Agricultural Innovations
Practical applications for sustainable agriculture
Fact Sheet
Sustainable Agriculture Research & Education

Selecting Cattle to Improve Grazing Distribution Patterns, Rangeland Health and Water Quality

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Hereford cow at Ross Ranch resting during midday. Cow activity and position was monitored with GPS collars.

Inside this fact sheet:

SARE Agricultural Innovations are based on knowledge gained from SARE-funded projects. Written for farmers and agricultural educators, these peer-reviewed fact sheets provide practical, hands-on information to integrate well-researched sustainable strategies into farming and ranching systems. The articles are written by project coordinators and published by SARE.

Geographic Range:

Western United States.
Especially on rugged terrain or extensive pastures

Introduction

Livestock grazing distribution is a critical concern for grazing lands, especially on extensive and rugged pastures. Rangeland health, riparian area condition, water quality, fisheries habitat, and threatened and endangered species are all affected by uneven grazing patterns. Cattle may more heavily graze areas with gentle terrain near water than rugged terrain or areas far from water, often preferring riparian areas where they spend a disproportionate amount of time compared to uplands [1]. Yet, concentrated grazing, especially in riparian zones, may reduce vegetative cover and increase soil erosion [2, 3]. Often, extensive and rugged pastures that experience problems associated with grazing have sufficient forage, but suffer from adverse impacts to natural resources from localized heavy grazing. The key to resolving such problems is to use pastures as evenly as possible.

Most of the management approaches currently used to increase grazing uniformity, such as water developments and fencing, can resolve livestock grazing distribution problems on both private and public lands. However, these practices usually require large capital expenditures. As a result, ranchers and land managers are often reluctant to develop water and build new fences. Less expensive solutions, such as salting away from water, are usually not effective enough to sufficiently alter cattle grazing patterns [4, 5]. New management techniques are needed

Selecting cattle with desirable grazing patterns and culling cattle with undesirable grazing patterns has been suggested as a tool for improving distribution. Research conducted in southern Idaho found that cattle maintained certain home ranges, some grazing primarily uplands and others grazing

(Introduction continued on page 2)

meadows and riparian areas [6]. Thus, removing animals that concentrate in over-utilized areas and selecting animals that travel farther from water and up steeper slopes has the potential to improve livestock grazing distribution.

This project is the first and only study that we are aware of that has evaluated whether grazing distribution has the potential to be improved through intensive selection. The study was replicated and the results showed that selection for distribution has great promise and that additional research is warranted. However, there is a great deal more to learn, and many questions must be answered. Below are a few ideas that may be useful to ranchers grazing extensive or rugged rangeland that resulted from this research.

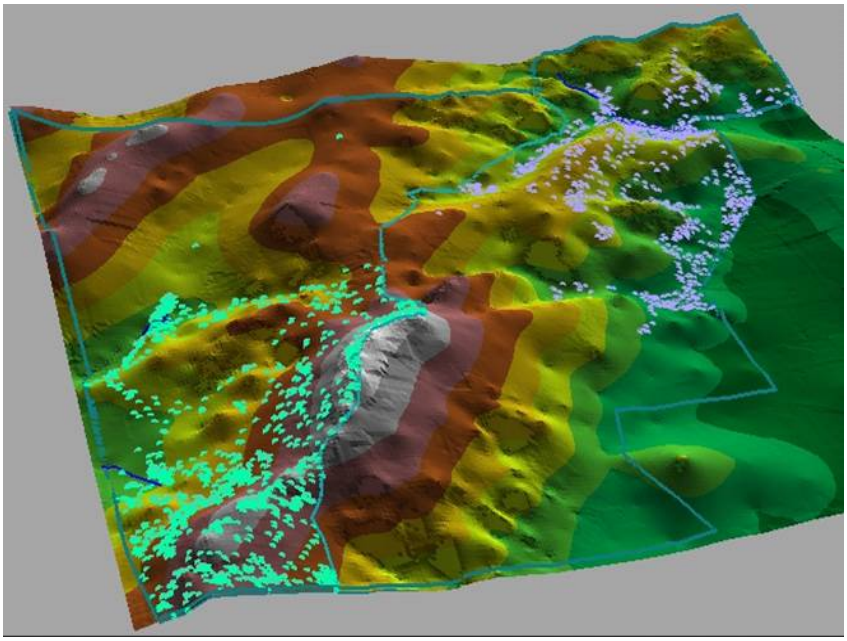

Figure 1. Example of the potential differences in distribution patterns of cows grazing similar pastures during similar time periods. The size of these two study pastures were roughly 420 acres each with changes in topographic relief over 330 feet. Dots represent locations of a hill climber cow (▲) and bottom dweller cow (▲) recorded at 10 minute intervals over a two-week period during August. Blue lines (~) are locations of streams and were the only water sources in the pastures.

Management Implications

Select adapted animals for seed stock or replacements

Results from this project show that cattle breeds developed in mountainous terrain utilize rugged rangeland more evenly than breeds developed in more gentle terrain. Ranchers in mountainous rangeland area may be able to alleviate some of their grazing distribution problems by incorporating breeds such Tarentaise and Salers that were developed in rugged terrain into their breeding programs. Two breeds developed in different parts of Europe as well as their crosses were observed at the Thackeray Ranch during this first part of this study. Tarentaise cattle developed in the French Alps consistently climbed higher and used higher elevations (greater vertical distance to water) than Herefords that were developed in more gentle terrain in England [7]. On average, Tarentaise cows used terrain that was 32 feet higher than Hereford cows. This may not seem that great of difference until you consider that 32 feet of vertical distance could make the difference between grazing upland slopes and grazing riparian areas or sensitive coulee bottoms.

Research technician, Robin Weinmeister, records the position of a Tarentaise cow during an early morning scan sample. This cow was also tracked with a GPS collar, which recorded her position at 10-minute intervals.

In addition to their use of rough topography, these breeds are also known for favorable maternal characteristics. In hot desert rangeland, ranchers may want to use breeds with Brahman breeding so that the cattle are adapted to hot, dry climates and more willing to travel far from water

Daughters of the Hereford, Tarentaise and Hereford x Tarentaise cows were evaluated in a later part this study. Sires of these daughters were Angus, Charolais, Piedmontese and Salers bulls. Cows sired by Piedmontese and Charolais bulls were observed farther horizontally from water in foothill pastures than cows sired by Angus bulls [8, 9]. Using an index of terrain use, Piedmontese-sired cows tended to use more rugged terrain than Angus-sired cows. Piedmontese cattle were developed in the foothills of the Italian Alps, while Angus cattle were developed in eastern Scotland. These differences in sire breeds are especially surprising considering that only half of the cow's genotype was contributed by the bull.

Other research has shown that calves learn where to graze from their mothers [10]. Anecdotal information suggests that problems may arise when cattle developed in gentle terrain or irrigated pastures are released into arid or rugged rangeland. In such situations, cattle may not venture far from water or up steep slopes. When purchasing female replacements, producers should try to find animals that were raised in terrain and vegetation that is similar to what they will be grazing.

Cull animals with undesirable grazing patterns and select animals with desirable patterns

Individual cows within a herd can have very different grazing patterns. Culling or removing cows that prefer bottoms and riparian areas and spend a disproportionate amount of time in sensitive rangeland can potentially increase uniformity and sustainability of grazing (Figure 1). The problem with this approach is accurately identifying cows with undesirable grazing patterns and determining how many cows should be culled.

The best time to observe cattle to categorize their grazing patterns as desirable or undesirable is when animals are first released into a pasture. Observations also should be collected during the early morning when cows begin grazing (e.g., 0600 to 0900). Cattle typically graze for two periods (or bouts) each day, during the morning and evening. At mid-day, cows are often resting near water, especially during the summer.

Research conducted as part of this project showed that the cow's location during the early morning was a good indicator of where she grazed during the current morning grazing bout as well as the previous evening grazing period. Cattle grazing patterns also can vary greatly form day to day, so to get an accurate estimate of a cow's grazing patterns, several observations are needed. In our study, we observed cows in multiple pastures and recorded their location at least 10 times in each pasture. If cows are observed on multiple occasions in bottoms or riparian areas during the early morning shortly after being turned into a pasture (first third or first half), it likely that their grazing patterns may be undesirable and could be considered for culling.

Determining how many cows should be culled is a difficult question that should be researched more thoroughly. In this project, we separated our cow herd in half, which is equivalent to a 50% culling rate. A 15% culling rate is typically recommended for most cattle producers. Many other factors other than distribution such as pregnancy status (open or pregnant) should be considered when determining which cows to cull. It may be difficult to make appreciable difference in grazing distribution, because only a limited number of cattle could be culled for distribution based on normal ranching practices. If grazing distribution is a major issue for a ranch, more emphasis on selection for desirable grazing patterns may be practical. Preliminary analyses have shown that grazing patterns of cows sired by different bulls within the same breed had different grazing patterns. If additional research shows that grazing distribution can be inherited, grazing distribution could be used as a trait for bull selection. Much more rapid progress can be made through bull selection than can be made from culling cows.

Cows from the hill climber treatment resting on a ridge at the Thackeray Ranch.

Implications for riparian area management

In critical areas such as riparian zones, stubble heights were 5 inches in pastures grazed by hill climbers and only 3 inches in pastures grazed by bottom dweller cows (Figure 1). The differences in stubble heights observed between treatments in this study would be economically important for many public-land ranchers. A standard for grazing on riparian areas is often forage stubble height of 4 to 5 inches [11, 12]. If stubble heights fall below the standard, livestock are often required to be moved to a new pasture or off the allotment. In this study, pastures grazed by hill climbers had acceptable grazing levels based on this standard, while grazing levels in pastures grazed by bottom dwellers were not acceptable. Forage utilization measurements on upland slopes also suggested that hill climbers used rough terrain more uniformly than bottom dwellers. Forage utilization in pastures grazed by hill climbers was affected less 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. 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 and to increase the use of upland slopes that previously received little grazing.

The impact of this proposed practice (selection for distribution) on performance of the herd is an important consideration for ranchers. Research conducted in this SARE project found that the location where cows grazed was not related to their pregnancy rates, weight or body condition score. In addition, cattle that used high and steep terrain had similar calf weaning weights as cows that remained in gentle terrain near water. Selection of animals that spend more time on high upland slopes and culling cows that graze in lower terrain near water should not have any adverse impact on calf growth or reproductive performance of the cows.

Derek Bailey, principal investigator, remains in touch with the office on his cell phone while recording cattle locations.

Summary and application

When cows with clearly undesirable grazing patterns are identified, culling the animals or separating them from herds that graze rugged pastures should increase uniformity of grazing with more use of upland slopes and less use of bottoms and riparian areas. Multiple observations are needed to characterize the grazing patterns of individual cows. Observations should be recorded in the early morning when cattle are grazing and more emphasis should be made during the first third of the grazing season. Using breeds that were developed in topography and climate that is similar to rangeland conditions of the ranch also should help resolve livestock distribution problems. Although results from this project clearly showed that selection has the potential to solve many issues associated with grazing, much more research is needed before this practice can be widely recommended and implemented.

SARE Research Synopsis

The overall goal of this project was to determine if selection had the potential to effectively alter cattle grazing patterns in rugged rangeland. Specifically our objectives were to: 1) Evaluate the effect of cattle breed on grazing patterns to determine if some breeds are more adaptable to mountainous terrain or extensive pastures; 2) determine if removing cattle with undesirable grazing distribution patterns could result in a more uniform use of forage in foothills rangeland; and, 3) determine the relationships among individual grazing distribution patterns and livestock production traits such as calf weaning weight, pregnancy rate and mature cow weight.

Study sites

Research was conducted at the Thackeray Ranch (part of Northern Agricultural Research Center) and at the Ross Ranch (cooperating private ranch owned and managed by Don and Warren Ross), in north central Montana in the Bear's Paw Mountains. Topography at both ranches included steep and gentle slopes. Vegetation was dominated by perennial cool-season grasses with a few areas of shrubs and trees. We attempted to use "management-sized" pastures and cattle herd sizes. At both ranches, study pastures were at least 200 acres and most were 400 acres. Forty to 90 cows grazed in each pasture.

Treatments

Before the study, cows were observed by researchers on horseback and ranked by terrain use. Based on previous observations, 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 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. At each ranch, hill climbers and bottom dwellers grazed in separate, but similar, pastures during 1999 to 2001 at the Thackeray Ranch and 2000 and 2001 at the Ross Ranch. Eight paired comparisons of hill climbers and bottom dwellers were completed (replicated in time and space).

Horseback cattle observations

Locations of cattle at the Thackeray Ranch were recorded by horseback observers during the summers of 1997 through 2001. At the Ross Ranch, cattle were observed from 1999 to 2001. The procedure used for recording cattle locations using horseback observers was identical in all years and study sites. Two to four observers on horseback rode a pasture during a 1- to 2.5-hour period during the early morning grazing period (0600 to 0900) and attempted to record the location of every

cow in the pasture. Observers recorded about 87% of the animals in the herd during an observation period. Cows in each pasture were observed two to four times each week. These observations were pooled and used to calculate the average slope, horizontal distance to water and vertical distance to water for each cow in each pasture during each year of the study.

Tracking with GPS collars

Some randomly selected cows at the Thackeray Ranch were tracked using Lotek GPS 2000 collars. These collars recorded cow locations with an accuracy within 22 feet [13] using the Global Positioning System (GPS). Cows were tracked for three to 15 consecutive days based on battery life.

Vegetative measurements

Forage utilization was measured after grazing throughout upland areas in each set of pastures. Forage stubble heights were measured in predetermined locations that historically received heavy grazing use and were considered sensitive areas. These areas included riparian zones and coulee bottoms.

Statistical analyses

All comparisons of telemetry data, horseback observations and stubble heights in sensitive areas between the hill climber and bottom dweller treatments were based on pasture averages each year. Analyses of upland forage utilization data compared the relationships between forage use and terrain use for each treatment.

This fact sheet is based on a SARE-funded project.
For more information, please visit
http://www.sare.org/reporting/report_viewer.asp
and search for SW98-064
and click on final report.

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