COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES

NM STATE

Department of Extension
Animal Sciences and Natural Resources

COOPERATIVE EXTENSION SERVICE • VOLUME 68 • July, 2021

Determining Grazing Capacity on Rangelands

by Casey Spackman,
Extension Range Management Specialist

Livestock production is the main economic activity on rangelands. Animals use vegetation that would otherwise be inaccessible by mechanical means. Monitoring is the method by which vegetation can be assessed and determine whether the trajectory of rangeland conditions is improving, sustaining or degrading. Calculating grazing capacity from monitoring data is critical to ensure overuse or natural resources does not occur and is defined as the average number of animals that a landscape or area can support. Understanding basic concepts of the calculation process can help provide a more accurate estimate of grazing capacity and promote better rangeland conditions.

Site Selection

Selecting areas representative of the landscape as a whole are key for site selection. Understandably, rangeland pastures vary greatly across the landscape and certain factors may contribute to under or over representation of vegetation present. Thus, there are some general factors to consider when selecting an assessment site. Because animals tend to congregate around infrastructure and look for easy travel pathways, it is suggested to select areas a quarter to one mile from water sources, fences, roadways, and other manmade structures. Additionally, it is recommended to select sites with slopes less than 15%, soils of satisfactory condition, and areas of greater than 5 acres.

Forage Quantities

The amount of forage available for livestock is determined by collecting vegetation samples from a designated area, drying, weighing, and converting those weights to pounds of forage per acre. Available forage data can be assessed through residual forage and annual forage production. Residual forage is plant material collected with possible defoliation from grazing and should only be used to assess current forage availability, as well as temporarily adjust carrying capacity. Annual forage production is plant material collected from grazing exclusion cages and used to assess potential forage production for the year. When annual forage assessments are taken over 5-10 years, trends can be established to make long-term management decisions, whereas 3-5 years of data can be used to make short-term management decisions. Residual forage assessments can be taken any time during the year, while annual forage should be taken at the end of the growing season.

Utilization

The percentage of forage removed by grazing animals or amount of residual vegetation remaining after grazing is referred to as utilization. When residual and annual forage production data is available the two can be used to deduce an approximate percent utilization level. This is done by subtracting annual forage production from residual forage and then dividing by the annual forage production. Utilization is only an approximation of forage use and an estimate of grazing intensity (Table 1). Light to conservative grazing in New Mexico optimizes vegetation and livestock productivity, whereas moderate to heavy grazing can lead to rangeland deterioration if grazing intensity persists over the short-term.

Table 1. Grazing intensity categories

Grazing Intensity Category	Percent Forage Use	Grazing Intensity Description
Light to nonuse	0-30	Only choice plants and areas show use. No use of poor quality forage plants
Conservative	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 grazing in key areas.
Moderate	41-50	Majority of area shows use. Key areas appear patchy with half to two thirds show grazing. Area between 1-1.5 miles from water show some use.
Heavy	51-60	All choice plants show grazing. Shrubs show hedging. Key areas lack seed stalks. Grazing noticeable at >1.5 miles from water.
Severe	Over 61	Key areas show a mowed appearance. Shrubs severely hedged. Livestock trails to and from available forage. Areas >1.5 miles from water appear mowed.

Source: Holechek and Galt (2000)

Landscape Adjustments

Several parameters limit livestock utilization of forages across the landscape. It is important to consider these elements when estimating carrying capacity. For instance, as distance from water and slope increases, vegetation use decreases. The exception to this is goats and sheep, which do not require water daily and can forage more readily on rugged terrain. Cattle on the other hand tend to graze flatter terrain and stay closer to water. Thus, tables 2 and 3 give recommended grazing adjustment for cattle only. Distances less than 2 miles from water and slopes less than 45 percent are considered to be used at 100 percent for sheep and goats.

Table 2. 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)	

Table 3. Cattle grazing reduction with distance from water	
Miles	Percent Reduction in Grazing Capacity
0-1	None
1-2	50
Over 2	100 (considered ungrazable)
Source: Holechek (1988)	

Forage Demand:

Animals consume on average 2 percent of their body per day on a dry matter basis. Intake of ruminants may be higher or lower depending on forage quality, with horses and donkeys consuming approximately 50 percent more due to a variation in their digestive system. Forage demand can be calculated by multiplying daily intake by body weight. A standardized method of assessing livestock numbers on rangelands has been established with cattle being the model unit. One animal unit equivalent (AUE) is considered to be one mature cow of 1000 pounds, with or without calf up to six months of age, consuming about 20 pounds of forage on a dry matter basis per day. Other rangeland animals and their unit equivalents can be found in Table 4.

Table 4. Forage demand of various rangeland animals			
Animal	Animal Weight (lbs)	Daily Dry-Matter Intake (lbs)	Animal Unit Equivalents (AUE)
Cattle (Mature)	1000	20.0	1.00
Cattle (Yearling)	750	15.0	0.75
Sheep	150	3.0	0.15
Goats	100	2.0	0.10
Horse	1200	36.0	1.80
Donkey	700	21.0	1.05
Bison	1800	36.0	1.80
Elk	700	14.0	0.70
Moose	1200	24.0	1.20
Bighorn Sheep	180	3.6	0.18
Mule Deer	150	3.0	0.15
White-tailed Deer	100	2.0	0.10
Pronghorn Antelope	120	2.4	0.12
Caribou	400	8.0	0.40
Source: Holechek (1988)			

Carrying Capacity Calculation

Once available forage quantities of a pasture, desired utilization, and animal forage demand is known, carrying capacity can be calculated. Carrying capacity is often synonymous with stocking rate. Several calculations may be necessary to adjust for landscape adjustments. For instance, a pasture may be 1000 acres but only 500 acres will be grazed at 100 percent. Pasture size is then 500 acres in the equation. Depending on the duration of grazing, AUE per day (AUD), per month (AUM), or per year (AUY) can be estimated. The number of grazing days then need to be added into the calculations. The following is the equation used to estimate carrying capacity:

$$(\textit{available forage} \times \textit{pasture size} \times \textit{percent utilization}) \div (\textit{animal forage demand} \times 30 \textit{ days}) = \textit{number of AUM}$$

The College of Agricultural, Consumer and Environmental Sciences is an engine for economic and community development in New Mexico, improving the lives of New Mexicans through academic, research, and Extension programs. New Mexico State University is an equal opportunity/affirmative action employer and educator. NMSU and the U.S. Department of Agriculture cooperating.