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Stocking Rate Determination on Native Rangeland

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Introduction

No other single management practice other than fire affects livestock production or wildlife habitat more than livestock stocking rate. A proper stocking rate is defined as balancing the needs of the plants with the needs of the animals. However, it is important to remember that stocking rate is mainly driven by the amount and distribution of precipitation received each year, which is also the driving factor in forage production. Because of this variability, stocking rate is a moving target from year to year, and must be adjusted regularly. Regardless of variability in forage production, the proper stocking rate for your ranch depends on your objectives and your management focus (e.g. cattle production, wildlife habitat). For some wildlife species, you cannot optimize cattle production and wildlife habitat at the same time. Native forages provide year-round grazing because they are made up of a diversity of grasses, forbs, legumes, and woody plants that grow both in the winter and summer. This publication addresses stocking rates on native forages only.

Stocking Rate Effects on Livestock Production

Stocking rate can influence several factors: plant composition, forage production, erosion, and livestock production. Stocking rate also has a major impact on animal performance and overall profitability of the livestock production system. Figure 1 indicates that maximum individual animal performance occurs at light stocking rates because there is little competition for the best forage plants. As stocking rate is increased beyond moderate levels (optimum), animal performance is reduced because of increased competition among livestock. The opportunity for diet selection afforded by low to moderate stocking rates ensures that individual animal performance is maximized. Figure 1 also indicates that as stocking rate increases, the amount of weight gain produced per acre is increased up to the optimum threshold and then declines sharply. Ranchers who continually use heavy stocking rates in an attempt to improve net profitability should realize that they have already passed the point at which maximum net return will be realized because of increased costs (such as herbicide, protein supplements, and hay) that are not offset by production increases.

An additional problem with long-term overstocking of native forages is the overuse of palatable species that results in an increase of less palatable or unpalatable plants and a reduction of fine fuel, which will eliminate the ability to use prescribed fire. Without fire, woody plants will increase rapidly. As the incidence of these undesirable plants increases at the expense of the more desirable forage species, animal performance will decline and the number of cattle that the ranch will support will decline. This situation is called overgrazing because of a change in forage species as the result of the improper use. The results for the rancher are decreased profitability from livestock, the increased likelihood of having to feed hay, and often results in the perceived need of herbicide applications to remove undesirable species, a consequence of mismanagement.

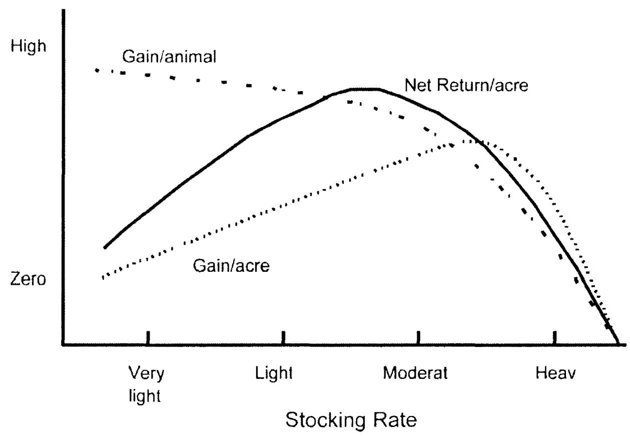

Figure 1. Effects of stocking rate on livestock performance and profitability.

look at this is to assume that 25 percent of the total forage is actually consumed by the grazing animal. Plant physiological requirements regarding remaining residue and waste by grazing animals set these limits. Plants that are overused will be weak and less productive the next growing season and will require rest.

Setting Stocking Rates on Native Vegetation

Forage production varies from year to year because of changes in precipitation. Stocking rate should be based on average long-term end-of-season standing crop values for an operation to remain productive and sustainable. Ranchers that have been in business for a longtime tend to stock conservatively (light). This is particularly important in arid rangelands. They know that years of low rainfall and low forage production (unfavorable years) are the years that will put them out of business. These ranchers also adjust their stocking rate calculation to account for the presence of bulls, replacement heifers, or other grazing animals including wildlife that are also consuming forage.

Technical Terms

Stocking rate is defined as the number of animals on a certain amount of land (acres) over a certain period of time (grazing period). A term that is used to help understand and estimate forage requirements is the animal unit (AU) concept. An animal unit is defined as a 1,000 lb. dry cow (Table 2). Thus, stocking rate is generally expressed as animal units (AU) per unit of land area.

Table 2. Carrying capacity in terms of the animal unit (AU) concept. These numbers are constants based on metabolic body weight explained below.

Term	*Abbreviation*	*Definition*
Animal unit	AU	1,000 lb. dry cow
Animal unit day	AUD	26 lbs. of dry forage
Animal unit month	AUM	780 lbs. of dry forage
Animal unit year	AUY	9,360 lbs. of dry forage

Because cattle and other grazing animals are not the same size, it is necessary to convert to animal unit equivalents. These calculations are based on metabolic body weight defined by the following equation:

Animal body weight converted to kilograms taken to the 0.75 power = $kg^{0.75}$

To convert to kilograms (kg) multiply pounds x 0.4536. For example, a 1,000 lb. cow's metabolic body weight (MBW) would be (1,000) (0.4536) = $(453.60)^{0.75}$ = 98.29.

See MBW column (Table 3) for comparison of different weight animals and generates the animal unit equivalent concept (AUE). The term animal unit equivalent is a useful and practical way to estimate forage demand for different species, kinds, or classes of animals or for cattle that weigh more or less than 1,000 lbs. Animal unit equivalent is based upon a percentage (plus or minus) of the standard AU that takes into account physiological differences (metabolic body weight).

Assuming forage dry matter demand (DM) of 26 lbs. per day, the 1,000 lb. cow is used as the base animal unit to which other livestock are compared. The AUE for cattle weighing 900 lbs. or less is calculated as:

AUE = (BODY WEIGHT + 100) ÷ 1,000

<u>or</u>, for animals of 1,100 lbs. or more,

AUE = (BODY WEIGHT-100) ÷ 1,000

Table 3. illustrates several different kinds and classes of animals, their various AUEs, and estimated daily forage demand.

Calculating Stocking Rates

Now that we have the basic calculations for AUE and DM, we are able to calculate the actual stocking rates. Below are 2 examples to illustrate this calculation.

Example 1: Calculating stocking rate:

For the first example assume 100 head of cows that average 1,000 lbs. with calves on a 1,000 acres native rangeland. The grazing system for this herd is continuous stocking for 12 months. The stocking rate would be calculated using information contained in Table 2 and Figure 1.

For a 1,000 lb. cow, AUE = 1.0 (26 lbs. per day) from Table 2.

$$\frac{\text{(Total Land Area) x (Average End of Season Standing Crop) x (Forage Utilization)}}{\text{(AU Forage Demand per AU per Day) x (Number of Days Grazed)}}$$

$$\frac{\text{(1,000 acres) x (6,360 lbs. per acre) x (25\%)}}{\text{(26 lbs. per day) (1 AUE) x (365 days)}} = \text{168 cows (average 1,000 lbs.)}$$

In this example this pasture could run 168 cows year-long but this does not take into account bulls, replacement heifers, or calves. Thus, as a general rule you should assign a cow an AUE of 1.4 and recalculate the stocking rate. Using an AUE of 1.4 for a 1,000 lb. cow takes into account bulls, replacement heifers, or calves. Unfortunately some ranchers have tended to run larger cows (usually inefficient and not profitable) over the years and have not taken into account the increase forage demand per animal which results in overgrazing. Thus, accurate animal weights are critical in determining proper stocking rate.

Example 2: Calculation of stocking rate on a grazing period of less than one year and cattle smaller than the standard AU.

A slight twist on the calculation would be to use livestock smaller than the standard AU, the 1,000 lb. cow. An example would be stocker calves managed for season-long (150 days) grazing entering (May 1) the grazing season weighing 600 lbs. and leaving (October 1) weighing 800 lbs. We will use an average weight for the grazing season of 700 lb. which gives an AUE of 0.8 from Table 1.

$$\frac{\text{(1,000 acres) X (6,360 lbs. per acre) x (25\%)}}{\text{(26 lbs. per day) x (0.8 AUE) x (150 days)}} = \text{509 stockers}$$

In this example this pasture could run 509 stockers for 150 days.

Table 3. Animal weight, metabolic body weight (MBW), rounded animal unit equivalent (AUE), and estimated daily forage dry matter (DM) demand as a percentage of demand for a 1,000 lb. animal. Various classes and species of animals are listed to demonstrate this concept. Average weights for your animal should be used.

Animal Type or Class (lbs)		*MBW*	*AUE*	*DM demand (lbs. per day)*
Sheep				
Ewe	175	26.6	0.27	7.0
Ram	250	34.8	0.34	8.8
Goat				
Nanny	120	20.0	0.20	5.2
Billy	175	26.6	0.27	7.0
Deer				
Doe-IM	60	11.92	0.12	3.1
Doe-M	100	17.48	0.17	4.4
Buck-IM	75	14.09	0.14	3.6
Buck-M	150	23.69	0.24	6.2
Cattle				
Calf	300	39.84	0.4	10.4
	400	49.35	0.5	13.0
	500	58.44	0.6	15.6
	600	67.01	0.7	18.2
	700	75.22	0.8	20.8
	800	83.14	0.8	20.8
Cow	900	90.82	0.9	23.4
	1,000	98.29	1.0	26.0
	1,100	105.57	1.1	28.6
	1,200	105.57	1.1	28.6
	1,300	119.66	1.2	31.2
	1,400	126.50	1.3	33.8
Bull	1,500	133.22	1.3	33.8
	1,600	139.83	1.4	36.4
	1,700	146.33	1.5	39.0
	1,800	152.74	1.5	39.0
	1,900	159.06	1.6	41.6
	2,000	165.30	1.7	44.2
	2,100	171.46	1.7	44.2
	2,200	177.55	1.8	46.8
	2,300	183.57	1.8	46.8
	2,400	189.52	1.9	49.4
	2,500	195.42	2.0	52.0
Horse	700	75.22	0.8	20.8
	800	83.14	0.8	20.8
	900	90.82	0.9	23.4
	1,000	98.29	1.0	26.0
	1,100	105.57	1.1	28.6
	1,200	105.57	1.1	28.6
	1,300	119.66	1.2	31.2
	1,400	126.50	1.3	33.8
	1,500	133.22	1.3	33.8

Summary

A wide variety of terms are used when discussing stocking rate—many of which can be confusing. To calculate stocking rate, it is not necessary to use these terms, ranchers only need to use the following steps:

1. Estimate forage production and adjust for loss to trampling, wildlife, decomposition.
   - 4,500 lbs/acre standing crop X 25% harvest efficiency = 1,125 lbs/ac available for consumption by the animal of choice

   Other factors to consider:
   - Distance from water
   - Slope

2. Calculate how much forage your livestock will demand for the grazing period.

Ranchers should keep detailed records on livestock stocking rates, livestock performance, forage standing crop, and wildlife response/harvest over time. Having long-term records is necessary to run a ranch as a business.

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