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Impacts of Rest-Rotation Grazing on Stream Banks in Forested Watersheds in Idaho

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Abstract

Rest-rotation grazing in Idaho allowed forage in the stream-side zone to be used at a higher rate than on either immediately adjacent range or the overall grazing allotment. Stream sides received unauthorized grazing during the scheduled rest periods, however, and complete rest was difficult to achieve. Cattle appeared to graze stream-side meadows at high elevations with less intensity during the early grazing period when vegetation was lush than during the late grazing period. Stream-bank alteration occurred soon after cattle were turned into ungrazed meadows.

Precisely when western stockmen first began to notice a reduction in forage as a result of overused rangelands is not known. Effects of overgrazing, however, were beginning to be recognized as early as 1878 (Box 1979) and the problem was no longer ignored by the turn of the century. By the 1930's, western rangeland conditions were degraded so obviously that Congress passed the Taylor Grazing Act in 1934 to regulate grazing on the public domain; in 1936, the U.S. Department of Agriculture issued its historic letter to the U.S. Senate entitled "The Western Range." This letter stated that deterioration of western rangelands was "so nearly universal under all conditions of climate, topography, and ownership that the exceptions serve only to prove the rule." The political and economic processes were then initiated to begin range rehabilitative efforts in earnest.

Today, many authorities believe that range conditions have improved. Busby (1979), for example, stated that today's rangelands, though possibly in only "fair" condition, are far superior to the denuded rangelands of the 1930's, and Box (1979) believes that western rangelands are presently in their best condition of this century. Appraisals by the Bureau of Land Management (BLM), U.S. Department of the Interior, and the Forest Service (U.S. Department of Agriculture), however, show that riparian lands are still in need of improved management. The BLM estimates that of 217,254 hectares of riparian habitat, 181,086 (83%) were in unsatisfactory condition (Almand and Krohn 1979). The 9.3 million hectares of riparian and wetlands managed by the Forest Service (Owen 1979) are receiving impacts that require prompt attention (USDA Forest Service 1979a).

The noteworthy recovery in overall range condition after the 1930's resulted from a variety of management activities, ranging from reduced livestock stocking rates (numbers per unit area) to special grazing strategies. One of these strategies, rest-rotation grazing, was developed early in this century but was not accepted until Forest Service personnel developed it for use on perennial bunchgrass ranges (Hormay and Evanko 1958; Hormay and Talbot 1961). Rest-rotation grazing is now the primary strategy used on many ranges.

We set up special pastures in ungrazed watersheds so we could follow the effects of rest-rotation grazing by cattle under previously pristine conditions. Additional study areas were situated in allotments that had already been under rest-rotation grazing by cattle for 20 years or more. These two approaches allowed us to look at long-term vs short-term effects, and the effects of this grazing and the timing of grazing on stream-bank stability and riparian vegetation. Some possible solutions for better compatibility between cattle grazing and riparian-stream systems are presented.

Rest-Rotation Grazing

Under rest-rotation grazing, the grazing area or allotment is partitioned into several pastures. Each pasture is grazed in turn and usually is rested at least 1 year during a grazing cycle. However, in some unusual situations such as periods of

low forage production, the pasture scheduled for rest may be grazed anyway at the range manager's discretion (Hormay and Talbot 1961; Hormay 1970). Opinions about the value of rest-rotation grazing vary considerably. Hormay (1970) believes that rest-rotation grazing is a powerful tool for increasing land and vegetative productivity, but W. R. Meiners (in a speech to the Society for Range Management at Tucson, Arizona in 1974) called rest-rotation grazing "a bummer." Blackburn et al. (1982), in a review of grazing impacts on watersheds, offered little support for special grazing strategies.

Ratcliff and Reppert (1974) reported increased vigor of Idaho fescue (*Festuca idahoensis* Elmer) under rest-rotation grazing in California, and Hughes (1979) showed increases in vegetation quality and quantity under rest-rotation grazing in Colorado. Hughes also demonstrated that animal weights could be increased without reducing animal numbers. Gifford and Hawkins (1976), however, surveyed the range management literature and suggested that there is little evidence to indicate that any specialized grazing strategy (including rest-rotation) consistently increased plant cover on watersheds. VanPoolen and Lacey (1979) also analyzed the literature and suggested that, while specialized grazing management usually increases vegetative production, reduction in stocking rates is much more influential. This disparity of opinion results because there is little conclusive evidence to support either line of thinking.

The lack of definitive information to guide multiple-use management is particularly detrimental to proper stream-side management. Hormay and Talbot (1961) made two statements relative to this problem: (1) selective grazing (grazing preferred plants) is one of the principal causes of range deterioration; and (2) under rest-rotation grazing, cattle stocking is based on forage production and use of all available forage, so the degree of use assumes less importance. Thus, under a typical rest-rotation strategy, one would expect the stocking rate to be based mainly on the total production and use of other vegetation that accounts for most of the forage. Because selective grazing causes range deterioration, however, one might reasonably expect continued deterioration of the stream-side vegetation because cattle generally prefer it to that of the drier uplands (uplands are all range types other than riparian). The question of preference has been only superficially addressed so far and needs considerably more research.

Hughes (1979) found that rest-rotation grazing improved range productivity but found no corresponding improvement in riparian conditions. He suggested the fencing of riparian areas. In Utah, Starostka (1979) not only found no stream-side improvement under rest-rotation grazing, but even speculated that the lush riparian growth produced by rest periods caused heavier than normal use of the riparian zone. Platts (1981) also pointed out that even though the ranges have improved since the 1930's, the associated riparian habitat could actually have deteriorated because cattle prefer to graze and rest in riparian zones.

Knowing how stream sides respond to widely used rest-rotation grazing strategies is important because stream-side vegetation is important to fish and wildlife and to the public that uses these areas. The importance of riparian vegetation to wildlife is well-documented by Thomas (1979) and Thomas et al. (1979). Its importance to fish is not necessarily as well appreciated. Furthermore, destructive trampling of the banks probably poses a more serious threat to fish than grazing over the long term. Removal of riparian vegetation which leads to increased erosion, along with trampling, must be evaluated in order to prepare livestock management strategies that will further the goals of multiple-use rangeland management.

Study Areas

Eleven study areas were located in three widely separated tributaries of the Salmon River of central Idaho (Fig. 1), a drainage famous for its chinook salmon (*Oncorhynchus tschawytscha*) and steelhead (*Salmo gairdneri*) production. Climatic conditions in this drainage are severe. Cold snowy winters are routine. Temperatures as low as −50 C have been recorded and annual precipitation runs as high as 1,778 mm (USDA Forest Service 1979b). Considerable rain falls during spring months, but summers generally are warm and dry. Intense storms are common and frost can occur during any month of the year.

All of these areas are located in Forest Service grazing allotments. The study areas on the South Fork Salmon River had not been grazed for 2 decades prior to the study. On the remainder of the study areas, grazing is confined mainly to highly productive, grassy, valley bottoms. The

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precise nature of the vegetation, like the climate, varies with topography, elevation, and longitude (Steele et al. 1981); all of the study areas are located at a similar latitude.

South Fork Salmon River Drainage

Stolle Meadows.—Four areas (Upper, Guard, Cougar, and Lower) were located on meadows in the South Fork Salmon River (SFSR) drainage, meadows that historically had been grazed only by wild ungulates and domestic sheep (sheep were eliminated from the allotment in 1962). Three of the study areas were located in meadows within forests of the *Abies grandis* series (Steele et al. 1981) at an elevation of 1,615 m above mean sea level. Stream-side vegetation typically consisted of sedges (*Carex* spp.), grasses such as timothy (*Phleum pratense* L.), and willows (*Salix* spp.). Adjacent range vegetation typically consisted of open stands of lodgepole pine (*Pinus contorta* Dougl.), with an understory of reedgrasses (*Calamagrostis* spp.) or open areas of timber danthonia (*Danthonia intermedia* Vasey) and Idaho fescue.

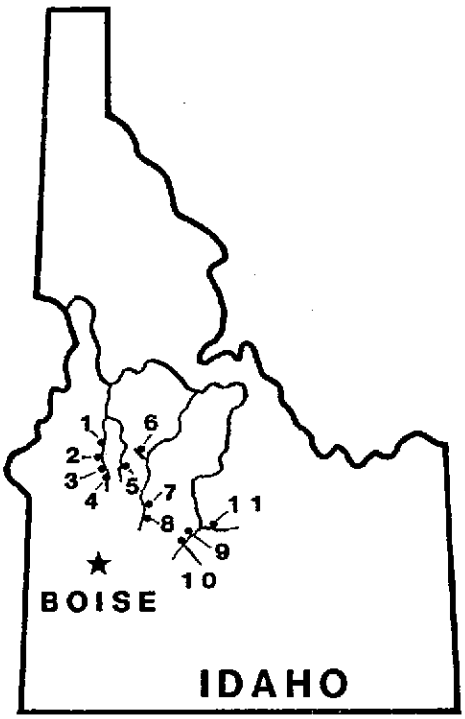
The fourth study area (Upper Stolle) was located in forest (USDA Forest Service 1977) of the *Abies lasiocarpa* series (Steele et al. 1981). The area consisted almost entirely of wet meadow dominated by sedges (*Carex* spp.), elkslip marshmarigold (*Caltha leptosepala* DC.), and alpine leafybract aster (*Aster foliaceous* Lindl.).

Tyndall Meadows.—This study area, at an elevation of 2,042 m, was located near the headwaters of Johnson Creek in a broad, low-gradient valley surrounded by forest vegetation of the *Abies lasiocarpa* series (Steele et al. 1981). The riparian corridor supports principally water sedge (*Carex aquatilis* Wahl.) and low willow (*Salix* sp.). Adjacent range forage was principally dry meadow species such as timber danthonia.

Middle Fork Salmon River Drainage

Bear Valley.—These two study areas (Bear Valley areas 7 and 8) were located on Bear Valley Creek at an elevation of 2,012 m in a broad, low-gradient meadow surrounded by forest vegetation of the *Pinus contorta* series (Steele et al. 1981). Stream-side forage included a variety of sedges, Baltic rush (*Juncus balticus* Willd.), tufted hairgrass (*Deschampsia caespitosa* [L.] Beauv.), bluejoint (*Calamagrostis canadensis* (Michx.) Beauv.), and willows. The drier adjacent range supported a variety of grasses and forbs, including timber danthonia, Idaho fescue, and whitehead wyethia (*Wyethia helianthoides* Nutt.).

Elk Creek.—The Elk Creek area was located in a broad, low-gradient valley at an elevation



Key :

1-Upper Stolle
2-Guard Stolle
3-Cougar Stolle
4-Lower Stolle
5-Johnson Cr.
6-Elk Cr.
7-Lower Bear Valley
8-Upper Bear Valley
9-Lower Frenchman
10-Upper Frenchman
11-Horton Cr.

Figure 1. Location of study areas.

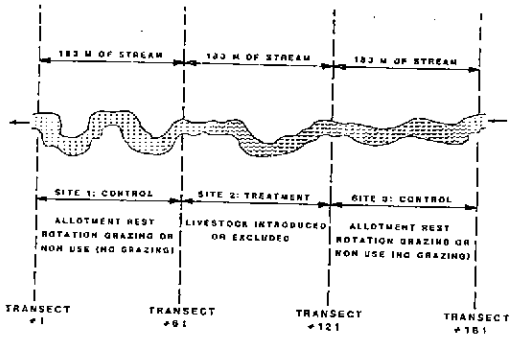


Figure 2. Arrangement of stream sections at a study site.

of 1,981 m. Surrounding forest vegetation belonged chiefly to the *Pinus contorta* series (Steele et al. 1981). Stream-side and adjacent range vegetation has not been adequately classified, but appears similar to that of the Bear Valley study areas.

Salmon River Drainage

Frenchman Creek.—These two study areas (Upper and Lower) were located on Frenchman Creek at an elevation of 2,286 m in a narrow glacial valley. The areas are surrounded by forest of the *Pinus contorta* series and probably of the *Pinus contorta/Carex geyeri* habitat type (Steele et al. 1981); Tuhy and Jensen (1982) have shown bluejoint, water sedge, and willows to be common riparian plants in this area. Wet meadow vegetation frequently occurred throughout, but there were some small patches of terrestrial forage that included sheep fescue (*Festuca ovina* L.) and various forbs.

Horton Creek.—Horton Creek, at an elevation of 2,256 m, is a small stream that emerges as a spring. The upper site within the study area was in a sheep-holding pasture (a grazing strategy atypical under allotment management but common on private lands) and has been heavily grazed for the past 80 years. The adjacent lower site within the area was in an administrative site that has received only light intermittent grazing since 1909. Stream-side vegetation was dominated by sedges and tall willows in the lower site, whereas the adjacent upper study site supported big sagebrush (*Artemesia tridentata* Nutt.), shrubby cinquefoil (*Potentilla fruiticosa* L.), and a variety of grasses including Idaho fescue.

Methods

Study Design

Each study area consisted of a 548.6-m reach of stream gridded by 181 transects placed at about 3-m intervals, except for the Horton Creek area where the study reach was 365.8 m long and gridded by 120 transects (Fig. 2). The central 182.9-m study site (60 transects) of each study area was fenced to create an experimental treatment pasture that could be rested or grazed under careful control (Fig. 2). On the rest-rotation grazed allotments, this design provided for 121 randomly stratified sample transects in the grazed areas and 60 independent samples within the ungrazed treatment pastures.

The Upper Bear Valley study area straddled two different rest-rotation pastures within one allotment; therefore, the two grazed sites, one with 61 and the other with 60 transects, were evaluated separately. The areas in the SFSR and

Table 1. Ratings of animal use of stream-side forage.

Rating	Description
76–100%	Use of stream-side vegetation by livestock is very high. Vegetation has been grazed to less than 51-mm average stubble height. Almost all of the potential vegetative cover has been used and only the root system and part of the stem remain. Potential plant growth no longer occurring because of past use by animals is considered to have been used.[a]
51–75%	Use of stream-side vegetation by livestock is high and less than half of the potential plant cover remains. Plant stubble height averages over 51 mm. Plant growth no longer on site because past use is considered as used vegetation.
26–50%	Use of stream-side vegetation by livestock is moderate and at least one-half of the potential plant cover remains. Average plant stubble height is over one-half of its potential growth at present stage of development. Plant cover no longer on site because past use is considered to have been used.
0–25%	Use of stream-side vegetation by livestock very light or absent. Nearly all potential plant cover is on the site and there are no bare areas because of past use. Vegetative cover is very close to what would occur naturally without grazing.

[a] Examples of these areas are cattle stream crossings, salting areas, fence lines, bedding areas, trailing routes, watering sources, or denuded areas.

Table 2. Descriptions of stream-bank alteration ratings.

Rating	Description
100–76%	Stream-bank areas intercepted by the transect line are severely altered. Less than 25% of the bank is in a stable condition. Over 75% of the bank is false,[a] broken down, or eroding.
75–51%	Banks are receiving major alteration along the transect line and less than 50% of the stream bank is in stable condition. Over 50% of the bank is false, broken down, or eroding.
50–25%	Banks are receiving only moderate alteration. At least 50% of the bank is in a natural stable condition.
24–1%	Banks are stable but receiving some light alteration. Less than 25% of the bank is receiving any kind of stress and, if stress is being received, it is very light. Less than 25% of the bank is false, broken down, or eroding.
0	Stream banks are stable and not being altered by water flows, animal use, or other factors.

[a] A false bank has been eroded by forces other than stream action until it gradually slopes away from the water surface. Such banks can become revegetated and stable but no longer provide fish cover. Even though stable, such banks are classified as altered.

Frenchman Creek drainages were opposite in design to the Bear Valley study areas. The treatment pastures in the SFSR and Frenchman areas were grazed by cattle under a three-pasture, rest-rotation strategy, and the control sites were either not being grazed (SFSR) or were lightly grazed by sheep under a rest-rotation strategy (Frenchman Creek). On the Horton Creek area, the rest-rotation pasture was grazed by cattle and was flanked by a sheep-grazed site and an ungrazed control. Only the ungrazed control and the rest-rotation site are compared in this study. All treatment and control pastures (except Horton) were studied a minimum of 4 years prior to any grazing treatment so that the results could be compared to pre-treatment conditions.

Stream-Side Forage Use

The degree of forage use along a stream by livestock was determined using the criteria outlined in Table 1. Forage use was estimated immediately after the grazing season ended and was determined along each transect line from the water's edge to 1.5 m out on the bank or to the top of the bank, whichever was greater. Each study area, therefore, had 362 measurements to determine forage use (except Horton, which had 242). This technique has been shown to be accurate, can be replicated (Platts et al. 1983), and compares well with simultaneous measurements taken with an electronic capacitance meter (Platts and Nelson 1983).

Use of Adjacent Range and Allotment Pasture

Forage use on the adjacent range (here defined as being within 0.5 km from the stream of predominantly meadow vegetation but normally outside of the stream-side corridor), and overall pasture (a pasture is a managed area within an allotment) was determined by Forest Service range conservationists using the methods outlined in the Intermountain Region 4 range analysis manual FSH 2209.21 of the Forest Service (USDA Forest Service 1981). Range conservationists determine production, use, and plant composition in one operation but only forage use estimates are presented in this report. By weighing sampled clipped vegetation and visually estimating the remaining vegetation, the weight of forage remaining and that used by livestock is determined for each plant species within the measurement plot. The amount of forage used by livestock was estimated by comparing grazed with ungrazed plants and by comparing ungrazed areas protected by metal cages with surrounding grazed areas.

Comparisons of Methods

Because of the different methods the range conservationists used to estimate vegetation use and the lack of statistical treatment, we have not attempted to apply tests of significance to average levels of use reported. We find this acceptable because all estimates are averages of point estimates that attempt to relate observed levels of use to areas impossibly huge for exhaustive sampling.

One method of determining the use of stream-side forage produces results comparable to the results derived by the electronic capacitance meter (±5% of mean averages) (Platts and Nelson 1983). Such results also compare favorably with the range specialists' estimates of desired use. Our method differs, however, in that it evaluates the complete area under the transect regardless of whether forage still grows there (banks covered solely with boulders, logs, gravel, or bedrock would be considered to have zero vegetation use). This method could tend to underestimate forage use as compared to the Forest Service method

Table 3. Increases in stream-side use (percentage) over adjacent and pasture range on study sites within grazed allotments.

Allotment pasture	Adjacent range		Overall pasture range		Increase adjacent range use over pasture use	
	All years	Without rested years	All years	Without rested years	All years	Without rested years
Upper Bear Valley						
Pasture 1	6	9	11	16	4	7
Pasture 2	14	15	19	23	7	10
Lower Bear Valley	5	−3	7	1	2	4
Elk Creek	5	11	11	5	−3	−7
Johnson Creek	ID[a]	47	ID	47	0	0
Average excluding Johnson Creek	8	8	12	8	3	4

[a] Insufficient data.

used by the range conservationists. Our method also accounts for potential forage lost to livestock trails, salting areas, bedding areas, and water crossings which could produce estimates higher than those derived by range conservationists. The two differences may be compensating. Range conservationists from the various government agencies generally agreed that the two methods were theoretically compatible, but we were cautioned that results could differ under certain circumstances.

We believe estimates derived from the two methods are comparable for the purpose of this report, based on discussions with other professionals, our stream-side forage use estimates being within ±5% of the electronic capacitance meter estimates, and the ability of range conservationists to consistently estimate forage use within 10% error (personal communication, Dennis Froeming, range specialist, BLM, Boise, Idaho). If there is an actual difference, our forage-use method probably would underestimate. Therefore, the use of stream-side vegetation vs the use on adjacent range and the overall allotment pasture could be slightly more than this report indicates.

Stream-Bank Alteration

Stream-bank alteration was evaluated in the treatment and control pastures using the criteria in Table 2. Observer bias was minimized by evaluating time trend differences between treatment

Table 4. Percentage of available forage used in treatment pasture study areas by location, 1979–1982.

Year and range location	Treatment pastures						
	Upper Stolle	Guard Stolle	Cougar Stolle	Lower Stolle	Upper Frenchman	Lower Frenchman	Horton Creek
1979:							
Stream side	68	68	69	32	58	74	Rested
Adjacent	85	81	99	72	80	81	
1980:							
Stream side	84	74	66	83	60	69	65
Adjacent	92	61	92	76	60	80	70
1981:	Rested						
1982:							
Stream side	73	43	66	60	56	64	62
Adjacent	79	57	81	53	80	85	70
Average[a]							
Stream side	75	62	67	58	58	69	64
Adjacent	85	66	91	67	73	82	70

[a] Rested years excluded.

Table 5. Average forage use (in percent) on stream side and adjacent range during early and late grazing in Idaho meadows.

Study area	Early grazing			Late grazing		
	Stream side	Adjacent range	Difference	Stream side	Adjacent range	Difference
Treatment pastures (1979–1982)						
Upper Stolle	71	82	−11	92	76	−8
Guard Stolle	56	69	−13	61	92	+13
Cougar Stolle	68	90	−22	92	61	−26
Lower Stolle	46	63	−17	76	92	+7
Upper Frenchman	57	80	−23	60	60	0
Lower Frenchman	69	83	−14	69	80	−11
Horton Creek	62	70	−8	65	70	−5
Averages	61	77	−16	73	76	−4
Allotments (1976–1982)[a]						
Upper Bear Valley						
Pasture 1[b]	79 (78)	61	18 (17)	78 (72)	54	24 (18)
Pasture 2	73	58	15	79 (79)	61	18 (18)
Lower Bear Valley	43 (61)	61	−18 (0)	70 (65)	60	10 (5)
Elk Creek	45 (56)	23	22 (33)	41 (69)	41	0 (14)
Averages	60 (65)	51	9 (16)	67 (69)	54	13 (15)

[a] 1976 data excluded. The number in parenthesis is the mean for all years of data collection. The number preceeding the parenthesis is the average from only those years when data for both stream side and adjacent use were available. Johnson Creek was not included because it was not grazed late during the study period.
[b] 1976 data excluded because of modified rotation schedule.

and control pastures rather than absolute levels of alteration.

Results

Stream-Side Use under Allotment Management

Forage use differed among stream banks, adjacent range sites, and on the overall pasture (Tables 3 and 4). Stream-side forage was more heavily used than adjacent range forage on all allotments. Only 1 year's data were collected on the Johnson Creek allotment because the pasture was rested most of the time. On the average, stream-side forage received about 8% greater use than the adjacent range and about 12% greater use than the pasture forage. Use of adjacent range was about the same as overall pasture use but varied by study area. Consequently, if the range manager were using the allotment for moderate grazing intensity (26–50%), the stream-side zone could readily sustain heavy grazing (51–75%) instead.

Stream-Side Use in Treatment Pastures

In our small treatment pastures (similar to riparian pastures) in which cattle were stocked to achieve pre-selected forage use, utilization was entirely different from use on adjacent range and on the overall pasture. Use of the adjacent range forage exceeded the use of the stream-side forage by an average of 12% (Table 4) in all treatment pastures. We believe that the small size of the treatment pastures (2.4–4.0 hectares) placed all of the forage within the group's home range (Roath and Krueger 1982), thereby encouraging a more balanced use of the forage. We believe that the riparian areas received less grazing intensity because salt was placed away from the streams, and the ratio of the amount of stream-side forage to adjacent range forage was much greater than found under allotment management. This reduced the grazing on the riparian areas.

Timing of Grazing and Forage Use

The timing of grazing appeared to influence use of stream-side vegetation in both the treatment pastures and on the grazing allotments (Table 5). Excluding the unusual year of 1976 when allotments scheduled for rest were grazed to compensate for low forage production, and excluding some periods when range conservationists did not collect data, utilization of stream-side forage in allotment pastures averaged about 13% greater than for adjacent range forage during late grazing. Utilization of stream-side forage in the allotment pastures averaged 9% greater during early graz-

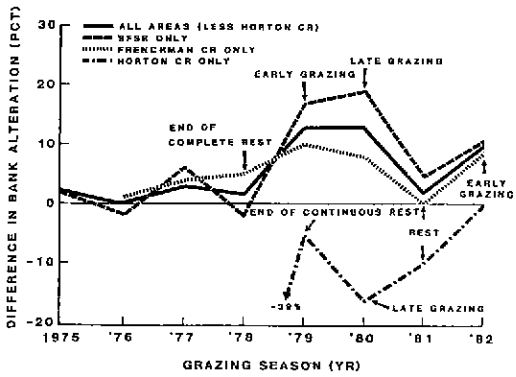


Fig. 3. Differences in stream-bank alteration (percentage) between grazing periods and rest periods, 1975–1982.

ing. This relationship suggests a general tendency for cattle to avoid certain stream-side zones early in the season when the soils and vegetation may be wet. Furthermore, vegetation on the adjacent rangeland in these high elevation meadows is more lush during the early growing season. Such inferences are further supported by the lower forage use along the banks in the wetter Elk Creek study area, which was grazed at a much lower intensity than the Bear Valley study areas.

The small treatment pastures (one each per study area) experienced 11% higher average use of stream-side vegetation with late grazing than with early grazing. This situation may change but a trend is certainly apparent. Future evaluation of extraneous influences, such as annual precipitation, temperature, and animal distribution patterns may reveal confounding factors.

Stream-Bank Alteration

In terms of fishery quality, grazing along the banks probably does as much or more damage through bank alteration than through changes in vegetative biomass. We only have preliminary interpretations of stream-bank changes because such changes usually occur slowly over time (Platts 1981). Differences in stream-bank alteration between grazed and ungrazed areas began to increase after cattle grazing (65–70% use) was initiated in the previously ungrazed treatment pastures (Fig. 3). In the South Fork Salmon River and Salmon River treatment pastures, stream-bank alteration increased relative to the ungrazed controls, followed by a remission period during the rest year. Bank conditions probably did not actually improve during a single rest period but, rather, re-growth of vegetation masked some of the stream-bank alteration.

The relationship of grazing to stream-bank alteration was less obvious and consistent in the Salmon River study areas, particularly in the Horton Creek study area. Horton Creek was not included in the combined relationship in Fig. 3 because the control site was altered by natural causes, whereas the treatment site initially was in nearly optimal condition (ungrazed). In all of the other study areas, the control and treatment sites were quite similar prior to treatment. Thus, one would expect the difference in bank alteration to approach zero if cattle began to modify the banks in the Horton Creek treatment pasture. This was precisely the situation that was observed after grazing began in 1980. The anomalous, low-alteration differential observed in 1980 is difficult to explain, but probably was due to difficulties the observer had in rating the large amount of natural alteration at the control site.

Management Implications

The results of this study show that under certain types of rest-rotation grazing, stream-side forage can be over-utilized, resulting in damage to the riparian stream habitat, while adjacent range and overall pasture forage is receiving acceptable use as dictated by the allotment management plan. In addition, rest-rotation grazing cannot be implemented without aggressive management. We measured as much as 47% use of bank forage in a pasture that was supposed to be rested. We also measured 6 consecutive years of stream-side forage utilization in excess of 30% (moderate or greater), with an average of 59%, in the Lower Bear Valley study area. This occurred while a three-pasture system of rest-rotation was supposed to provide at least two seasons of rest. Thus, the rest-rotation may be sound theoretically but difficult to implement.

Heavy and prolonged use of stream-side vegetation not only will alter a bank but also will retard the rehabilitation of previously altered banks. After one cycle of rest-rotation grazing (3 years) in the grazed treatment pastures (previously ungrazed meadows) where forage utilization would be better balanced than on conventional allotments, stream-bank alteration relative to the adjacent ungrazed control sites was detectable. This alteration, however, was not enough to affect fisheries resources. The cumulative ef-

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began in 1980. The anom-
differential observed in 1980
ı, but probably was due to
ver had in rating the large
lteration at the control site.

ENT IMPLICATIONS

study show that under cer-
ıtation grazing, stream-side
ıtilized, resulting in damage
am habitat, while adjacent
ısture forage is receiving ac-
ated by the allotment man-
dition, rest-rotation grazing
ted without aggressive man-
ıred as much as 47% use of
ture that was supposed to be
sured 6 consecutive years of
ıtilization in excess of 30%
r), with an average of 59%,
Valley study area. This oc-
e-pasture system of rest-ro-
l to provide at least two sea-
e rest-rotation may be sound
ficult to implement.
ıged use of stream-side vege-
l alter a bank but also will
ation of previously altered
:le of rest-rotation grazing (3
l treatment pastures (previ-
ıdows) where forage utiliza-
:r balanced than on conven-
ream-bank alteration relative
grazed control sites was de-
ion, however, was not enough
:sources. The cumulative ef-

fects over time, as have occurred on sections of Horton Creek (Platts 1981), may result eventually in some fishery impacts. This will be determined as this study progresses.

Our grazing studies indicated that it may be impossible to optimize all uses of riparian zones simultaneously. We must, however, improve management of both fisheries and livestock grazing. Land managers should give serious consideration to using the special riparian pastures with those grazing strategies that are not working well. Such pastures may encourage a more equitable use of all available forage and would allow the intensity of use to be carefully controlled, especially where close control of livestock without fences is difficult to attain. Fencing such pastures would be expensive, with costs approaching $3,730 per stream kilometer (Platts and Wagstaff 1984), but increases in revenues derived from increased recreational fishing and the other riparian stream resources can make it cost-effective in certain situations. We also must keep refining existing grazing strategies for more compatibility with other uses and develop new strategies if existing ones do not work.

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