

Grazing Systems on the Edwards Plateau of Texas: Are They Worth the Trouble?

II. Livestock Response

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Grazing systems implemented on *rangelands* have generally been designed to improve or maintain range condition. Grazing systems designed for use on *tame pastures* generally aim to maximize animal production. During the past decade, grazing systems developed for tame pastures have been applied to rangelands in an effort to increase livestock production.

Before we discuss the effects of grazing systems on livestock production, it seems appropriate to discuss differences between range management and tame pasture management. Tame pastures usually have a few plant species that are highly resistant to grazing. Expensive cultural practices may be employed to increase forage quality and quantity (i.e., fertilizer, irrigation, etc.). High stock density and grazing pressure may be necessary to improve grazing distribution and prevent the accumulation of mature forage (most forage is consumed at a immature growth stage). Grazing is usually restricted to the growing season, thus removing the need to conserve forage for dormant season grazing. Tame pastures are usually developed in high rainfall areas or on deep, productive homogeneous soils with access to supplemental

irrigation. All of this results in large investments per unit area of land, with increased emphasis on livestock production.

In contrast, rangelands consist of irregular terrain and complex mixtures of plant species that vary in palatability, production and resistance to grazing. Most rangelands are located in arid and semi-arid regions where precipitation is low and variable. Soils may be very shallow or very rocky and may be very heterogeneous and subject to severe erosion if adequate amounts of vegetation are not present. Grazing pressures and animal densities are generally moderate to low; this, in combination with the differential growth and maturation of range vegetation makes grazing distribution problems the rule rather than the exception. Plant growth is usually limited to very short periods during the year; regrowth following defoliation may be very slow or non-existent due to lack of moisture. Livestock may have to survive on dormant vegetation for many months of the year and secondary plant succession is necessary for the forage resource to survive.

Unfortunately, tame pasture management techniques have been attempted on Texas rangelands without a full understanding of the effects of increased animal impact. Some supporters of intensive rotation grazing systems propose that heavy stocking and high livestock densities

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(i.e., hoof action, increased animal impact) may be advantageous to the range ecosystem (Savory 1978, 1979).

In order to address these questions the Sonora Research Station initiated two 7-pasture, 1-herd grazing systems in 1983. One had a grazing cycle of 49 days with a 7-day graze period and a 42-day rest period (SDG). The other 7-pasture grazing system had a 14-day graze period with an 84-day rest period and a 98-day cycle (HILF). We also had a 14-pasture 1-herd grazing system with a variable cycle length, depending upon weather and growing conditions. Two complete 4-pasture, 3-herd grazing systems, one with brush control and one without, also exist on the Research Station. All of these grazing systems had the same stocking rate and same ratio of grazing animals (i.e., cattle, sheep and goats). Heifers represented the cattle component while Rambouillet ewes and Angora nannies represented the sheep and goat grazing, respectively.

Heifer and sheep performance from 1985 until 1988 (3 years) in the 5 treatments is presented in Table 1. These data show that heifer gains from the 4-pasture, 3-herd brush control grazing system were greater compared to the other grazing systems. It is the authors' opinion that brush control had more to do with the increased heifer production than the grazing system. A discussion of the benefits of brush control is beyond the scope of this paper; however, to enhance the understanding of these data, we offer these hypotheses.

Juniper is a fire-intolerant brush species that rapidly invades the Edwards Plateau region of Texas and significantly reduces herbaceous forage production. Because all four pastures of the 4-pasture, 3-herd system had been treated with some type of mechanical brush control in 1969 (2 pastures were root-plowed, one was front-end grubbed, and the remaining pasture was chained two directions with a heavy anchor chain), juniper is found in limited amounts relative to the other grazing systems. Because of this, pastures in the 4-pasture brush control treatment are more productive in terms of the higher

Table 1. Heifer and sheep response (production averaged over three years) from five grazing systems (1985 through 1988).

Grazing system	Heifer production		Sheep production	
	1985-88	Production efficiency ³	1985-88	Production efficiency
	(lbs/ac) ¹	(%)	(lbs/ac) ²	(%)
7-past, 49-day cycle ⁴	7.1	98	7.9	138
7-past, 98-day cycle ⁴	7.2	99	6.5	114
14-past, flexible cycle ⁴	6.1	84	3.6	63
4-past, 3-herd ⁴	7.0	97	4.8	85
4-past, 3-herd ⁵	8.8	122	5.7	100

¹Heifer gain (lbs/ac).

²Sheep production includes both lamb and wool production (lbs/ac).

³Determined by dividing each production value by the average value of the column (i.e., if production value = mean of column then production efficiency = 100%).

⁴No brush control.

⁵Brush was controlled in this grazing system in 1969.

successional grasses. Even though the stocking rates are the same for all treatments, the grazing pressure [ratio between animal demand and available forage at any instant, (Scarnecchia and Kothmann 1982)] was significantly lower for the animals grazing in the 4-pasture brush control treatment. The removal of juniper has two important benefits: (1) selective grazing pressure is lower for higher productive grasses, allowing for faster range improvement (i.e., juniper reduces the pasture area available for grazing, therefore increasing grazing pressure on remaining herbaceous forage) and (2) lower grazing pressure provides the grazing animals with greater quantity and quality of forage, which results in greater livestock production. While heifer production was enhanced by brush control in this study, sheep production appeared not to be affected. Previous research on the Sonora Research Station has shown that sheep production is less affected by heavier grazing pressures than cattle production.

While it is easy to understand why heifer production was greater in the 4-pasture brush control treatment, it is

difficult to understand why both heifer and sheep production was less in the 14-pasture flexible grazing treatment. Management in the 14-pasture system was flexible relative to rate of rotation and length of stay in any given pasture. Rotation cycles ranged from 45 to approximately 90 days. Length of stay in any given pasture ranged from 1 to 13 days depending upon the relative carrying capacity of a pasture and desired rate of rotation (amount of vegetation was measured in each pasture at least 3 times per year). However, all of this intensive management did not result in either increased vegetation or livestock production.

Proponents of SDG or intensively managed grazing systems suggest that a significant increase in livestock production can be expected following implementation of SDG. This was not the case for this study and we think it is important for us to understand why livestock production was not enhanced with the adoption of intensive management practices. The important biotic and abiotic factors were similar among all of the treatments. Stocking rate and animal species were the same. Range sites were equally represented in each treatment. With the exception of the brush control treatment, brush canopy cover was essentially the same. Herbaceous species composition and precipitation were the same across treatments. Supplemental feeding and other livestock management practices were the same. Even pasture size was similar for each treatment, 20 to 80 acres per pasture. Since all of these factors were similar, then what made the difference?

First of all, animals are selective grazers; they don't uniformly graze all plant species. This is the basic tenet for subdivision and implementation of grazing systems on rangelands: to give us some control of the frequency and intensity of plant harvest. Because animals are selective grazers, grazing distribution problems always occur, especially on rangeland. Grazing distribution problems can be classified into three principal categories: (1) spacial selective grazing, (2) topographic selective grazing and (3) species selective grazing. Spacial selective grazing is related to the uniformity of forage utilization between and within different range sites and at varying distances from water. This problem can be partially solved by creating smaller pastures and utilizing different mixtures of animal species. Topographic selective grazing problems are related to the type of terrain while species selective grazing is related to individual animal preferences for plants. Both topographic and species selective grazing problems can be reduced by grazing more than one animal species.

Grazing management directed toward solving grazing distribution problems and determining optimum plant harvest are two positive practices on semi-arid rangelands which can increase livestock production within economic bounds. The 14-pasture flexible system did not significantly improve grazing distribution or enhance forage harvest efficiency, relative to the other grazing treatments.

What was significantly different about the 14-pasture

system was an increase in the livestock density (the number of specified animals per unit-area of land at any instant). Livestock density averaged 3.8 acre per AU for the two 7-pasture systems, 20 ac per AU for the two 4-pasture, 3-herd grazing systems, and varied from .56 to 2.2 acre per AU for the 14-pasture intensive grazing system. Previous research indicates an increase in livestock density should not reduce livestock performance (Walker et al. 1989). However, a large increase in the number of pastures could significantly increase the amount of livestock travel (Walker and Heitschmidt 1986) and also affect animal foraging strategy. It is the authors' opinion that livestock performance in the 14-pasture system was reduced, relative to the other treatments, because of: (1) additional stress associated with frequent moves, 2) disruption of grazing activity, and 3) increasing grazing pressure which restricted livestock selectivity (Table 2). Livestock production efficiency values were 84 and 63%, respectively, for cattle and sheep from the 14-pasture, 1-herd grazing system (Table 1). However, after the 14-pasture system split into two separate 7-pasture systems, the average production efficiency values for both systems increased to 94 and 98%, respectively, for heifer and sheep production.

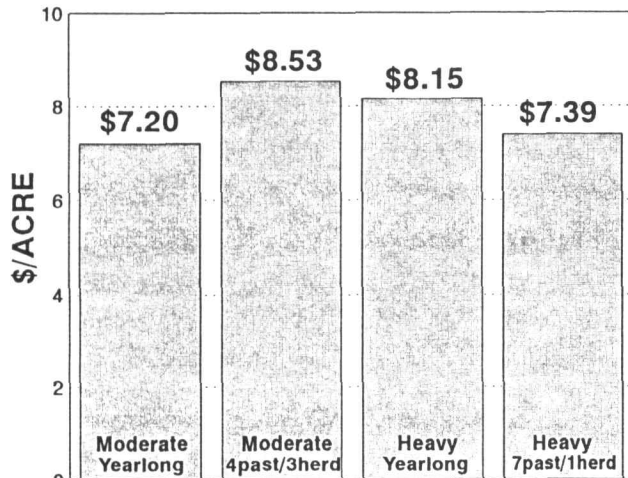
What Have We Learned?

Grazing systems based on the rotation of livestock with periodic grazing and resting of pastures represent only a part of grazing management. Designing and implementing grazing systems before the other basics of grazing management have been properly planned and implemented will generally result in failure. Proper grazing management should:

- 1) conserve soil and other natural resources
- 2) achieve management goals for forage production and range improvement
- 3) meet specified livestock goals
- 4) be compatible with personal goals and objectives of manager
- 5) be profitable

If a manager decides that an intensive grazing system (i.e., SDG) is needed for his particular operation, we recommend the following for the *Edwards Plateau* region of Texas.

- * Stocking rates should not be increased due to implementation of SDG. Regardless of the grazing system used, maximum profit will generally occur at a moderate stocking rate where forage availability does not restrict the animal's selection of high quality forage or restrict intake (Fig. 1).
- * 7-8 pastures is maximum number of pastures needed to optimally manage SDG systems.
- * Use existing fences as much as possible (if a grazing distribution problem does not exist, further subdivision of existing pastures may not increase efficiency).
- * Long grazing cycles (i.e., HILF with approximately 100-day cycle length) should be employed during the major part of the growing season (approximately May through September).



SOURCE: Conner and Taylor 1988

Fig. 1. Net returns from four grazing systems at moderate and heavy stocking rates 1970–1982.

- * SDG strategies (cycle length approximately 50 days) can be employed from approximately September until January.
- * Continuous grazing should be implemented from January through April for ranches that carry either breeding sheep and/or goats (this is based on lambing and kidding dates). Based on carrying capacity on each pasture, the sheep and goats should be distributed among all of the pastures. Cattle can continue with their normal rotation schedule during this time.

These are general guidelines and may not fit into every ranching operation; however, we feel that long rest periods are needed during the major part of the growing season to allow the more productive midgrasses to recover from grazing. Also, long graze periods during this period of the year should not reduce livestock production if proper grazing pressures are maintained. Shorter graze periods can be implemented during the dormant period of the year to enhance livestock production without hurting the warm-season vegetation. Also, annual forbs can represent a rather large portion of the vegetative complex during the late dormant and early spring period. We feel the most efficient way to harvest these plants is to disperse the sheep and goats over the entire grazing system and allow them to graze each pasture continuously.

Table 2. Heifer and sheep response to six grazing systems from 1989 through 1991.

Grazing system	Heifer production		Sheep production	
	1989–91	Production efficiency	1989–91	Production efficiency
	(lbs/ac)	(%)	(lbs/ac)	(%)
7-past 49-day cycle ¹	6.2	103%	4.9	106%
7-past 98-day cycle ¹	5.8	97%	4.4	95%
7-past 49-day cycle ²	5.9	99%	5.1	110%
7-past 98-day cycle ²	5.3	88%	3.9	85%
4-past, 3-herd ¹	5.7	96%	4.2	91%
4-past, 3-herd ¹	7.1	118%	5.3	114%

¹Same grazing systems as represented in table 1 but different years.

²Grazing systems developed from 14-past system in table 1.

We also conclude that livestock production is not significantly different between intensive and deferred-rotation grazing systems when moderate grazing pressures are employed. Grazing systems are only one component of grazing management. They should be left to the final and not the initial stage of ranch planning (i.e., the type of grazing system used should facilitate the goals, objectives, and resources of the rancher).

Are Grazing Systems Worth the Trouble?

Yes, grazing systems are certainly worth the trouble when they facilitate the implementation of biologically and economically sound grazing management principles. Furthermore, the appropriate kind of grazing system will vary from one ranch to another, depending upon the goals and objectives of the ranch manager and the resources of the ranch.

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