Cattle Grazing System Effects on Forb Biomass and Nutrition in Pronghorn Native Habitat in the Trans-Pecos

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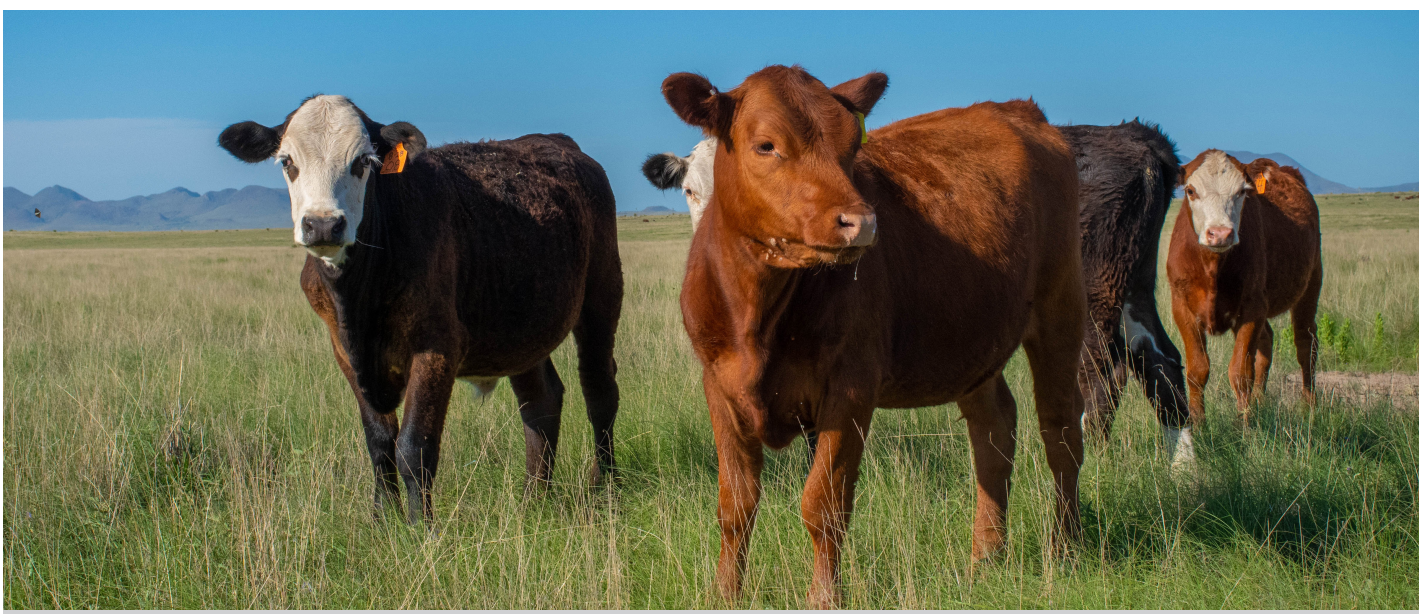


Cattle management in arid regions, including the Trans-Pecos, requires adaptation and attentiveness to climatic variation to maintain sustainability and conservation of forb communities and the rangeland. Pictured here are cattle on the Mimms Ranch during the monsoon season.

Pronghorn and cattle have shared the Trans-Pecos for more than 400 years. Once abundant in the Trans-Pecos, pronghorn populations dwindled from 17,000 individuals to less than 3,000 by 2012 due to drought, disease, habitat degradation, and land fragmentation. Given that livestock grazing operations have been the primary land use in the Chihuahuan Desert Borderlands for those four centuries of shared habitat, livestock grazing may have the greatest influence on long–term vegetation changes.

Pronghorn are herbivore specialists that rely on key plant species for metabolic de-

mands. Their nutritional requirements can change during growth, reproductive investment, and thermoregulation, and their body condition and resource acquisition depend on the nutritional value of available forage, which varies seasonally. Thus, pronghorn are adapted to diverse vegetation communities.

The grazing of large herbivores has complex influences on the quantity and quality of vegetation that other species like pronghorn require. Historically, the unique grazing activities of bison were fundamental for grassland maintenance and species diversity. Bison consumed large quantities of grass that inhibited its overgrowth while their nomadic movement prevented overgrazing.

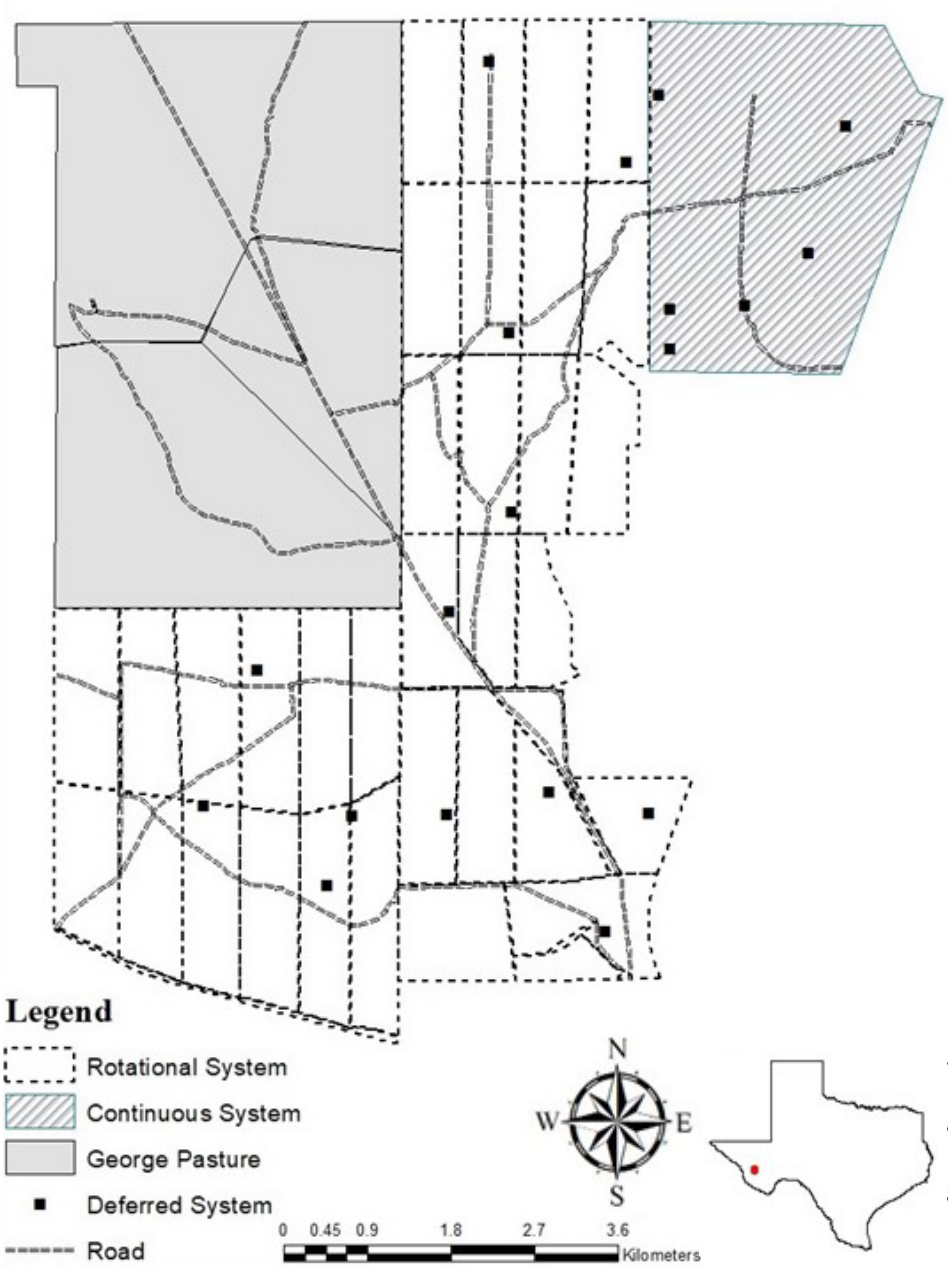
Foraging by bison of grass-dominated sites also increased nitrogen cycling and available nutrients for other species, like forbs and shrubs.

However, after European settlement in the Chihuahuan Desert Borderlands, the primary dominant grazer shifted from the near extirpated American bison to the introduced domestic cow. Although the spatial and environmental effects of bison grazing cannot be replicated, cattle may serve as a suitable alternate.

Yet, research regarding the effects on plant communities by cattle grazing reveals inconsistent results across various ecosystems. Collectively, plant community structure is a result of its evolutionary history and active grazing management.

Cattle grazing systems manipulate grazing through time and space to maintain or increase cattle productivity while minimizing adverse ecological consequences. Successful grazing systems and optimum cattle productivity are thus dependent on understanding the relationship between how cattle cope with their environment and forage dynamics.

There is a need for grazing systems in arid ecosystems, and investigating their effects on vegetation communities can provide critical information to keep rangelands productive for cattle and pronghorn. Stakeholders can be a significant part of accomplishing that as they modify the environment through various management tools.



This map displays the Dixon Water Foundation Mimms Ranch in Marfa, Texas. Map shows ranch roads, ranch perimeters, and boundaries of the rotational, continuous, and exclosed (deferred) cattle grazing systems.

If cattle are managed to use forage sequentially through the seasons, their grazing can improve forage conditions for wild herbivores. Cattle require large quantities of forage and can digest fibrous food efficiently when they remove dead and mature grasses, it allows easier access and growth for small forbs such as the ones pronghorn select.

A look at cattle grazing management shows three major systems. One example is the continuous grazing system, which allows cattle to graze an undivided pasture for an entire year. Another is the rotational system, which involves cattle movement through a sequence of divided paddocks. Lastly is the deferred grazing system that does not allow grazing in a specific designated area.

However, literature regarding how cattle grazing helps wildlife populations is limited, including the effects of cattle

Can pronghorn and cattle share the same habitat? Yes, according to research by the Borderlands Research Institute on the Dixon Water Foundation's Mimms Ranch in Marfa, Texas.

foraging on pronghorn habitat. Previous research has found rotational systems to facilitate high biomass and nutritional forb production during the warm–wet season. But there is little research regarding nutrition and biomass of forb species during the most limiting period of the year, the cool season. Examining how cattle foraging interacts with pronghorn foraging will aid in conservation efforts.

We investigated the effect of cattle grazing systems on forb abundance and quality to assess approaches for improving pronghorn habitat. Our objectives were to compare vegetation production, available biomass, and nutritional quality in rotational, continuous, and deferred cattle grazing systems during the cool season.

We conducted this project on the Dixon Water Foundation's Mimms Ranch in Presidio County, Texas. The 10,848-acre property is on the northwest edge of Marfa, Texas, bordered by State Highway 17 and US Highway 90. We focused our sampling in winter 2020-21, expecting

the least quantity and variety of forb species during this time because of cold temperatures, shorter daylight hours, and low precipitation.

We sampled 260 plots proportionally across continuously grazed, rotationally grazed, and non-grazed pastures. We measured surface biomass of non-woody forb species exclusively. We then measured the acid detergent fiber (ADF), the amount of plant fiber that is comprised of cellulose and lignin, neutral detergent fiber (NDF), the addition of ADF and the amount of plant hemicellulose, and total digestible nutrients (TDN), the total percentage of digestible carbohydrates, digestible protein, and digestible fat, of the vegetation samples. To investigate correlations between grazing system, forb biomass, and nutritional contents, we used statistics to detect relationships between plant species and the environment relevant to cattle grazing systems.

Our results suggest that cattle grazing systems had little influence on forb biomass and forb nutrition. The few forb species detected in our study suggest that they could be less reliant on precipitation during the Trans-Pecos monsoons, or more resistant to drought, compared to those not detected. Since we did not find greater biomass or nutrition comparatively, our results support previous research that no specific grazing system we evaluated has an advantage over others in arid rangelands.

In arid ecosystems, precipitation plays an influential role in plant production and is highly variable within and between years. The average annual precipitation of our study site is around 15.4 inches, while our data collection followed a year of merely 6.8 inches. Thus, the forb biomass and quality may not have been necessarily indicative of their values in average precipitation years because precipitation is a critical component to vegetation growth and composition.

Another important consideration is determining stocking rate. Essentially, forage is the supply, and cattle are the energy demand. Thus, supply and demand should be balanced using stocking rate as a fundamental tool.

This is especially appropriate for the Trans-Pecos because variation of forage production between years in the Chihuahuan Desert is immense. Since our analysis included only one season, it is possible that our results captured changes in forb communities partly due to discrepancies in stocking rate decisions.

Understanding the dynamics of vegetation communities is a necessary component of management for sustainable animal production and plant integrity in arid rangelands. Our research shows that grazing systems have only a minor effect. on improving forb communities during or after a drought.

We conclude that cattle management in arid regions, including the Trans-Pecos, requires adaptation and attentiveness to climatic variation to maintain sustainability and conserve forb communities and the rangeland. To effectively use forage resources in the Trans-Pecos, understanding the relationships between grazing, forb dynamics, and climate is necessary to aid pronghorn habitat.