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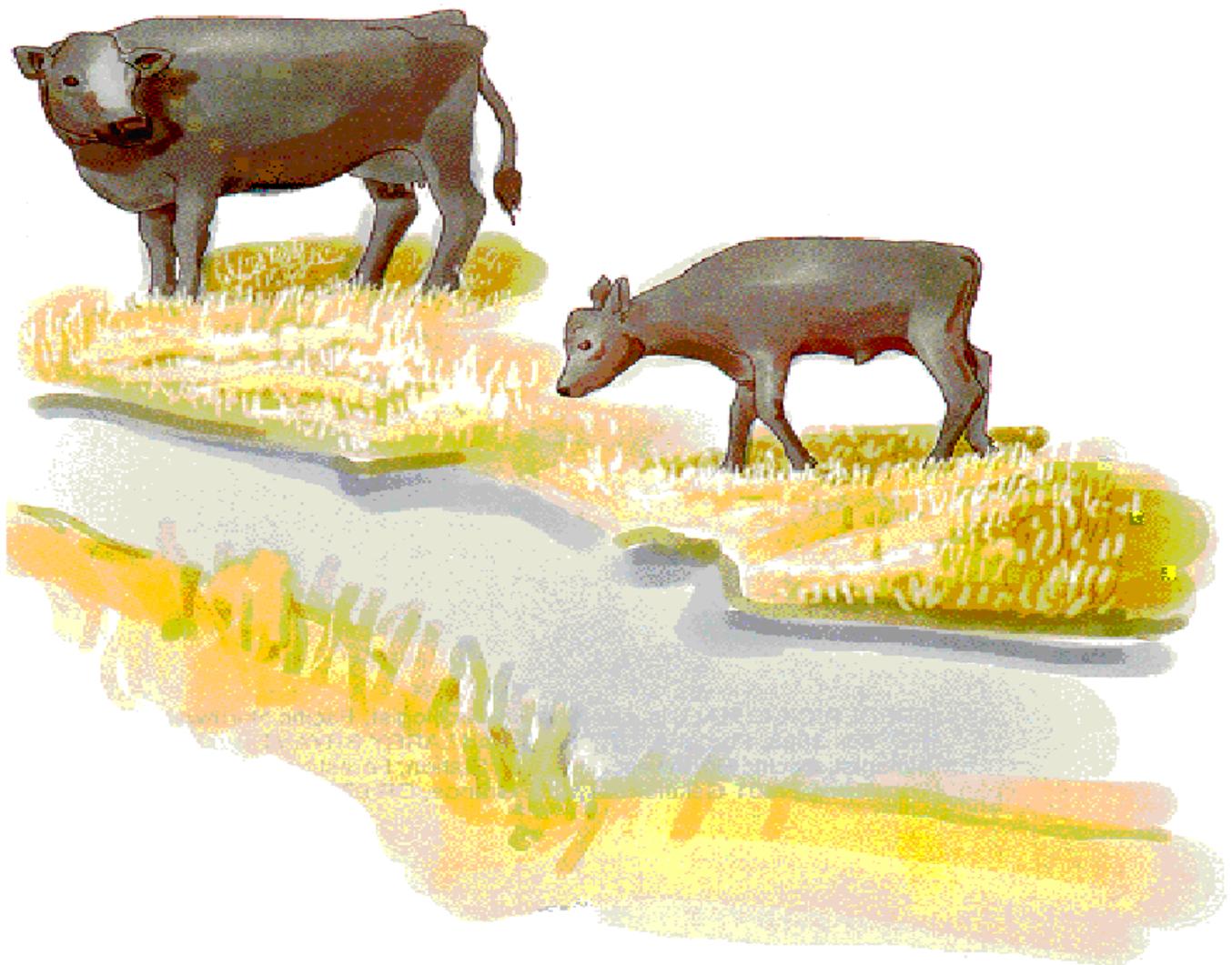
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Herbaceous Stubble Height as a Warning of Impending Cattle Grazing Damage to Riparian Areas

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Abstract

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Prevention of damage to riparian areas from cattle grazing is essential for sound watershed management. Various stubble heights of the most palatable species are used to predict when unacceptable impacts-heavy use or trampling, or both-are about to occur. Managers can observe stubble height and usage and recommend moving the cattle if undesirable effects from continued livestock grazing are anticipated. Three guides for determining when to move cattle are presented: (1) stubble height approaches 3 inches; (2) stubble height changes from 3 inches to 3/4 of an inch; and (3) the most palatable vegetation starts drying regardless of stubble height.

Keywords: Stubble height, riparian, damage, cattle, drying.

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Introduction

Riparian ecosystems are generally defined as a body of water with its adjacent soil and vegetation. Cattle graze riparian areas throughout the inland Pacific Northwest. This grazing may affect the vegetation and soils in undesirable ways. Methods are needed to help predict when continued livestock grazing will begin to cause undesirable impacts on the riparian vegetation and soils. We have adequate criteria for documenting damage after it occurs (General Accounting Office 1988); needed are methods to warn of impending unwanted impacts. This paper presents some methods to predict when cattle grazing may begin to adversely impact riparian ecosystems.

Riparian Ecosystems

Riparian ecosystems have two important areas of concern: (1) woody vegetation for shade, cover, and streambank protection; and (2) streambanks themselves, often called "the green line," with their protective herbaceous vegetation. Cattle can affect each of these in different ways. Direct browsing of shrubs reduces the cover and shade they provide over the stream and could prevent their regeneration. Heavy use of streambanks by cattle may cause direct physical damage through the breakdown of the bank and the overuse of the herbaceous vegetation. Overuse may change the vegetation from protective sedges to open, nonprotective forbs. This fosters streambank erosion and reduces the filtering action of dense sedges, which tends to reduce sediment loading (Clary and Medin 1985, Clary and Webster 1989, Elmore 1992, Platts 1989).

Livestock Grazing

Livestock grazing allotments are an integral part of the USDA Forest Service's land management activity. When livestock grazing is closely managed and monitored by professional land managers, assumptions are made that some degree of cattle use is compatible with riparian ecosystem management and that trends toward a desired future condition can be achieved while cattle graze the area (Bryant 1985, Clary and Webster 1989, Elmore 1992, Elmore and Beschta 1987, Hanson 1993, Johnson 1992, Platts 1989, Ratcliff and others 1987, Skoviin 1984). In short, riparian management objectives must be defined and criteria established by which these objectives can be appraised. If site-specific monitoring proves conditions are not improving and moving toward the desired state, then livestock grazing should not occur or grazing management should be changed.

Concepts

The following concepts were used to develop methods for predicting impending impacts:

- Cattle generally prefer grasses and forbs to woody vegetation, at least when the herbaceous vegetation is green (Gillen and others 1985, Holechek and Vavra 1983, Kovalchik and Elmore 1992, Vavra and others 1980).
- Some degree of moderate use of palatable herbs (primarily grasses and sedges) can occur without undesirable browsing of riparian shrubs and without streambank damage (Clary and Webster 1989, Kauffman and Krueger 1984, Kauffman and others 1983b, Kovalchik and Elmore 1992, Platts and Nelson 1989).
- * The eating technique of cattle is used to fashion warning indicators. A premise is that cow preference for forage species will shift as stubble heights drop below 3 inches (Cook and others 1967, Cook and Harris 1968).

Cattle prefer to reach their tongue out of the side of their mouth and draw in the vegetation, tasting it as they do (fig. 1, p. 4). Thus they limit themselves to those

species that taste best. But this preference begins to change as stubble heights are lowered to 3 inches because the vegetation is too short to be pulled in by the tongue. At this time, cattle must begin eating in bites (like a horse), which takes up to twice the effort and time. Yet their rumen continues to say, "Fill me up." The result is a shift to more quickly eaten and less palatable forage (Van Soest 1982).

Finally, cattle are limited by the thickness of their lower lip to stubble heights of about 3/4 of an inch. At this stubble height, their preferences have changed dramatically and they must search for something to fill their rumen (Van Soest 1982).

- Cattle preference will change as herbaceous vegetation dries (Clary and Webster 1989, Gillen and others 1985, Hanson 1993, Kauffman and others 1983a). Even at stubble heights above 3 inches, their preference may shift to shrubs.

Warning Signs

The above concepts have been used to develop a set of three warning signs:

1. The stubble height of the **most palatable species approaches 3 inches**.
2. The stubble height on the **most palatable species** changes from 3 inches to **3/4 of an inch**.
3. **Greenness** (that is, crude protein, quality of forage) of the **most palatable species** diminishes and the species shows signs of drying, thereby indicating a change in forage quality and a consequent change in palatability.

These stubble height and greenness factors are critical elements in palatability and cause shifts in cattle forage preference, such as changing from grasses and sedges to shrubs or from moist-site grasses and sedges to wet-site coarse sedges (Clary and Webster 1989, Gillen and others 1985, Hanson 1993, Kauffman and others 1983a).

A two-pasture deferred rotation grazing system may be used as an illustration: Cattle are assigned to graze for 2 months in each pasture during a 4-month season. In one case, 3/4-inch stubble is reached by the end of the second week, which forces cattle out onto less desirable rangeland. In this case, the 3/4-inch stubble is maintained over the remaining 6 weeks while the cattle are held in the pasture. In the second case, the pasture could be stocked such that the 3/4-inch stubble height occurs at the end of the second month. Impacts on the riparian ecosystem of these two grazing programs probably would be quite different: 6 weeks of grazing on 3/4-inch stubble compared to a day or two on 3/4-inch stubble (Clary and Webster 1989, Johnson 1992). The concept of deferred-rotation grazing to "force use on the side hills" may not adequately protect or enhance the riparian ecosystem (Clary and Webster 1989, Elmore 1992, Johnson 1992, Myers 1989).

Application Desired Future Condition

First and most important in reaching a desired future condition is to define what is **achievable** (Clary and Webster 1989, Elmore 1992, Elmore and Beschta 1987, Hansen 1993, Kovalchik and Elmore 1992, Myers 1989). Achievable means that the site can grow the desired vegetation. Not all riparian ecosystems will support dense shrubs or trees along the water's edge; for example, most riparian shrubs require a certain degree of root aeration or a minimum percentage of dissolved oxygen in the

water (Kovalchik 1992). These conditions often are provided by a gravel layer under the soil through which water can move. A soil resting directly on a clay layer usually does not have sufficient aeration to support dense shrubs (Bohn and Buckhouse 1985). Likewise, a raised water table, as might occur with beaver impoundments, may reduce aeration to the point of discouraging woody vegetation (Stevens and Waring 1988).

In addition to vegetation, other riparian objectives should be considered. One is to reduce or eliminate bank breakage by livestock trampling (Kauffman and others 1983b, Platts and Nelson 1989). Another is to leave enough stubble height on streambank sedges to reduce soil surface erosion and filter out sediment (Clary and Webster 1989, Stevens and Waring 1988).

Establish Key Areas

After defining the desired future condition, determine if cattle grazing is compatible with attaining these conditions. If it is, then establish key areas where livestock use can be monitored. These key areas should be the **most palatable locations** within the riparian ecosystem; often, they are patches within apparently homogeneous areas (fig. 2, following page). They will be the ones evaluated for stubble height and drying of the vegetation (fig. 3, p. 5). Site-specific objectives and conditions may dictate taller stubble heights or other standards.

When residual vegetation is needed during high flow periods to trap and retain silt and buffer banks, stubble heights below 3 inches may be acceptable when enough spring soil moisture remains after livestock removal to allow regrowth to 3 inches or more.

Monitor

Monitor key areas as follows:

1. As stubble height **approaches 3 inches** for the **most palatable species**, such as Kentucky bluegrass, assume that cattle preference will change and unacceptable grazing use will begin.

Monitor shifts in preference to assure that unacceptable impacts are not occurring on desired vegetation. If they are, move the livestock; if they are not, continue the grazing and continue the monitoring.

2. As the grazing season advances, monitor **drying soil and vegetation curing** in the key areas. Cattle **preference will shift** as species palatable in spring and early summer become dry, particularly Kentucky bluegrass and other introduced species.
3. If livestock continue to graze, stubble height of the **most palatable species** (that is, Kentucky bluegrass) will **decrease from 3 inches toward 3/4 of an inch**. Assume that cattle preference has changed to the degree that unacceptable grazing is about to occur or is occurring (fig. 3). Prepare to move the livestock to avoid damage (fig. 4, p. 5).

Monitor frequently enough, at least once per week, to detect changes in cattle preference that will adversely impact the established grazing management objectives.



Figure 1—The preferred method of eating by cattle is to reach their tongue out and draw forage into their mouth, tasting it as they do. This feeding method works only when the forage is tall enough to be drawn in and bitten off. At a stubble height of about 3 inches, the animal must change its biting method because forage is too short to be drawn into the mouth. Change in eating method is associated with change in preference for forage species. (Photo by Ben Roché.)



Figure 2—Pattern of cattle use in a meadow of Kentucky bluegrass and sedges. Kentucky bluegrass is grazed to 1-1/2-inch stubble while the less palatable sedges are essentially ungrazed. At this level of use, when bluegrass is still green, no damage has been done to the shrubs or stream edge (line of low shrubs near bottom of hill).



Figure 3—Change from 3-inch stubble of Kentucky bluegrass to 3/4-inch stubble. Cattle were removed before the 3/4-inch level was reached thus preventing damage to the riparian area.



Figure 4—Kentucky bluegrass after 2 weeks at a 3/4-inch stubble level. Less palatable sedges have been grazed to 4 inches and willows have been heavily browsed. Two weeks of use at 3/4-inch stubble was too long and resulted in the unwanted browsing of the willows.

4. If grazing impacts are acceptable as stubble height approaches $\frac{3}{4}$ of an inch, **monitor** the situation at least **twice per week** and move the animals at the first hint of unacceptable use or soil damage (fig. 4, p. 5). More frequent monitoring is desirable.

At stubble heights below 3 inches, and particularly at $\frac{3}{4}$ of an inch, livestock can quickly cause damage to the riparian ecosystem, often within a few days. Intensively managed pastures that can be monitored frequently and where livestock can be moved effectively may be appropriate for this intensity of use. Extensively managed pastures, not monitored to this standard or where livestock removal may be tenuous, are probably not appropriately grazed to less than 3 inches in stubble height.

If shrub use and bank breakage are to be avoided, critically evaluate cattle shift in preference as stubble height approaches 3 inches. Assume that shrub use will occur at stubble heights below 3 inches, or as the most palatable vegetation cures. If grazing is to continue, verify that unacceptable use is not occurring.

Conclusions

Unacceptable impacts from livestock grazing can be avoided in riparian areas by recognizing that a shift in cattle preference can occur as the 3-inch stubble height is approached. Assume undesirable impacts will occur at any time as stubble height changes from 3 inches to $\frac{3}{4}$ of an inch as a result of major shifts in livestock preference. Drying of herbaceous forage, particularly Kentucky bluegrass, also will cause a shift in preference that may adversely impact riparian ecosystems.

Literature Cited

- Bohn, C.C.; Buckhouse, J. 1985.** Some responses of riparian soils to grazing management in northeastern Oregon. *Journal of Range Management*. 38(4): 378-381.
- Bryant, L.D. 1985. Livestock management in the riparian ecosystem.** In: *Riparian ecosystems and their management: reconciling conflicting uses: First North American riparian conference; 1985 April 16-18; Tucson, AZ.* Gen. Tech. Rep. RM-120. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 285-289.
- Clary, W.P.; Medin, D.E. 1985.** Differences in vegetation biomass and structure due to cattle grazing in a northern Nevada riparian ecosystem. Res. Pap. INT-427. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 8 p.
- Clary, Warren P.; Webster, Bert F. 1989.** Managing grazing of riparian areas in the Intermountain Region. Gen. Tech. Rep. INT-263. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 11 p.
- Cook, C.W.; Harris, L.E. 1968.** Nutritive value of seasonal ranges. Bull. 472. [Location of publisher unknown]: Utah Agricultural Experiment Station.
- Cook, C.W.; Harris, L.E.; Young, M.L. 1967.** Botanical and nutritive content of diets in cattle and sheep under single and common use on mountain ranges. *Journal of Animal Science*. 26:1169-1174.
- Elmore, Wayne. 1992.** Riparian responses to grazing practices. In: *Watershed management: balancing sustainability and environmental change.* New York: Springer-Verlag: 442-457.
- Elmore, W.; Beschta, R.L. 1987.** Riparian areas: perceptions in management. *Rangelands*. 9: 260-265.
- General Accounting Office. 1988.** Public rangelands: some riparian areas restored but widespread improvements will be slow. B-230548. Washington, DC: U.S. Accounting Office, Resources, Community and Economic Development Division. 85p.
- Gillen, R.L.; Krueger, W.C.; Miller, R.F. 1985.** Cattle use of riparian meadows in the Blue Mountains of northeastern Oregon. *Journal of Range Management*. 38(3): 205-209.
- Hanson, Paul. 1993.** Developing a successful riparian wet land grazing management plan for the upper Ruby River cattle and horse allotment in southwestern Montana. In: *Riparian management: common threads and shared interests: a western regional conference on river management strategies; 1993 February 4-6; Albuquerque, NM.* Gen. Tech. Rep. RM-226. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 328-335.
- Holechek, J.L.; Vavra, M. 1983.** Drought effects on diet and weight gains of yearling heifers in northeastern Oregon. *Journal of Range Management*. 36(2): 227-231.

- Johnson, Kendall L. 1992.** Management for water quality on rangeland through best management practices: the Idaho approach. In: Watershed management: balancing sustainability and environmental change. New York: Springer-Verlag: 415-441.
- Kauffman, J. B.; Krueger, W.C. 1984.** Livestock impacts on riparian ecosystems and streamside management implications—a review. *Journal of Range Management*. 37(5): 430-438.
- Kauffman, J. B.; Krueger, W.C.; Vavra, M. 1983a.** Effects of late season cattle grazing on riparian plant communities. *Journal of Range Management*. 36(6): 685-691.
- Kauffman, J.B.; Krueger, W.C.; Vavra, M. 1983b.** Impacts of cattle on streambanks in northeastern Oregon. *Journal of Range Management*. 36(6): 683-684.
- Kovalchik, Bernard L. 1992.** Growth and yield of willows in central Oregon compared to reports in world literature. In: Proceedings-Symposium on ecology and management of riparian shrub communities; 1991 May 29-31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 83-88.
- Kovalchik, Bernard L.; Elmore, Wayne. 1992.** Effects of cattle grazing systems on willow-dominated plant associations in central Oregon. In: Proceedings Symposium on ecology and management of riparian shrub communities; 1991 May 29-31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 111-119.
- Myers, Lewis H. 1989.** Grazing and riparian management in southwestern Montana. In: Practical approaches to riparian resource management: an educational workshop; 1989 May 8-11; Billings MT Billings, MT: U.S. Department of the Interior, Bureau of Land Management: 117-120.
- Platts, William; Nelson, Rodger L. 1989.** Characteristics of riparian plant communities and streambanks with respect to grazing in northeastern Utah. In: Practical approaches to riparian resource management: an education workshop; 1989 May 8-11; Billings, MT Billings, MT: U.S. Department of the Interior, Bureau of Land Management: 73-81.
- Platts, William S. 1989.** Compatibility of livestock grazing strategies with fisheries. In: Practical approaches to riparian resource management: an educational workshop; 1989 May 8-11; Billings, MT Billings, MT: U.S. Department of the Interior, Bureau of Land Management: 103-110.
- Ratliff, R.D.; George, M.R.; McDougaid, NX 1987.** Managing livestock grazing on meadows of California's Sierra Nevada: a manager-user guide. Coop. Exten. Leaflet. 21421. [Location of publisher unknown]: University of California, Division of Agriculture and Natural Resources. 9 p.
- Skoviin, Jon M. 1984.** Impacts of grazing on wetlands and riparian habitat: a review of our knowledge. In: Developing strategies for rangeland management: a report pre-

pared by the committee on developing strategies for rangeland management. Boulder, CO: Westview Press: 1001-1103. In cooperation with: National Research Council; National Academy of Sciences.

Stevens, L.E.; Waring, G.L. 1988. The effects of prolonged flooding on the riparian plant community in Grand Canyon. In: Riparian ecosystems and their management: reconciling conflicting uses: 1st North American riparian conference; 1985 April 16-18; Tucson, AZ. Gen. Tech. Rep. RM-1 20. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 81-86.

Van Soest, P.J. 1982. Nutritional ecology of the ruminant. Corvallis, OR: O&B Books Inc.

Vavra, M.; Krueger, W.C.; Wheeler, W.P. 1980. Cattle grazing potential on clearcuts. Res. Rep. 586. Corvallis, OR: Oregon State University, Agricultural Experiment Station.

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