

Integrating Management Practices to Improve the Uniformity and Sustainability of Grazing

Derek W. Bailey

Northern Agricultural Research Center
Montana State University
3848 Fort Circle
Havre, Montana 59501

ABSTRACT: An integration of existing and new management techniques can alter traditional livestock grazing patterns and significantly improve the sustainability of sensitive grasslands and rangelands. Livestock often congregate and heavily graze areas of higher forage quality near water (e.g., riparian areas). Increasing uniformity of grazing across uplands will help protect streams and fisheries. Water developments and fencing can be used successfully to modify grazing patterns, however these practices usually require substantial capital investment and maintenance. Selection of more adapted animals may improve uniformity of grazing especially in rugged and extensive pastures. Cattle breeds developed in mountainous terrain utilize rugged rangeland more uniformly than breeds developed in more gentle terrain. Previous exposure to the topography in which animals will graze, especially at a young age, may improve subsequent grazing patterns. For example, older and more experienced animals use mountainous terrain more uniformly than younger animals. Individual animal selection also has the potential to improve grazing patterns. Another approach to improve uniformity of grazing is strategic supplement placement. Cattle can be lured to graze areas that typically receive little use by placing supplements such as low moisture blocks in steeper areas that are further from water. This practice appears to be effective in focusing grazing near supplement placement, irrespective of the animal's adaptability to rough terrain. Herding shows great promise for protecting riparian areas. Preliminary data shows that residual riparian forage in pastures where livestock were herded was at least 3 inches (7.6 cm) higher than riparian forage in control pastures. A combination of herding and strategic supplement placement can reduce labor cost and may be more effective than herding alone based on preliminary evaluations. Ongoing research is developing new opportunities for land managers and livestock producers to change livestock behavior so that problems associated with grazing can be minimized or eliminated. A combination of techniques such as selection of more adapted livestock, strategic supplementation, herding and water development have the potential to alter grazing patterns sufficiently to resolve critical resource concerns without total livestock exclusion.

INTRODUCTION

Livestock grazing distribution is a critical concern for grazing lands, especially on extensive and rugged pastures. Many issues associated with livestock grazing such as rangeland health, riparian area condition, water quality, fisheries habitat, and threatened and endangered species result from uneven grazing patterns. Cattle may graze areas with gentle terrain near water more heavily than rugged terrain or areas far from water (Valentine, 1947; Cook, 1966). Cattle and other large herbivores often prefer riparian areas and spend a disproportionate amount of time in these areas as compared to uplands (Smith et al., 1992). Concentrated grazing, especially in riparian zones, may reduce vegetative cover and increase soil erosion (Blackburn, 1984; Kauffman et al., 1983). Often extensive and rugged pastures that have problems associated with grazing have sufficient forage, but adverse impacts to natural resources can occur from localized heavy grazing in preferred areas. The key to resolving such problems is to use pastures as evenly as possible.

Most of the management approaches currently used to increase uniformity of grazing have been known for almost 50 years (Williams, 1954; Skovlin, 1957). Water developments and fencing have been used to resolve livestock grazing distribution problems on both private and public lands. However, these practices usually require large capital expenditures. As a result, managers are often reluctant to develop water and build new fences. Managers should evaluate all alternatives to determine which practice or practices would be the most economical method for modifying livestock grazing patterns. Combinations of management practices may be needed to resolve high priority resource issues. The objective of this paper is to describe ongoing research that is developing and integrating management practices that manipulate livestock behavior to ensure riparian areas and other sensitive portions of grazing lands are protected and improved.

USE OF MORE ADAPTED ANIMALS

Breed Selection

Livestock producers and land managers may be able to improve uniformity of grazing by selecting breeds that were developed in more rugged terrain. Tarentaise cattle developed in the French Alps consistently climbed higher ($P < 0.05$) and used higher elevations (greater vertical distance to water) than Herefords on northern Montana rangeland (Bailey et al., 2001a). In one of the two years of this study Tarentaise used steeper slopes ($P < 0.05$) than Herefords. There were no differences among breeds in use of slopes during the other year of the study ($P > 0.1$). Additional research compared terrain use of the daughters of the Hereford, Tarentaise and Hereford x Tarentaise cows. The sires of these daughters were Angus, Charolais, Piedmontese and Salers bulls. Overall, cows sired by Piedmontese bulls used higher terrain ($P < 0.05$) than cows sired by Angus bulls (Bailey et al. 2001b). Piedmontese cattle were developed in the foothills of the Italian Alps, while Angus cattle were developed in eastern Scotland. If only lactating cows were considered and non-lactating cows were excluded, cows from Tarentaise dams used higher ($P < 0.05$) terrain than cows from $\frac{3}{4}$ Hereford and $\frac{1}{4}$

Tarentaise dams. In New Mexico, Herbel and Nelson (1966) found that Santa Gertrudis cows traveled further than Hereford cows during grazing. The Brahman breeding of the Santa Gertrudis cattle apparently made them more adapted for travel in the hot climates of New Mexico. Differences between the breeds were more pronounced during the spring and summer than during the winter.

Individual Animal Selection

Selecting livestock based on their grazing patterns and terrain use has the potential for improving livestock grazing distribution (Roath and Kruegar, 1982; Howery et al., 1996). If animals have preferences for localized areas of pastures or types of terrain, uniformity of grazing could be improved by choosing animals that prefer upland slopes, higher elevations, and distances further from water and by culling animals that graze near water or other overgrazed areas. To test this hypothesis, two herds in northern Montana were observed and were ranked on terrain use. One half of each herd was classified as "hill climbers." Hill climbers were cows that spent more time grazing steeper slopes and higher elevations during previous observations. Cows in the remaining half of each herd were classified as "bottom dwellers" and included cows that used gentler slopes and areas closer to water. Hill climber and bottom dwellers grazed in sets of similar pastures during 1999 to 2001. Cows from each treatment were observed simultaneously using horseback observers and global positioning system (GPS) collars. Forage utilization and standing crop were measured after grazing in each set of pastures. Eight comparisons (replications) of hill climbers and bottom dwellers were completed. Stubble height in riparian areas and other sensitive areas was greater ($P < 0.01$) when grazed by hill climbers than when grazed by bottom dwellers (Fig. 1). Forage utilization measurements on upland slopes suggested that hill climbers used rough terrain more uniformly than bottom dwellers. Forage utilization in pastures grazed by hill climbers was affected less ($P < 0.05$) by slope, horizontal distance to water, and vertical distance to water than pastures grazed by bottom dwellers. For example, forage utilization declined by 0.33 percentage points for every degree increase in slope in bottom dweller pastures, and forage utilization only declined 0.25 percentage points for every degree increase in slope in hill climber pastures. Movement patterns recorded by GPS collars and horseback observers showed that hill climber cows used rougher terrain ($P < 0.05$) than bottom dweller cows using a ratio that combined slope use, horizontal distance from water, and vertical distance from water. These results demonstrate that selection for grazing distribution has the potential to improve conditions of riparian and other sensitive areas that have been heavily grazed in the past.

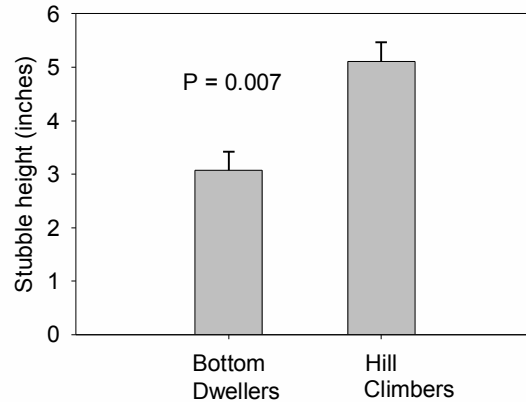


Figure 1. Mean forage stubble heights in riparian areas and coulee bottoms of pastures grazed by bottom dweller (cows that preferred to graze on gentle slopes near water) and hill climber cows (cows that preferred to graze steeper slopes that were further from water).

Training and Experience

Animal behavior results from an interaction of an individual's experience and its genome (Moore, 2001). Howery et al. (1998) found that offspring grazed in similar areas as their dams and demonstrated that early learning influences grazing distribution patterns of cattle. Other research conducted in Montana and Oregon suggests that experience affects where cattle graze. In northern Montana, older cows (5 to 8 years) used rougher terrain ($P = 0.05$) than younger cows (3 to 4 years). Two-year old cows spent more time in riparian areas than older cows in eastern Oregon (DelCurto et al., 2003). Apparently, cows learn to use more rugged terrain more efficiently as they gain more experience. These studies demonstrate the potential to manipulate livestock grazing patterns through training and early learning from their mothers. Producers should ensure that replacement females graze in the same or similar pastures when they are young that they will use as adults. Purchased female replacements should be raised in topography that is similar to what they will use later. Animals that are raised in extensive pastures and rugged terrain as calves, yearlings and two-year olds may graze more uniformly in similar conditions as adults.

STRATEGIC SUPPLEMENTATION

Most commercially available supplements fed to cattle are palatable and potentially could be used to lure animals to underutilized rangeland. Low-moisture supplements are available in containers or blocks that weigh up to 250 lbs (113 kg) and can be readily transported to rough terrain and then self fed. Manufacturers often recommend placing one container for every 20 to 25 cows. When fed at this rate, larger containers of low-moisture molasses blocks (e.g., 250 lbs or 113 kg) usually continue to provide supplement for about 2 weeks, which reduces the labor and costs required to deliver the product. Bailey and Welling (1999) showed that cattle spent more time and grazed

more forage in pasture areas where low-moisture molasses supplement was provided than in similar control areas where no supplement was provided. Although it was more effective in moderate terrain (10-20% slopes), strategic supplement placement noticeably changed livestock grazing patterns in steeper terrain (15-30% slopes) at greater distances from water. Bailey et al. (2001c) found that supplement placement increased grazing use of areas that previously received little use. The effect was relatively similar for distances up to 660 yards (600 m), but at further distances (> 660 yards) the effect of supplement placement diminished rapidly.

Comparison of Low-Moisture Blocks to Dry Mineral Mixes

Low-moisture blocks and conventional dry mineral mixes were evaluated as tools for manipulating cattle grazing patterns and delivering supplemental trace mineral on rugged rangeland pastures in a Montana study (Bailey and Welling, 2002). Cows were tracked with GPS collars to record cattle grazing patterns and to determine how often they visited supplement sites (position within 11 yards or 10 m of supplement). Cows spent more time ($P<0.05$) within 110, 220, 440 and 660 yards (100, 200, 400 and 600 m) of low-moisture blocks than within similar distances from dry mineral mix. The proportion of cows that did not visit low-moisture blocks (26%) tended to be less ($P=0.07$) than for dry mineral mix (45%). In addition, cows visited low-moisture blocks more frequently ($P=0.005$) than dry mineral mixes. In a subsequent study (Bailey 2003), the proportion of cows that visited low-moisture blocks (88%) was greater ($P<0.05$) than the proportion of cows that visited conventional dry minerals (60%). Low-moisture blocks were not only more effective in manipulating grazing patterns than conventional dry mineral mixes, but animals appeared to use the low-moisture blocks more consistently as a source of supplemental trace minerals.

Comparison of Low-Moisture Blocks to Other Protein Supplements

Protein supplements can be hand fed or self fed. Range cake (cubes) is a commonly used protein supplement that is often typically hand fed two to three times per week. Self fed supplements such as low moisture blocks can be fed much less frequently, typically once every two weeks. In a recent Montana study (Bailey et al. 2004a), 4 lbs of range cake was fed three times per week (1.8 kg / feeding) in moderate and gentle terrain near two-track roads while low moisture blocks were placed every 2 weeks in difficult terrain (steeper slopes and higher elevation). Disappearance of low moisture blocks was 0.7 lbs / head /day (0.32 kg). Supplement type did not affect ($P>0.10$) live-weight gain or body condition score. Cows fed low-moisture blocks were observed at higher elevations ($P = 0.06$) than cows fed cake. Forage utilization was greater ($P=0.004$) at higher portions of pastures when low moisture blocks was fed than when cake was fed. Cows spent more time ($P = 0.03$) within 110 yards (100 m) of low moisture blocks than cake feeding sites (Fig 2). Strategic placement of low moisture blocks appears to be a more practical and effective approach than hand feeding range cake to lure cattle to graze high and rough terrain that typically receives little use.

Low moisture blocks and pressed blocks were evaluated as attractants for grazing cattle in eastern New Mexico (Bailey et al. 2004b). Cows grazed more ($P<0.05$) near low

moisture blocks than pressed blocks when placed at sites that were further from water. The differences in the attraction of the two supplement types appeared to be related to intake. The effectiveness of supplement to lure cattle to graze further from water was more apparent when intake rates were greater.

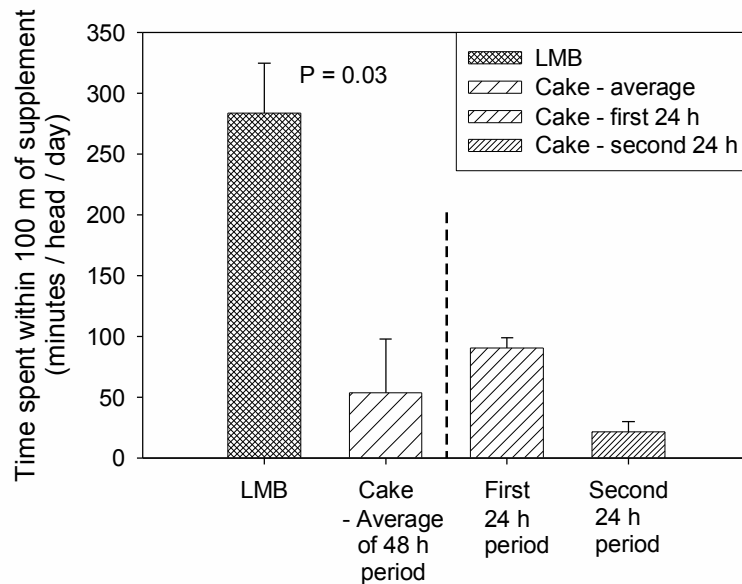


Figure 2. Time spent within 110 yards (100 m) of low-moisture block (LMB) and range cake (cake) feeding sites. Positions of cows were recorded by global positioning system (GPS) tracking collars every 10 minutes. Low-moisture blocks were self fed and always available at one location, while range cake was fed three times per week at varied locations. During the first 24-hour period, cows consumed the cake and then usually moved to water or to areas further than 110 yards (100 m) to graze. On the following day (second 24-hour period), cows spent little time on the range cake feeding site.

HERDING

Although herding has been used to manipulate grazing distribution for centuries, its use on rangeland cattle operations has been limited. Herding requires additional labor, and its effectiveness has been questioned (Roades and Marlow, 1997). Some producers believe that when cattle are herded away from riparian areas, “the cows beat them back to the creek.” Other anecdotal observations suggest that regular herding is a very effective practice to protect riparian areas (Butler, 2000). An ongoing research project in central Montana is evaluating midday herding using low-stress livestock handling techniques as a tool to protect riparian areas. For two consecutive years in this three-year study, forage stubble heights have been greater in pastures where cattle have been herded than in control pastures with no herding (Fig. 3). These preliminary results

suggest that herding is an effective tool for improving riparian areas that are grazed by cattle during the summer.

INTEGRATION OF PRACTICES TO MANIPULATE BEHAVIOR

Practices designed to increase uniformity of grazing appear to be complementary. Although the compatibility of distribution management practices have not been rigorously studied, our research and experience in Montana suggest that combining various techniques should not adversely affect each other and may result in synergistic benefits. In the study evaluating herding discussed above, we combined strategic supplement placement with herding and compared cattle grazing patterns to animals that were only herded and to a control with no herding. We hypothesized that the integration of herding and strategic supplementation would be more effective than either practice used alone. In this three treatment study (control, herding, and herding combined with strategic supplementation), cattle grazing patterns are being evaluated in three 550-ha (1360 acres) pastures for three years using a latin-square design. Cattle grazing patterns are being documented with GPS tracking collars, horseback observers, forage utilization, and stubble height measurements. Preliminary results and anecdotal observations suggest that strategic supplement placement increased the effectiveness and efficiency of herding. For example, cows tend to walk faster as they approach the low moisture block supplements when herding them away from streams. The supplement may provide a reward for cattle at the end of herding. In another Montana study, cattle use of a new water development was increased by placing low moisture block supplement nearby. Strategic supplementation can complement other management practices by attracting and holding animals to specific areas. In two separate fall studies (Bailey and Welling, 2002; Bailey et al. 2004a), cows spent about 5 hours within 110 yards (100 m) of low moisture blocks. Cows spent less than 2.5 hours within 110 yards (100 m) of conventional dry mineral, range cake feeding sites, and water.

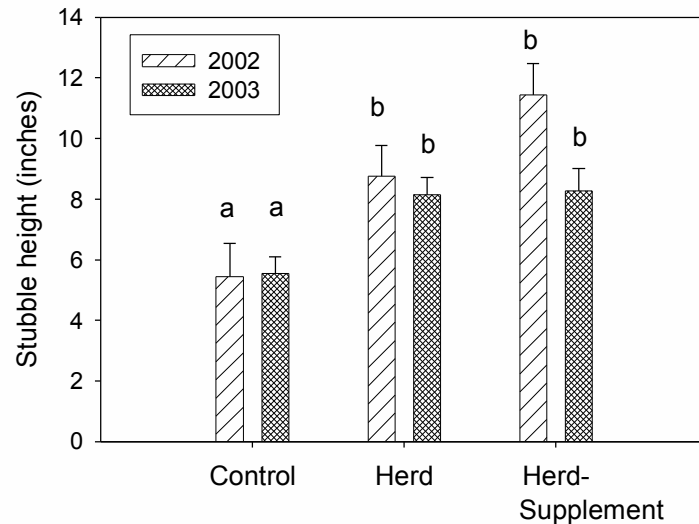


Figure 3. Forage stubble heights in riparian areas of study pastures during first 2 years of a 3 year study. Treatments were designed to protect riparian areas and include herding, herding combined with strategic placement of low-moisture blocks, and a control. If cow-calf pairs were near the primary streams during midday, they were herded at least 1 mile (1.6 km) to uplands and supplement if applicable.

In extensive pastures, livestock often avoid traveling long distances to water (Valentine, 1947), which can constrain grazing distribution. Development of water sources in upland areas can make herding more effective (Skovlin, 1957). Animals have an alternative to returning to streams to drink.

Selecting more adapted livestock and training animals to use rough topography should also complement other distribution management practices. For example, culling cattle that are reluctant and difficult to move may make herding cow-calf pairs out of riparian areas more effective and reduce the required effort (Budd, 1999, Mosely, 1999). Our anecdotal observations in Montana suggest that Tarentaise, Salers and Piedmontese cows that often use higher and steeper terrain (hill climbers, see discussion above) require less effort to herd than Hereford cows that generally prefer gentle terrain near water (bottom dwellers). The hill climber cows appear to have a larger flight zone and respond to low stress handling techniques (Cote, 1999) more efficiently than bottom dweller cows. Analyses of GPS collar tracking data did not show any differences in the effectiveness of strategic supplement placement between hill climber and bottom dweller cows. There were no differences in the frequency of visits to low-moisture block supplements; both hill climber and bottom dweller cows readily consumed supplement. Strategic supplement placement during the fall may lure bottom dweller cows to graze rough terrain and enhance and focus grazing patterns of hill climber cows that already use rugged topography.

Most of the grazing distribution research has focused on a single practice and demonstrated the potential to increase uniformity of grazing. However, an integrated

approach using multiple practices may be more effective. Studies evaluating integrated programs to manage livestock grazing patterns are needed.

CONCLUSIONS

Ongoing research promises to give livestock producers and land managers new tools to improve the sustainability of grazing on western watersheds. Behavior of cattle and other livestock appears to be very malleable and can be modified to meet management goals. Selection of animals and/or breeds that are more adapted to extensive rugged pastures should improve uniformity of grazing and help prevent concentrated grazing near streams and other sensitive areas. Strategic placement of palatable supplements such as low-moisture molasses blocks can lure cattle to graze areas that typically receive little use. Preliminary results suggest that herding can be a very effective tool for protecting riparian areas, and the combination of herding and strategic supplementation appears to be more efficient than herding alone. The integration of these practices along with other well-established practices, such as off-site water development, has the potential to significantly improve uniformity of grazing and give managers an alternative to livestock exclusion to protect sensitive watersheds.

ACKNOWLEDGEMENTS

The USDA Western Regional SARE and the USDA IFAFS programs supported much of the Montana research described in this paper. The efforts of the range technicians at Northern Agricultural Research Center (Lynn Hester, Russell Gregoire, Delyn Jensen, Amber Steilstad, Harv VanWagoner, Robin Weinmeister, and Bob Welling) made the Montana research discussed above possible and their efforts are much appreciated.

REFERENCES

Bailey, D.W. (2003) "Use of low-moisture block and loose dry mineral supplements by cows grazing rangeland and fed hay." Proceedings of the 56th Annual Meeting of the Society for Range Management, Casper, WY, February 2-6, 2003, page 9.

Bailey, D.W. and Welling, G.R. (1999) "Modification of cattle grazing distribution with dehydrated molasses supplement." Journal of Range Management, 52: 575-582.

Bailey, D.W. and Welling, G.R. (2002) "Comparison of low-moisture molasses blocks and loose dry mineral mixes as delivery systems for supplementing trace minerals to rangeland cattle." Proceedings of the 55th Annual Meeting of the Society for Range Management, Kansas City, MO, February 13-19, 2002, page 113.

Bailey, D.W., Kress, D.D., Anderson, D.C., Boss, D.L., and Miller, E.T. (2001a) "Relationship between terrain use and performance of beef cows grazing foothill rangeland." Journal of Animal Science, 79: 1883-1891.

Bailey, D.W., Kress, D.D., Anderson, D.C., Boss, D.L., and Davis, K.C. (2001b) "Evaluation of F1 crosses from Angus, Charolais, Salers, Piedmontese, Tarentaise, and Hereford sires V: Grazing distribution patterns." *Proceedings of the Western Section American Society of Animal Science*, 52: 110-113.

Bailey, D.W., Welling, G.R., and Miller, E.T. (2001c) "Cattle use of foothills rangeland near dehydrated molasses supplement." *Journal of Range Management*, 54: 338-347.

Bailey, D.W., Jensen, D., and VanWagoner, H. (2004a) "Effects of self-fed and hand-fed protein supplements on cattle grazing patterns: low-moisture blocks vs. range cake." *Proceedings of the 57th Annual Meeting of the Society for Range Management*, Salt Lake City, UT, January 24-30, 2004.

Bailey, D.W., Long, K., and Long, B. (2004b) "Evaluation of low-moisture blocks and pressed blocks for manipulating cattle distribution patterns." *Proceedings of the 57th Annual Meeting of the Society for Range Management*, Salt Lake City, UT, January 24-30, 2004.

Blackburn, W.H. (1984) "Impacts of grazing intensity and specialized grazing systems on watershed characteristics and responses." Pages 927-933 in *Developing Strategies for Rangeland Management*. Natural Resources Council / National Academy of Science, Westview Press, Boulder, CO.

Budd, B. (1999) "Livestock, wildlife, plants and landscapes: putting it all together (lessons from Red Canyon Ranch)." Pages 137-142 in K.L. Launchbaugh, K.D. Sanders, and J.C. Mosley, (editors). *Grazing Behavior of Livestock and Wildlife*. Idaho Forest, Wildlife and Range Experiment Station Bulletin #70, University of Idaho, Moscow, ID.

Butler, P.J. (2000) "Cattle distribution under intensive herded management." *Rangelands*, 22: 21-23.

Cook, C. (1966) "Factors affecting utilization of mountain slopes by cattle." *Journal of Range Management*, 19: 200-204.

Cote, S. (1999) "Low stress livestock handling." Pages 79-84 in K.L. Launchbaugh, K.D. Sanders, and J.C. Mosley, (editors). *Grazing Behavior of Livestock and Wildlife*. Idaho Forest, Wildlife and Range Experiment Station Bulletin #70, University of Idaho, Moscow, ID.

DelCurto, T., Porath, M., Parsons, C., and Morrison, J. (2003). "Management strategies for sustainable beef cattle grazing on forested rangelands." *Proceedings of the 56th Annual Meeting of the Society for Range Management*, Casper, WY, February 2-6, 2003, page 59.

Herbel, C.H. and Nelson, A.B. (1966) "Activities of Hereford and Santa Gertrudis cattle on a southern New Mexico range." *Journal of Range Management*, 19:173-181.

Howery, L.D., Provenza, F.D., Banner, R.E., and Scott, C.B. (1996) "Differences in home range and habitat use among individuals in a cattle herd." *Applied Animal Behaviour Science*, 49: 305-320.

Howery, L.D., Provenza, F.D., Banner, R.E., and Scott, C.B. (1998). "Social and environmental factors influence cattle distribution on rangeland." *Applied Animal Behavior Science*, 55: 231-244.

Kauffman, J.B., Krueger, W.C., and Vavra., M. (1983) "Impacts of cattle grazing streambanks in northeastern Oregon." *Journal of Range Management*, 36: 683-685.

Moore, D.S. (2001). *The Dependent Gene: The Fallacy of Nature vs. Nurture*. Henry Holt, New York.

Mosley, J.C. (1999) "Influence of social dominance on habitat selection by free-ranging ungulates." Pages 109-118 in K.L. Launchbaugh, K.D. Sanders, and J.C. Mosley, (editors). *Grazing Behavior of Livestock and Wildlife*. Idaho Forest, Wildlife and Range Experiment Station Bulletin #70, University of Idaho, Moscow, ID.

Roath, L.R. and Krueger, W.C. (1982) "Cattle grazing and behavior on a forested range." *Journal of Range Management*, 35: 332-338.

Rhodes, B.J. and Marlow, C.B. (1997) "Intensive range riding for improving livestock distribution." *Proceedings of the 50th Annual Meeting of the Society for Range Management*, Rapid City, SD, February 16-21, 1997, pages 37-38.

Skovlin, J.M. (1957) "Range riding – the key to range management." *Journal of Range Management*, 10: 269-271.

Smith, M.A., Rodgers, J.D., Dodd, J.L., and Skinner, Q.D. (1992) "Declining forage availability effects on utilization and community selection by cattle." *Journal of Range Management*, 45: 391-395.

Valentine, K.A. (1947) "Distance from water as a factor in grazing capacity of rangeland." *Journal of Forestry*, 45: 749-754.

Williams, R.E. (1954) "Modern methods of getting uniform use of ranges." *Journal of Range Management* 7: 77-81.