Developing a Grazing System for Arid Climates

Circular 649

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INTRODUCTION

One of the most beneficial uses of arid lands is livestock grazing. Ranch managers in arid climates are charged with implementing a grazing system that can provide a sustainable response to arid conditions. Debates exist as to what type of grazing system fits into the long-term resource management of ranching operations in arid climates. Numerous management factors within the grazing system have a large influence on the observed responses in cattle and on the land, which in turn influence short- and long-term profitability. This publication evaluates the two general classifications of grazing systems commonly observed in arid climates, and describes factors of importance when developing a grazing system for ranching operations in arid climates.

Figure 1. **These cows are grazing pasture dominated by blue grama (*Bouteloua gracilis*) grass, a high-quality warm-season grass, and juniper (*Juniperus monosperma*), an invasive woody shrub.** (To view color images, visit http://aces.nmsu.edu/pubs/_b/B-820.pdf)

GRAZING SYSTEMS

The most profitable grazing systems in arid climates are those designed to work within the production environment, matched to class and types of cattle, as well as those that meet natural resource goals of the ranch. Ranch size, terrain, plant species, and present range condition are usually fixed components that influence the type of grazing system implemented on the ranch (Figure 1). Grazing units (pastures), water supplies, and class/type of cattle are variable components that can be used to fine-tune a grazing system to meet natural resource goals and affect profitability. The most successful grazing systems in arid climates tend to be either continuous grazing systems or various rotational grazing systems.

A continuous system involves unrestrictive grazing of a single pasture for a calendar period (year-long or seasonal) in which grazing is feasible. In this system, cattle are always on the specific pasture and have the option to be highly selective of grass species and the extent to which grass species are used. If given the opportunity, cattle will voluntarily select grass species of a higher nutritional quality. In continuously grazed pastures, it is common to observe a greater use of conveniently located, higher nutritive quality grass species and decreased use of lower quality grass species. Continuous grazing is common on many ranching operations due to minimal management and labor inputs.

Rotational systems schematically rotate cattle through a series (>1) of pastures during a calendar period. In theory, this type of system should provide a period of rest, recovery, and re-growth of grazed plants. Unlike continuous systems, rotational systems rely on the experience of the ranch

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manager to determine the length of the rest period. In arid climates, the greatest advantages of rotational systems are more timely utilization of grass species and possibly improved animal management (due to more frequent visits to pastures). Rotational systems are often touted as an opportunity to increase stocking rates between 15 and 30% and improve the ecological health of rangelands. Multiple research studies have also observed an improvement in plant species health and increased diversity among plant communities in grazing scenarios with specific rotational grazing systems.

In a review of the most "classic" long-term grazing management studies that evaluated continuous versus rotational grazing, Holecheck et al. (1999) found many inconsistencies in ecological responses. Across fifteen studies evaluated by Holecheck et al. (1999), forage production was increased by 7% with rotation compared to continuous systems. However, Briske et al. (2008) state that plant production was equal or greater in continuous compared to rotational grazing in 20 of 23 peer-reviewed published experiments. Interestingly, forage production advantages for rotational systems were observed mainly in high annual precipitation (>20 inches) regions. In general, forage production was not increased in semi-arid and desert range types using rotational systems. Nevertheless, one concept that can be agreed upon by academics and progressive natural resource managers is that conservative rotational systems may minimize overuse and decline in availability of preferred grass species by providing periods of rest (Allison, 2004).

Holecheck et al. (1999) found that, overall, continuous grazing resulted in higher net returns ($/acre) than rotational systems in cow–calf operations. Presumably, the increase was due to increased production efficiency, resulting from a higher calf crop (%) and increased weaning weights in a low-input type grazing system. Animal production per head and per unit area was equal or greater in continuous compared to rotational grazing in 35 of 38 and 27 of 32 peer-reviewed published experiments, respectively (Briske et al., 2008). After weaning, the most profitable grazing systems for light-weight calves were continuous grazing systems (Bodine et al., 1999). It is likely the observed responses were due to the enhanced selectivity and diet quality of continuous grazing.

While inconsistencies exist in the scientific literature, success of rotational systems across many geographical regions should not go unrecognized. However, caution should be exercised by ranchers in arid climates when evaluating claims that rotational systems warrant increasing cattle numbers and provide a safeguard to minimize range degradation.

FACTORS INFLUENCING CATTLE AND PLANT RESPONSES

Grass Species

Forage production is the first limiting factor of a grazing system. The rate at which grass grows will dictate the type of grazing system that will prove to be the most successful. When discussing how grass grows, it is important to recognize that certain species have minimum thresholds to survive, recover, and re-grow. Many of the grass species we find in arid regions exist because they fit the constraints of prevailing environmental conditions (e.g., precipitation and soil dynamics). In the Chihuahuan desert, rangelands are dominated by warm-season grass species and have a smaller cool-season component. Warm-season grasses have a reduced window of high nutritive value compared to cool-season grasses, but require less soil moisture to grow, making them more drought-tolerant. It is important to note that performance responses observed in cattle will be different in grazing systems dominated by warm-season compared to cool-season species.

During a majority of the calendar year when warm-season grasses are abundant, protein—not energy—is typically insufficient to meet nutrient requirements for growing cattle (i.e., replacement heifers and bulls) or lactating cows. Therefore, protein supplementation is typically required for a majority of the calendar year to achieve optimum animal performance on warm-season–dominated rangelands in arid climates. Conversely, if grass is short and not abundantly available, both protein and energy supplementation will be required to sustain performance. Effectively aligning periods of high forage quality with heightened nutrient demands of an animal can minimize supplementation and improve financial returns, regardless of the grazing system. If grass is limited and a supplementation program attempts to replace significant proportions of the diet (i.e., substitution), the grazing system has failed and other factors (yet to be discussed) need to be evaluated.

Drought

In arid regions, one of the most unpredictable contributors to forage production is precipitation. It is not uncommon in many arid regions of North America to receive below average precipitation a majority of the time. Whether these periods are classified as a drought is based on individual interpretation or drought indices used. A grazing system with flexibility (e.g., of stocking rates and class/type of cattle) is critical to sustaining long-term ecological health and profitability of ranches in arid climates. Natural resource managers need to recognize drought and respond in a timely fashion. Overgrazing and trying to feed our way out of drought does not lead to ecological or financial sustainability. Developing a drought management plan and sticking to it may greatly assist in minimizing the negative consequences of drought. Reducing stocking rate, commencing water hauling, and other management options should be based upon ecological, climatic, and production events. De-stocking in anticipation of extended drought addresses two primary concerns: (1) receiving higher cattle prices compared to probable prices later in a drought, and (2) rangelands tend to recover more quickly after drought if not as heavily grazed, allowing ranchers to restock more quickly post-drought. For more information on range management in drought, see NMSU Extension guide B-816, *Management of Rangelands and Cattle in Drought-Prone Areas of the Southwest* (http://aces.nmsu.edu/pubs/_b/B-816.pdf).

Wildlife Interactions

While much of the discussion has focused on factors influencing cattle and plant responses, it is critical to account for use of available forages by wildlife species. Diets of antelope, deer, and elk overlap to greater or lesser amounts with diets of cattle. Competition among herbivores is most likely in times of limited forage quality or quantity. For example, competition between elk and cattle is most probable to occur when forage quantity and quality diminish during the fall months. Competition among deer and cattle is less probable, as deer diets tend to contain greater quantities of forbs and browse species than cattle diets. In times of drought, quality and quantity may be limited, presenting increased opportunities for competition or conflict. If limited forage quality or quantity (e.g., during drought) occurs during periods of high nutrient requirements (i.e., lactation), the likelihood of competition is increased. Determining if competition is occurring is nearly impossible without substantial prior research; therefore, accurately determining if competition is occurring during a drought is equally improbable. In some situations, the concentrated use of available grass by wild ungulates may "make or break" a grazing management plan. If competition for available grass between domestic and wild ungulates is suspected, efforts should be made to assess wildlife impacts on grazing resources and take management actions to minimize the potential for competition. Accounting for wildlife use is critical for ranch managers to achieve the desired vegetation and cattle responses. A common approach is to plan for wildlife use and to incorporate this in the grazing plan.

Grazing Distribution

Certain aspects of ranching are fixed and cannot be altered or are difficult or expensive to change. Ranch size, terrain, plant species, and present range condition typically influence the type of grazing system implemented on the ranch. Success, measured ecologically and financially, of a grazing system is dependent upon our ability to evaluate components of the ecological response and financial consequences of grazing. One of the largest obstacles to overcome with any grazing system is poor grazing distribution. Like most animals, cattle will use the least amount of energy necessary to meet their nutrient requirements. The "sweet-spots" or most heavily used areas of a pasture are usually near water. Terrain, specifically slope, also influences grazing distribution. As the terrain becomes more challenging, utilization of grass species decreases. One of the largest fallacies of rotational grazing systems is that cattle graze in a uniform manner across a pasture. In theory, this could occur in small pastures with minimal species diversity, and uniform states of growth. However, achieving the mechanical mower-type grazing is highly unlikely on the larger ranches typically found in arid climates.

Poor grazing distribution can be overcome by incorporating management strategies and tools that may be either permanent, temporary, or both. The most effective of these tools is water. Permanent water developments are costly and may not be economically or logically justified in all grazing systems attempting to improve grazing distribution.

Figure 2. **Distributing palatable supplement to an underutilized area can improve grazing distribution.**

Many ranches within arid climate zones attempt to use seasonal water developments (stock ponds or dirt tanks), but in dry periods these developments will not be as reliable as those capturing water from perennial streams or subsurface sources (wells). The ability to fence off or shut off permanent water sources may aid ranchers in accomplishing their distribution objectives. Strategically placing salt, mineral, and other palatable supplements in areas where available grass is under-grazed is a temporary yet flexible and effective tool that can be used to improve grazing distribution (Figure 2). Supplements have traditionally been placed next to or near watering sources, but to serve as effective distribution tools they should be placed away from water in underused areas.

While not commonly observed on rangelands in arid climates, underutilization of available grass under certain circumstances can go beyond "poor grazing distribution" over time and actually decrease the grazeable area. When grass becomes decadent and mature to a stage where cattle will not harvest it, the grazeable area of rangelands is reduced. Fire, the oldest range management tool known to humans, has been effectively used in these situations to remove the decadent grass and stimulate growth of palatable and nutritious grass. In many situations, prescribed fire has been shown to increase the grazeable area, improve grazing distribution of both livestock and wildlife, and also improve performance of various species and classes of livestock.

Stocking Rates

Research regarding stocking rates has been thoroughly evaluated by the rangeland science community. Stocking rate refers to the amount of land allocated to an animal unit (cow or cow–calf pair) for a specified time (grazing intensity). Because environmental conditions change over time, stocking rates are not static but change with improved and degraded vegetation conditions. With the exception of precipitation, stocking rates may be the most significant factor influencing the sustainability of any grazing system. Stocking rate greatly affects animal performance, range conditions, and economic returns (Bodine et al., 1998). In general, as stocking rate increases, individual animal performance (average daily gain, conception rate, weaning weight, etc.) will decline as more and more animals compete for preferred species, subsequently decreasing the nutri-

ent quality of their diet. At the same time, as more livestock are added to the system, production per unit area (lb beef/acre) increases to a point and then declines as forage supply becomes more limiting.

In most stocking rate studies in the literature, grazing intensity is classified as low, moderate, or heavy. What do these terms mean? Holechek et al. (1999) found the best definitions for these terms stem from Klipple and Bement (1961). Light grazing means a degree of grass utilization that allows palatable species to maximize their producing ability. Moderate grazing means a degree of grass utilization that allows the palatable species to maintain themselves but usually does not permit them to improve in producing ability. Heavy grazing means a degree of grass utilization that does not permit desirable grass species to maintain themselves. Note that we are discussing stocking rate in the context of grazing intensity. Stocking rate per unit area will differ according to the characteristics of the land being grazed.

The percent use of grass species (utilization) is subjective, and not as precise as more quantitative measures (e.g., stubble height), but it is the most commonly documented measure of grazing intensity in grazing studies. Percent use has been correlated to productivity changes in cattle performance, forage production, and financial returns in 25 long-term grazing studies in North America (Holechek et al., 1999). In the Holecheck et al. review, light, moderate, and heavy grazing represent utilization rates of 32, 43, and 57%, respectively. Contrary to conventional wisdom that suggests moderate stocking rates typically involve 50% utilization (i.e., take half, leave half), these authors suggest significant rangeland deterioration could occur in arid rangelands at such stocking rates over an extended period of time. In their review, moderate grazing equated to 35 to 45% utilization.

Light stocking increased forage production by 8%, moderate stocking did not change, and heavy stocking decreased forage production by 20% in the Holechek et al. (1999) review. Grazing systems that implemented conservative (light to moderate) stocking rates provided the greatest response during drought. Forage production (lb/acre) decreased linearly as the average use of grass (before and during the drought) increased from 32 to 57%. Conservative stocking resulted in increased calf crops, weaning weights, average daily gain, and net returns. The greatest financial returns were observed with moderate grazing intensity (43% use of grass species). Moderate stocking gave 31 and 11% higher net financial returns than heavy and light stocking rates, respectively. Independently, others (Shoop and McIlvain, 1971) have demonstrated that heavy stocking rates coupled with drought in arid climates lead to financial devastation of ranches in arid climates. Martin (1975) suggested moderate stocking strategies make the most ecological and financial sense in arid climates. All of this suggests that a balance should be sought between what the land can sustain in use without degradation (ecological sustainability) and financial returns of the ranching operation (financial sustainability).

Figure 3. **Cattle and grass in good condition.**

Measuring Cattle and Plant Responses

Resource managers are strongly encouraged to utilize common approaches or tools to evaluate the responses of both cattle and plants to a specific grazing system (Figure 3). Assessing body condition of cattle using a 1 to 9 scoring system, where 1 is equal to a severely emaciated animal and 9 is a severely obese animal, is the most commonly used subjective measure to determine nutritional status of beef cattle (for more information on cow body condition scoring, refer to NMSU Extension Circular 575, *Managing and Feeding Beef Cows Using Body Condition Scores,* available at http://aces.nmsu.edu/pubs/_circulars/CR575.pdf). Conversely, multiple approaches are routinely used to measure plant responses to grazing. For all practical purposes, most managers utilize plant stubble heights and photo points to define range resource conditions

and responses to grazing (for more information on rangeland monitoring, refer to NMSU Range Improvement Task Force Reports 53 and 76, available at http://aces.nmsu.edu/pubs/taskforce/#ritf). As an additional component of a rangeland monitoring program, many grazing managers are collecting plant samples of both the desirable and undesirable grass species to have them laboratory analyzed for nutritional composition.

Once methods to measure both cattle and plant responses have been selected, it is highly advisable to establish a routine. Cattle body condition is commonly evaluated at calving and weaning, whereas range resources are commonly assessed prior to and at the end of the normal growing season. Monitoring body condition and the rangeland can greatly assist a manager in measuring both short- and long-term responses to make timely adjustments to the grazing system or nutrition program.

CONCLUSION

Selecting a grazing system that will fit arid climates and elicit desired responses is a challenge that all ranch managers face. Successful grazing systems require a manager to possess not only experience and logic in range management but also the ability to seek alternatives to existing systems that will fit the production environment of arid climates. Many factors in arid rangelands are fixed, while some, like precipitation, are unpredictable and create larger challenges. Improving grazing distribution and accounting for wildlife uses are key factors in developing successful grazing systems. Developing or modifying ranch infrastructure and selecting areas to place supplements can greatly aid efforts in optimizing grazing distribution. Accounting for the needs of wildlife will reduce the potential for future conflict in drought situations. The most manageable factor of a grazing system is stocking rate. A conservative stocking rate provides flexibility to balance cattle numbers with presently available grass supply. Maintaining the ability to adjust (increase or decrease) stocking rates will make a grazing system ecologically sustainable and financially successful. Finally, it is strongly advisable to routinely utilize tools to monitor both the body condition of cattle as well as the plant responses to the grazing system to determine if the grazing system is meeting the manager's goals.

LITERATURE CITED

Allison, C.D. 2004. Continuous vs. rotational grazing on arid lands. In Proc. Southwest Beef Symposium, Odessa, TX. pp. 2–5.

Bodine, T.N., H.T. Purvis II, S.D. Fuhlendorf, G.W. Horn, R.L. Gillen, F.T. McCollum III, J.R. Weir, and B.R. Karges. 1999. Effects of grazing system and stocking density on performance of summer stocker cattle grazing tallgrass prairie. Oklahoma State University Department of Animal Science Research Report. pp. 162–167.

Briske, D.D., J.D. Derner, J.R. Brown, S.D. Fuhlendorf, W.R. Teague, K.M. Havstad, R.L. Gillen, A.J. Ash, and W.D. Wilms. 2008. Rotational grazing on rangelands: Reconciliation of perception and experimental evidence. *Rangelands Ecology and Management, 61*, 3–17.

Holecheck, J.L., H. Gomez, F. Molinar, and D. Galt. 1999. Grazing studies: What we've learned. *Rangelands, 21,* 12–16.

Klipple, G.E. and R.E. Bement. 1961. Light grazing—Is it economically feasible as a range improvement practice? *Journal of Range Management, 14*, 57–62.

Martin, S.C. 1975. Stocking strategies and net cattle sales on semi-desert range. U.S. Dept. Agr. For. Serv. Res. Pap. RM-146.

Shoop, M.C. and E.H. McIlvain. 1971. Why some cattlemen overgraze and some don't. *Journal of Range Management, 24*, 252–257.

NOTES

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