Grazing Management Considerations on New Mexico Rangelands

Casey Spackman and Marcy Ward[1]

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Cattle graze on poppies at the New Mexico State University Chihuahuan Desert Rangeland.

INTRODUCTION

One of the major uses of rangelands in New Mexico is livestock grazing. The land's vegetation provides a renewable resource not only for livestock production but also for wildlife and many other life forms. Rangeland managers are entrusted with the role of sustainably managing these natural resources. Livestock grazing is one way to promote resilient vegetation, biodiversity, and healthy soils. Grazing strategies fall into four interwoven and basic principles: timing, intensity, distribution, and duration (TIDD). While distinct concepts, these principles are interdependent, with each complementing and impacting others. Integrating TIDD into grazing management principles is essential for effective rangeland management. This publication aims to summarize key concepts and their interconnections, enabling livestock producers to make informed decisions to enhance natural resource conditions.

TIMING

Plants exhibit different growth patterns depending on species, but they all progress through the same stages of growth. Generally, there are three plant phenological stages: vegetative and elongation, reproductive, and dormancy. The vegetative and elongation stage is characterized by active growth and leaf production,

[1]Respectively, Assistant Professor and Extension Range Management Specialist, College of Agricultural, Consumer, and Environmental Sciences (ACES); Extension Livestock Specialist, ACES. All from New Mexico State University.

while the reproductive stage is when flowers and seeds are developed. Dormancy occurs when the plant is not actively growing but maintains metabolic function. These growth stages vary throughout the year depending on species and plant type factors such as seasonal conditions (warm or cool), and whether the plant is annual or perennial (Figure 1). The timing of grazing in relation to these phenological stages is important, as it will impact both plant vigor and rangeland conditions.

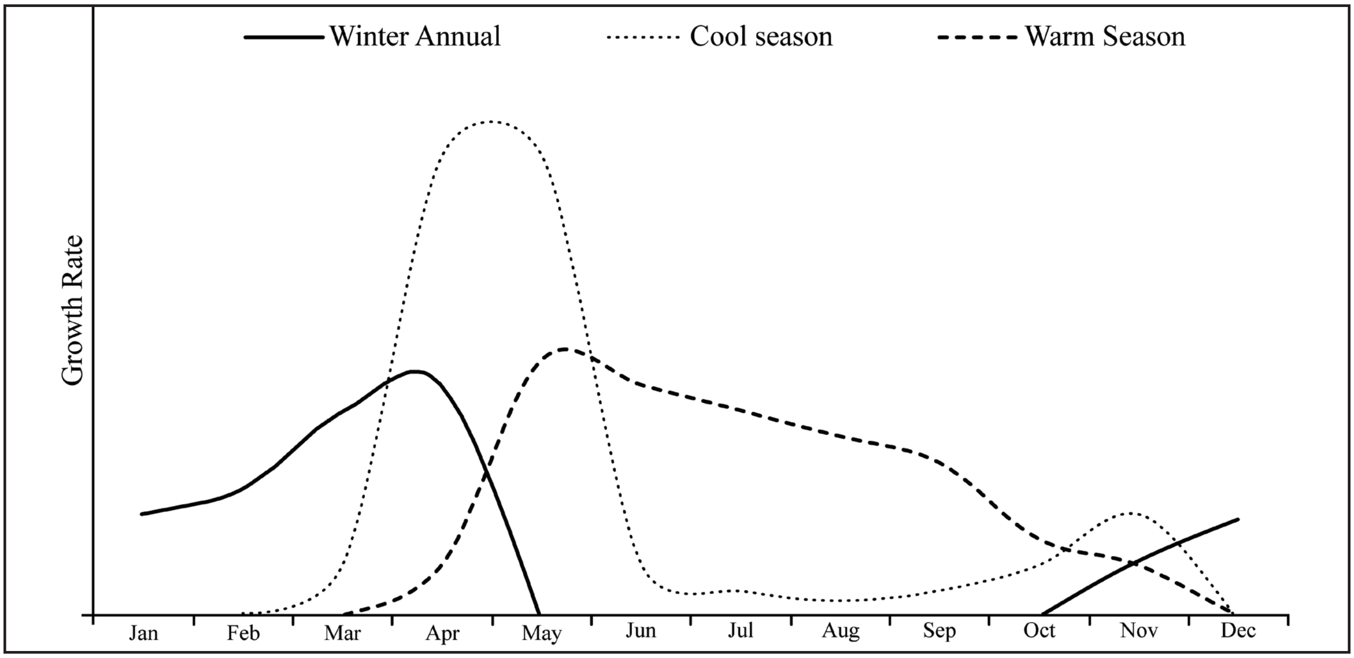

Figure 1. Seasonal growth of three different grass types

Energy reserves are a critical component of plant growth and survival. During the early vegetative stage, or when the plant begins to grow, plants rely on energy reserves in the root system. These reserves are drawn upon until sufficient leaf mass is produced. Once the 4 to 5-leaf stage is reached, reserves begin to be replenished, correlated to the plant's photosynthetic capacity. Grazing before this stage can impose high demands on energy reserves, potentially killing or substantially reducing plant growth and vigor. Reserves will continue to increase without grazing until the reproductive stage. A slight dip can be expected as the plant produces seeds, increasing again after seeds shatter. However, plant species vary in their ability and timing to synthesize or replenish energy reserves (Figure 2). While grazing during active growth stages typically has minimal impact as long as sufficient leaf area is maintained for photosynthesis and linked to its phenological stage. During dormancy, plants will use a small amount of energy reserves sufficient to sustain metabolic function. While it is widely accepted that grazing during dormancy will have little to no adverse effects on plants due to minimal use of energy reserves, residual plant material is important and serves to protect soils and guard against extreme temperatures, insects, and pathogens.

Overall, grazing can occur at any time provided that there is sufficient photosynthetic leaf mass to maintain energy reserves and ensure plant vigor. However, the intensity, distribution, and duration of grazing are equally important factors to consider in tandem with timing to ensure plant sustainability. In a rest-rotation strategy (i.e., duration), allowing a deferment period corresponding to plant regrowth would ensure adequate photosynthesis. If deferment is not possible, limiting grazing intensity to 30 to 50 percent plant removal ensures that plants have sufficient time to recover between grazing events. Therefore, timing should not be the sole consideration in grazing management but should be considered in conjunction with intensity, distribution, and duration.

INTENSITY

Grazing intensity is defined as the 'degree of vegetation use' or the proportion of current year's forage production consumed or destroyed by grazing animals (SRM 1998). This aspect of grazing is crucial, since it determines the amount of leaf area a plant has available for obtaining sunlight and nutrients necessary for growth. Plants typically produce a surplus of leaf area, allowing for a portion of the plant to be removed without consequence. However, the question arises as to what amount of the plant can be safely removed to sustain plant productivity.

As mentioned in the timing section, avoiding severe defoliation during key growth stages like the vegetative and reproductive phases is crucial, as this can reduce energy reserves to a damaging level. Grazing intensity guidelines

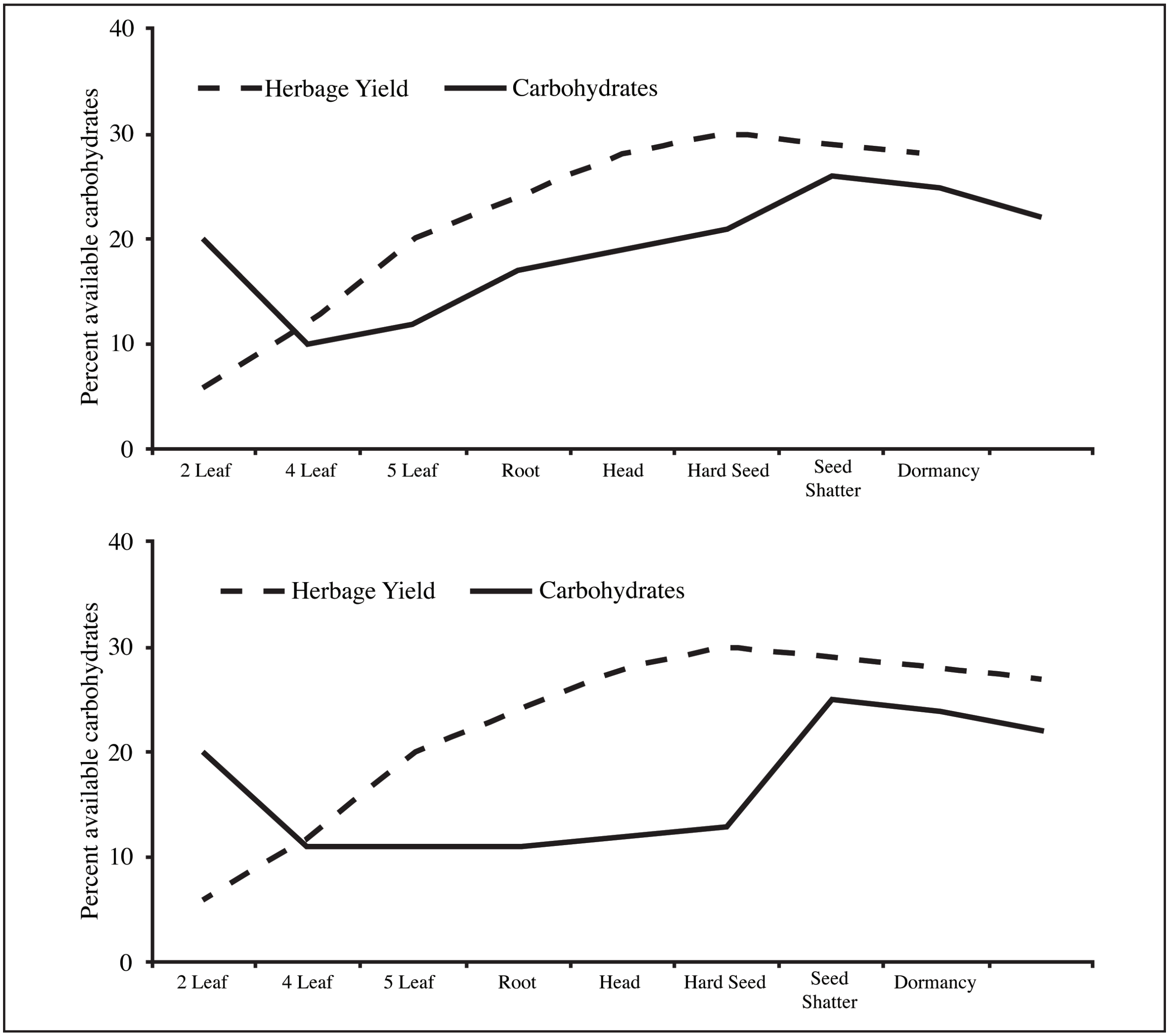

Figure 2. Carbohydrate cycles and growth curves for typical range plant species (top) and for one that replenishes its reserves late in the growing season (bottom); adapted from Cook, 1966.

have been established and categorized by percentages of none to light (0-30%), conservative (31-40%), moderate (41-50%), heavy (51-60%), and severe (>60%) (Holechek & Galt, 2000). Table 1 provides a description of vegetation conditions for these categories. It's important to note that these categories should be viewed as guidelines rather than fixed values or percentages due to considerable overlap of plant composition and species, precipitation variability, elevation, and other site-specific factors. While traditional wisdom suggests grazing moderately through a 'take-half-leave-half' approach, this may lead to rangeland deterioration in drier areas (<12 inches) of the Southwest. Conversely, conservative grazing has been shown to be the optimal intensity in New Mexico, promoting vegetation and animal productivity while stabilizing financial and operational risks (Holechek, Gomez, & Molinar, 1999). The intensity by which forage is consumed depends on the size of the area being grazed, the number and distribution of animals, and duration of time spent grazing, underscoring the integrated nature of TIDD principles.

DISTRIBUTION

Distribution of animals on rangelands is defined as the dispersion of a known number of grazing animals within a given area or management unit. Several factors impact whether animals congregate or are more dispersed, directly influencing the intensity of vegetation use. Some of these factors include water availability, topography, vegetation attributes, and environmental features.

Table 1. Defoliation intensity categories.		
Defoliation Intensity Category	**Percentage Forage Use**	**Defoliation Intensity Description**
Light to nonuse	0-30	Only choice plants and areas show use. No use of pooer quality forage plants.
Conserva-tive	31-40	Choice plants have abundant seed stalks. Areas >1 mile from water show little use. One third to a half of primary forage show defoliation in key areas.
Moderate	41-50	Majority of area shows use. Key areas[a] appear patchy with half to two thirds show defoliation. Area be-tween 1-1.5 miles from water show some use.
Heavy	51-60	All choice plants show defoliation. Shrubs show hedging. Key areas lack seed stalks. Defoliation notice-able at >1.5 miles from water.
Severe	Over 61	Key areas show a mowed or se-verely hedged appearance. Animal trails to and from available forage. Areas >1.5 miles from water appear mowed or severely hedged.

Adapted from Holechek and Galt (2000).
[a]Key area is defined as a portion of land that is representative of a pasture, landscape, or larger area due to its environmental or grazing value.

Water availability is the most limiting factor of Southwest rangeland. As the distance from drinking locations increase, animal distribution decreases, which corresponds to decreases in vegetation use (Table 2). Typically, cattle will travel three miles or less between watering locations, with a recommended distance of less than one mile to more uniformly graze an area.

Table 2. Cattle grazing reduction with distance from water.	
Miles	Percent Reduction in Grazing Ca-pacity
0-1	None
1-2	50
Over 2	100 (considered ungrazable)

Source: Holechek (1988)

Slope or steepness of terrain is another major influence on animal distribution. As slope increases, travel and vegetation use proportionally decreases (Table 3). There can be significant overlap between slope and distance from water when determining forage use reductions, and the greatest reduction between the two should be used to determine limitations in distribution. Additionally, animal species, age, experience, and breed can greatly influence distribution relative to distance from water and slope steepness.

In addition to terrain, the vegetation itself plays a role in distribution patterns. With over 3000 different plant species in New Mexico, some are more desirable for consumption than others based on phenological stage, nutritional content, general palatability, or a combination of these factors. Livestock will first consume forages that meet their dietary requirements before moving on to less desirable plants. Less dispersed animals lead to overgrazing of desirable forages (patch grazing) and congregating in areas where these plants are more abundant. To promote more uniform vegetation use and better distribution, supplementation is recommended to disperse the animals and decrease grazing use intensity. When livestock's dietary needs are partially met by mineral or protein supplements, less desirable plants are more readily consumed, promoting more uniform species consumption.

Finally, environmental factors such as adverse wind, weather conditions, and temperatures can also reduce distribution, with livestock likely congregating to avoid prevailing conditions, thereby altering grazing patterns. Providing shelter from the elements, such as trees and structures, can assist in dispersing livestock across the landscape or help target under-utilized grazing areas.

Table 3. Grazing reduction with slope for cattle.	
Percent Slope	**Percent Reduction in Grazing Capacity**
0-10	None
11-30	30
31-60	60
Over 61	100 (considered ungrazable)

Source: Holechek (1988)

DURATION

The amount of time an animal spends consuming forages in a particular location or area is known as grazing duration. The selection of an appropriate grazing strategy largely determines this duration component. It is beneficial to highlight two different concepts here. The most common strategy in New Mexico is continuous grazing, where animals graze an area for the entire year without being rotated to other pastures. An alternative rotational strategy involves moving animals through separate pastures or areas over varying periods, from days to months.

Implementing a rotational grazing strategy often requires additional infrastructure such as fences and strategically located watering sources. Research suggests grazing intensity has a greater influence on rangeland productivity and conditions than the grazing strategy employed. For example, when comparing continuous grazing to more intensive strategies under conservative to moderate grazing intensities, there were no observable differences in rangeland conditions (Briske et al. 2008). However, in continuous systems where animals congregate in areas with desirable plants, overuse and uneven utilization becomes a concern related to poor distribution.

Proper grazing management, allowing sufficient recovery periods through controlled timing, intensity, and distribution, can significantly impact plant vigor, root development, forage accumulation, resource competition, and plant longevity. The removal of leaf area decreases plants' ability to photosynthesize and produce energy. The duration over which leaf area is reduced or plants are defoliated becomes critical, as it directly impacts the time needed to replenish energy reserves and regenerate leaf mass. Concurrently, the plant's phenological stage when defoliation occurs dictates its vulnerability and capability for regrowth. Furthermore, the intensity of severity of defoliation determines the level of stress imposed on vegetation, affecting its resilience. Therefore, an integrated approach carefully addressing duration, timing, intensity, and distribution is paramount for safeguarding plant productivity and promoting sustainable rangeland ecosystems.

CONCLUSION

The principles of Timing, Intensity, Distribution, and Duration (TIDD) are fundamentally interconnected, forming an essential framework for sustainable rangeland grazing management. By incorporating TIDD concepts, rangeland managers and livestock producers can promote resilient vegetation, enhanced biodiversity, and improve overall natural resource conditions. The timing of defoliation must account for plant phenology, while factors like intensity, distribution, and duration are interdependent and influence vegetation recovery and productivity. Through thoughtful implementation of these integrated principles, managers can cultivate sustainable rangelands that support long-term ecological and operational success. Recognizing and embracing the interdependencies between TIDD is paramount to building sustainable rangeland conditions and ensuring longevity of ranching operations.

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Casey Spackman is an Assistant Professor and Extension Range Management Specialist at New Mexico State University. He earned his Ph.D. at Utah State University. His Extension efforts aim to assist producers, land managers, and agency personnel in monitoring and developing management objectives that maintain or improve natural resource health and sustainability.

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