**Influencing Livestock Grazing Distribution**

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## Introduction

Livestock grazing distribution refers to the uniform dispersion of grazing over a given management unit (Schacht et al. 1996). Managing livestock grazing distribution, along with determining the appropriate stocking rate, kind and class of livestock, and season of grazing, is one of the main principles of sustainable grazing management (Vallentine 2001). Overgrazing on western rangelands is often a function of poor livestock grazing distribution because cattle overutilize preferred areas while other areas of the pasture are only lightly grazed or ungrazed (Bailey 2005). These grazing patterns cause 1) localized areas of degraded rangeland, 2) reduced harvest efficiency because areas of the pasture are underutilized, and 3) reduced animal production per acre.

Livestock grazing distribution is influenced by both abiotic (i.e., physical) and biotic (i.e., biological) factors on rangelands (Bailey 2005). Abiotic factors include horizontal and vertical travel distance to water, topography, and shelter. Biotic factors include the quantity, quality, and distribution of vegetation on a landscape. Preferred grazing locations are often areas near water, areas with gentle terrain, and areas with higher quantity and quality of vegetation. For example, utilization will usually be greater on flat riparian areas near streams because these areas provide high quality vegetation, shade, and water throughout the growing season compared to upland areas which often have lower forage quantity and quality and/or steeper slopes and greater climbs.

Improving livestock grazing distribution on extensive western rangelands is often difficult because of rough topography, heterogeneous landscapes, large pasture size, annual variations in standing crop, and limited water availability. However, there are several management options that are effective in improving livestock distribution and grazing uniformity. Most methods used to influence livestock distribution fall within two categories: 1) changing attributes of the pasture or landscape, and 2) modifying animal behavior (Bailey 2004). Table 1 outlines some of the management options available for improving livestock distribution.

**Table 1. Management options for improving livestock distribution**

| Changing Attributes of the Pasture of Landscape | Modifying Animal Behavior |
|---|---|
| Changing the season of use | Salt, mineral, and protein supplements as attractants |
| Cross fencing pastures | Low-stress herding |
| Increasing water locations | Breed selection |
| | Genetic Selection |

## Changing attributes of the pasture or landscape

### *Changing the season of use*

Altering the season of use may improve the overall distribution in pastures that have areas with both high and low forage quality and quantity. For example, changing the season of grazing from late-summer to early-summer may improve grazing uniformity of pastures with both uplands and subirrigated areas. Upland vegetation is actively growing on upland areas during the early summer, and the disparity of forage quality between uplands and subirrigated areas may be lower at this time compared to later in the growing season when upland vegetation is dry and dormant and subirrigated vegetation is still green and lush (Bailey 2004). Additionally, grazing pastures in the late fall or winter may improve distribution because vegetation is dormant during this time of the year and quality of vegetation is typically more uniform across ecological sites. As a result, cattle will be less likely to focus grazing on areas that would typically be preferred at other times of the year.

*Cross fencing pastures*

Strategically building pastures to control where livestock graze is one of the most effective ways to alter livestock distribution. Fencing can be used to exclude livestock grazing from preferred ecological sites to better manage the forage resource. Fencing of lowland ecological sites from upland sites (e.g., fencing out riparian areas) can be used to improve degraded areas because managers can control the season and amount of time cattle spend in these preferred areas.

Strategic fencing also can improve grazing distribution by decreasing pasture size and increasing the stocking density of livestock on a given land unit, thereby providing greater opportunities to control where and when livestock are grazing across a landscape. However, more research is needed to determine the optimal pasture size in variable environments and how pasture and herd size affect localized areas that receive concentrated use (Hunt et al. 2007).

Electric fencing in grassland areas provides range managers opportunities to improve livestock distribution. However, the cost and logistic feasibility of building smaller pastures or fencing out sensitive ecological sites can be prohibitive on some western rangelands. This is especially true in areas of the western United States with rough topography and limited water availability. Disruption of wildlife movement can also make building fences undesirable on rangelands managed for multiple uses (Stevens et al. 2012).

*Increase watering locations*

Increasing water locations often goes hand-in-hand with cross fencing of large pastures. Distance between watering points is one of the main causes of poor livestock distribution; it is recommended that watering points be no more than 0.5 to 1.5 miles apart, depending on the roughness of the topography. Holechek et al. (2004) indicated that utilization levels at distances of 1 to 1.5 miles from water (26 % utilization) were approximately half of what was seen within areas that were less than 0.5 miles from water (50 % utilization) on moderately stocked, continuously grazed pastures in southern New Mexico. Increasing the number of watering locations will aid in distributing utilization more evenly across a landscape. Additionally, strategic placement of water and limiting when water is available on specific areas of large pastures may provide opportunities to rotate livestock distribution without fencing.

**Modifying animal behavior**

*Salt, mineral, and protein supplements as attractants*

Using supplements to attract cattle to underutilized areas has often been recommended as a successful method to manipulate distribution of cattle grazing within large, topographically diverse pastures (Bailey and Welling 1999; Bailey et al. 2001; Bailey 2005; George et al. 2008).

While a variety of supplements are available, research has suggested that low-moisture block protein supplements (LMB) may be more effective at altering distribution when compared to range cake (Bailey and Jensen 2008) or conventional dry mineral mixes (Bailey and Welling 2007). However, efforts should be made to provide supplemental feed in underutilized areas when feeding all supplements.

As with all distribution methods, the cost of LMB supplements and the value of increased distribution should be taken into account when determining which supplementation strategy to use to improve livestock grazing distribution. Tanaka et al. (2007) indicated that strategic placement of LMB supplements could be a profitable practice to lengthen the grazing season in late summer/early fall on northeastern Oregon rangelands. Strategic LMB placement provides incentive for cattle to travel to underutilized areas of the pasture that are farther from water, on steeper slopes, have less palatable vegetation, or are at higher elevations. The increased use on these areas reduces potential overgrazing on riparian areas or areas that typically receive greater livestock use, and allows for utilization of otherwise unused forage. Utilization on upland rangelands can be increased in areas up to 600 m from LMB supplement locations in the late summer (Bailey et al. 2001).

However, the effectiveness of using LMB to increase utilization on upland areas is greater on moderate terrain compared to rough terrain (Bailey and Welling 1999). Additionally, if nutrients in the available forage are adequate to meet the nutritional needs of the animals (e.g., springtime when vegetation is actively growing), protein supplements are not effective in focusing distribution of livestock on targeted upland areas, as livestock will often select green grass over the supplement (George et al. 2008; Stephenson 2014).

*Low-stress herding*

Herding has long been recommended as a management tool to modify grazing patterns of cattle (Skovlin 1957; Butler 2000; Cote 2004; Bailey 2005). Herding is the process of moving cattle, usually on horseback, from one location of a pasture to areas which have received little use because of distance from water, steeper slopes, or greater elevation climbs. Herding usually comes at a high cost to the cattle producer in labor and travel expense and may not be cost effective in all situations (Tanaka et al. 2007). However, overutilization on preferred areas (i.e., riparian zones) may make herding necessary to reduce the negative impacts of heavy grazing pressure on sensitive areas. Additionally, moving cattle with low-stress herding techniques may help livestock producers condition cattle to seek out new areas and use a greater proportion of large pastures.

Low-stress herding (LSH) is, in part, the process of moving livestock to a desired location using calm and consistent pressure and release methods. Low-stress herding differs from conventional methods of moving cattle by limiting practices that may cause an animal stress (i.e., loud vocal cues, erratic movements, excessive pressure, etc.). Low-stress herding also uses positive reinforcement of correct cattle movements in an effort to train cattle to move to desired locations and remain settled once there (Cote 2004; Hibbard and Locatelli 2012). Cote (2004) suggested that low-stress herding, when properly conducted, provided herd managers the ability to keep cattle together as one herd, place and keep cattle on upland positions away from riparian areas without fences, and keep cattle away from previously grazed areas. Other research has suggested that employing low-stress herding alone or to salt only may not be as effective in increasing cattle use of targeted upland areas as a combination of LSH and LMB in the late summer (Bailey et al. 2008; Bailey and Stephenson 2013). Low-stress herding and strategic LMB placement were effective in altering grazing distribution of cattle and focusing grazing on underused areas 1 to 2 miles from water in the late fall/early winter in New Mexico (Stephenson 2014; See Fig. 1) and Arizona (Bruegger 2013).

*Breed selection*

Research evaluating breed differences in variable environments has shown that the breed of cattle can influence distribution patterns. Santa Gertrudis cattle (3/8 Brahman and 5/8 Shorthorn) traveled 60% farther per day than Hereford cattle on southern New Mexico desert rangelands (Herbel and Nelson 1966). The greater distance traveled by Santa Gertrudis cattle was likely a result of the Brahman influence. Brahman cattle were developed in hotter climates and are more adapted to hot desert environments than the English Hereford breed. Bailey et al. (2001a) reported that Tarentaise cattle used higher elevations and steeper slopes than Hereford cattle on northern Montana foothill rangelands with steep slopes and variable topography. Tarentaise cattle were initially developed on the steep slopes of the French Alps; whereas, Herefords were developed on the rolling hills of southern England. Bailey et al. (2001b) also observed that cows sired by Piedmontese bulls (breed initially developed in the Italian Alps) used higher elevations than cows sired by Angus bulls (breed developed in eastern Scotland). Selecting breeds of cattle that were developed within and are better adapted for specific environmental conditions may aid in improving the distribution of livestock without direct management.

*Genetic selection*

Carryover differences between different breeds of cattle indicates that grazing distribution may be affected in part by the genetics of the animal (Bailey et al. 2015). It has also been observed that some cattle use steeper slopes and areas farther from water than their herd mates (Bailey et al. 2004). Selective culling has been recommended as a tool to remove cattle that are always observed within preferred, overgrazed areas to improve overall distribution within a herd (Bailey 2004; Howery et al. 1996). However, consistently observing individual animals is often difficult within extensive pastures.

Identification of genotypic markers that correlate with phenotypic responses of cattle grazing distribution may provide options for genetic selection of cattle that better distribute themselves across a landscape. Bailey et al. (2015) used global positioning system (GPS) tracking of 87 cows in variable environments to identify genetic markers of cattle that consistently used areas farther from water, with steeper slopes, and at higher elevations than their herd mates. Specific genetic markers accounted for as much as 24% of the phenotypic variation in cattle with greater distribution characteristics. One genetic marker found on chromosome 29 that was associated with cattle with greater distribution had previously been linked to locomotion, motivation, and spatial memory. A combination of markers on 5 different chromosomal regions explained 34% to 36% of terrain use. This suggests that the heritability of grazing distribution may be as high as weaning weight heritability (20 to 35% heritability) in beef cattle. While more research is needed and is currently being conducted to verify these results, grazing distribution may be a trait that could be identified and selected for in the future through creation of a genomic expected progeny difference (EPD) program.

## Is uniform grazing of pastures always the best option?

While we often manage for uniform grazing distribution, it is also important to consider the role of heterogeneity (i.e., the uneven distribution of vegetation or range condition) across a landscape. Poor livestock grazing distribution can create patch areas of rangeland in poor to excellent condition throughout a pasture. Fuhlendorf et al. (2006) suggested that these patches of disturbance may enhance biodiversity on rangelands by creating several different areas at variable successional states. Grazing practices that influence livestock distribution, such as supplementation and herding, have been recommended in some areas to create mosaics of areas with small scale disturbance for different habitat requirements for grassland bird species in the Great Plains (Derner et al. 2009). For example, birds like the Mountain Plover prefer areas in the western Great Plains that are heavily grazed. In contrast, other species are more adapted to areas with little or no grazing. In the tallgrass prairie, spatial heterogeneity of vegetation across a landscape has also been suggested to stabilize livestock productivity in drought years (Allred et al. 2014). While healthy, sustainable environments are the goal, managing rangelands so that some small areas receive a higher degree of utilization, and as a result reduced range condition, may improve the overall diversity and health of a grassland ecosystem. With livestock grazing distribution management methods, different areas of a pasture can be targeted for greater or less grazing pressure to create these patches with varying levels of range condition and vegetation structure that are altered over time.

## Conclusion

As with all aspects of grazing management, strong objectives should be established prior to changing management practices to improve livestock distribution. Understanding factors that contribute to livestock distribution and monitoring pastures to identify affected areas will help in determining which method to use to improve or manipulate livestock distribution within a specific rangeland area. Implementation of multiple methods may produce the most desired outcome for improving distribution. Changing pasture attributes and modifying animal grazing behaviors provide valuable distribution management tools for livestock managers to increase harvest efficiency, decrease localized degraded areas, increase livestock production per acre, and influence the spatial and temporal heterogeneity of vegetation across a landscape for specific management objectives.

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