1998 and 1999 three grazing treatments were examined: (1) nongrazed; (2) early summer grazing (28 days; mid-June to mid-July); and (3) late summer grazing (28 days; mid-August to mid-September). Estimates of stream bank cover and stability were taken before and after each grazing period by pacing both sides of the creek and examining plots (about 20 x 12 inches) along the "greenline" (the first vegetation at the water's edge). Additionally, frequency of cattle hoof prints (plots with hoof prints/total number of plots) was measured as an indicator of cattle presence. Plots were classified as "covered" if they contained any of the following features: (1) living perennial vegetation ground cover greater than 50 percent, or (2) roots of deeply-rooted vegetation such as shrubs or sedges covering more than 50 percent of the plot, or (3) at least 50 percent of the stream bank surface covered by rocks of cobble size or larger, or (4) at least 50 percent of the bank surface covered by logs 4 inch diameter or larger. Otherwise plots were rated "uncovered". Cover estimates were based on visual assessment of the vertical projection of a polygon drawn around extremities of above-ground parts onto the ground.

Plots were classified "stable" unless they exhibited any of the following features: (1) blocks of banks broken away and lying in the stream channel adjacent to the bank

("bank breakage"), (2) bank sloughed into the stream channel ("slump"), (3) bank cracked and about to move into stream ("fracture"), (4) bank uncovered as defined above with an angle visually estimated steeper than 80 degrees from horizontal ("vertical bank"). Plots exhibiting any of those features were rated "unstable".

Each plot was rated according to stream bank cover and stability and grouped into one of four classes: (1) covered/stable, (2) covered/unstable, (3) uncovered/stable, (4) uncovered/unstable. One person collected all data.

Study No. 2: Providing Off-stream Water and Mineral Supplements

During 1996 and 1997 three replications of each of the following grazing treatments were studied using the same pasture design described above: (1) nongrazed; (2) "supplemented" pastures in which free-choice off-stream water and trace mineralized salt was provided; and (3) "nonsupplemented" pastures in which no off-stream water or salt was provided. Free-choice off-stream water and salt was provided in supplemented pastures about 400 yards upslope from Milk Creek. Feeders containing salt were placed about 15 ft from water troughs. Cow-calf pairs grazed 42 consecutive days beginning mid-July. Frequency of hoof prints and estimates of stream bank cover and stability were made before and after grazing the second year of the study using the methods described above.

RESULTS AND DISCUSSION

Study No. 1: Altering Timing of Grazing

Frequency of plots with cattle hoof prints in nongrazed, early-grazed and late-grazed pastures, respectively, averaged 0 percent, 53 percent (SE$\pm$ 11 percent), and 90 percent (SE $\pm$ 1 percent). Change in stream bank cover resulting from early grazing (-3 percent) was not statistically different from nongrazed controls, but was significantly less than the 8 percent reduction in cover observed following late summer grazing (Table 1). Stream bank stability decline resulting from early grazing (-13 percent) was less than half that observed after late-season grazing (-31 percent). The greatest change was in the covered/stable category, which declined 10 percent during early summer and 28 percent during late summer. Grazing resulted in increased percentages of covered/unstable and uncovered/unstable stream banks, and in each category the increase was greatest for the late summer grazing treatment. There were proportionally larger changes in stability compared to cover that resulted from grazing (Table 1). Therefore decline in bank stability likely contributed more to change in the uncovered/unstable category than did decreases in cover.

Study #2: Providing Off-Stream Water and Mineral Supplements. Following grazing, the percentage of plots having cattle hoof prints averaged 0%, 26% (SE $\pm$ 4) and 31% (SE $\pm$ 5) in control, supplemented, and non-supplemented pastures, respectively. While there was a trend for supplemented pastures to have a lower frequency of hoof prints in the greenline compared to non-supplemented units, the two treatments did not differ statistically. Neither stream bank cover alone nor stability alone differed between grazed treatments, and both decreased compared to nongrazed controls (Table 2). When combined, stream bank cover and stability declined 9% in non-supplemented pastures compared to only 3% in supplemented pastures. Declines in stream bank stability contributed more to this change than declines in stream bank cover.

Table 1. Mean proportions of stream bank (m/100 m of stream bank) before grazing, after grazing and change for nongrazed pastures (control), early summer grazing (mid-June to mid-July), and late summer grazing (mid-August to mid-September), 1998 and 1999. See McInnis and McIver (2009) for full data set.

Streambank parameter	Non-grazed pastures			Early summer grazing			Late summer grazing		
	(m/100 m of stream bank)								
	Before	After	Change	Before	After	Change	Before	After	Change
Covered	90	91	$+1^{a}$ *	90	87	-3^{a}	95	87	-8^{b}
Stable	92	92	0^{a}	91	78	-13^{b}	99	68	-31^{c}
Covered/ stable	83	84	$+1^{a}$	81	71	-10^{b}	94	66	-28^{c}
Uncovered/ stable	9	8	-1^{a}	10	7	-3^{a}	5	2	-3^{a}
Covered/ unstable	7	7	0^{a}	9	16	$+7^{b}$	1	21	$+20^{c}$
Uncovered/ unstable	1	1	0^{a}	0	6	$+6^{b}$	0	11	$+11^{c}$

* Change within stream bank parameters among treatments (rows) with different superscripts are significantly different (lsd; $P < 0.05$; $n = 6$).

Table 2. Mean proportions of stream bank (m/100 m of stream bank) before grazing (June), after grazing (September), and change for nongrazed pastures (control), supplemented pastures (water and mineralized salt), and nonsupplemented pastures, 1997. See McInnis and McIver (2001) for full data set.

Streambank parameter	Non-grazed pastures			Supplemented pastures			Nonsupplemented pastures		
	(m/100 m of stream bank)								
	Before	After	Change	Before	After	Change	Before	After	Change
Covered	92	92	0^{a}*	94	90	-4^{ab}	89	83	-6^{b}
Stable	91	91	0^{a}	95	85	-10^{b}	93	76	-17^{b}
Covered/ stable	90	90	0^{a}	89	79	-10^{b}	82	68	-14^{b}
Uncovered/ stable	3	3	0^{a}	5	6	$+1^{a}$	10	8	-2^{a}
Covered/ unstable	5	5	0^{a}	5	11	$+6^{ab}$	8	15	$+7^{b}$
Uncovered/ unstable	2	2	0^{a}	1	4	$+3^{b}$	0	9	$+9^{c}$

* Change within stream bank parameters among treatments (rows) with different superscripts are significantly different (lsd; $P < 0.05$; $n = 6$).

MANAGEMENT IMPLICATIONS

Proper management of stream banks is key to maintaining properly functioning riparian areas. Cattle impact stream banks through two processes: grazing and trampling. Several studies have shown that loss of cover by grazing can reduce resistance of stream banks to high flows and increase erosion. Trampling can loosen fragments of soil, making them more erodible, and hoof action can shear off segments of stream banks, making them less stable. Our studies show how the following two grazing strategies can help encourage cattle into uplands and thereby limit stream bank degradation.

Strategy No. 1: Alter Timing of Grazing

Parsons et al. (2003) found that during the cool season of early summer, when forage quality and quantity were not limiting and ambient air temperatures were moderate, cattle were evenly distributed across riparian areas. As ambient air temperature and forage dry matter increased during the hot season of late summer, cattle spent more time near the stream compared to uplands. We found that grazing during either season impacted stream banks compared to nongrazed controls. However, grazing during mid-June to mid-July, when cattle were attracted to adjacent uplands, limited damage to stream bank cover and stability compared to grazing later in the year when cattle congregated in riparian areas. Grazing should not occur so early in the season as to trample wet soils, but early grazing may have an additional benefit of allowing time for subsequent regrowth of grazed riparian plants before high flows the following year. Cattle may behave differently in other geographic areas, and be attracted to uplands at other times of the year compared to our study in northeastern Oregon. Land managers must consider timing, as well as frequency and intensity of grazing impacts on individual streams and even portions of streams to formulate best management practices for meeting grazing and land management objectives in specific watersheds.

Strategy No. 2: Provide Off-Stream Water and Salt Supplements

These amenities resulted in slightly (though not statistically) less use of stream banks by cattle compared to nonsupplemented pastures. The difference was enough to reduce development of uncovered/unstable stream banks threefold.

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