Estimating Carrying Capacity on Rangelands

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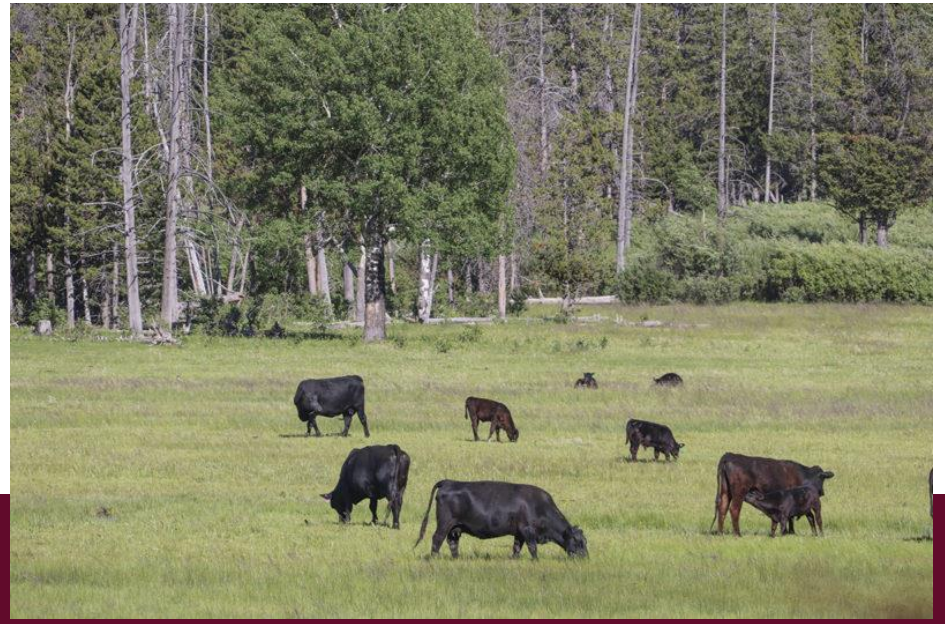
Carrying Capacity vs. Stocking Rate

- The number of ***all*** animals an area of land can support long-term while maintaining or improving the rangeland resources (vegetation, soils, water).

- The number of ***livestock*** an area of land can support for ***a designated period of time*** while maintaining or improving the rangeland resources (vegetation, soils, water) over the long-term.



What is the Objective?

Environment?

Aesthetics?

Livestock?

Wildlife?

Plants?

Essential information

Total Available Forage

1. **How much forage do you have (Pounds)?**
2. **How big is the area (Acres)?**
3. **How much are you allocating to an animal** (*Utilization*)**?**
4. **How much food will the animal eat** (*Forage Demand*)**?**

(Total Available Forage X Percent Utilization) ÷ (Animal Forage Demand) = Animal Unit Equivalent

How much forage do you have?

- MONITORING!!!!
  - Residual Forage vs Annual Forage
  - Hoop Size and Conversions

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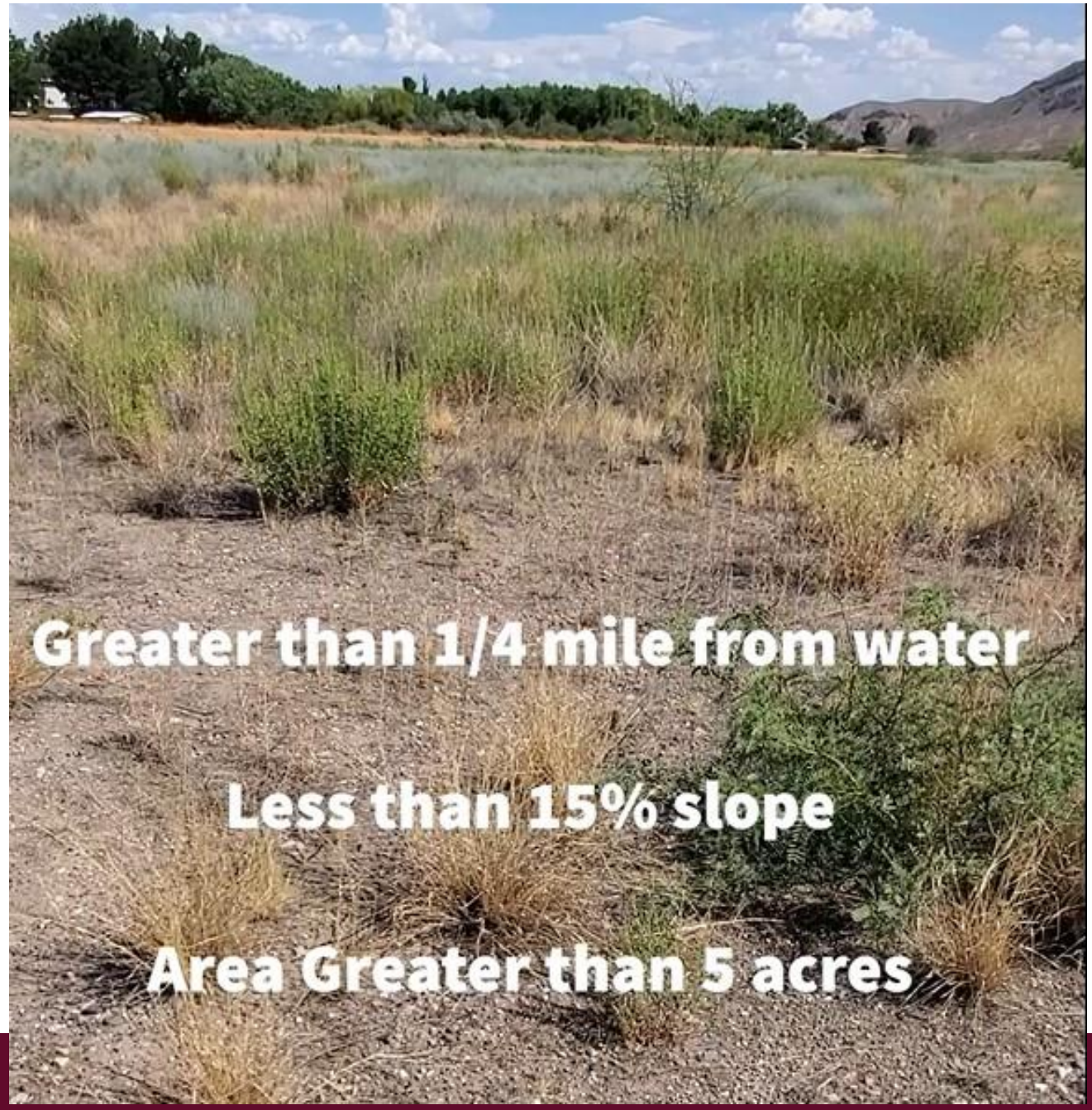
- MONITORING!!!!
  - Residual Forage vs Annual Forage
  - Hoop Size and Conversions

Table 1. Range hoop and square conversion factors

Plot Size	Conversion Factor	Hoop Radius	Hoop Circumference	Square Dimensions
0.96 ft^2	grams × 100	0.55 ft	3.5 ft	0.98 × 0.98 ft
1.92 ft^2	grams × 50	0.78 ft	4.9 ft	1.39 × 1.39 ft
2.40 ft^2	grams × 40	0.87 ft	5.5 ft	1.55 × 1.55 ft
4.80 ft^2	grams × 20	1.24 ft	7.8 ft	2.19 × 2.19 ft

Source: Pratt and Rasmussen (2001)

Site Selection for Forage Collection

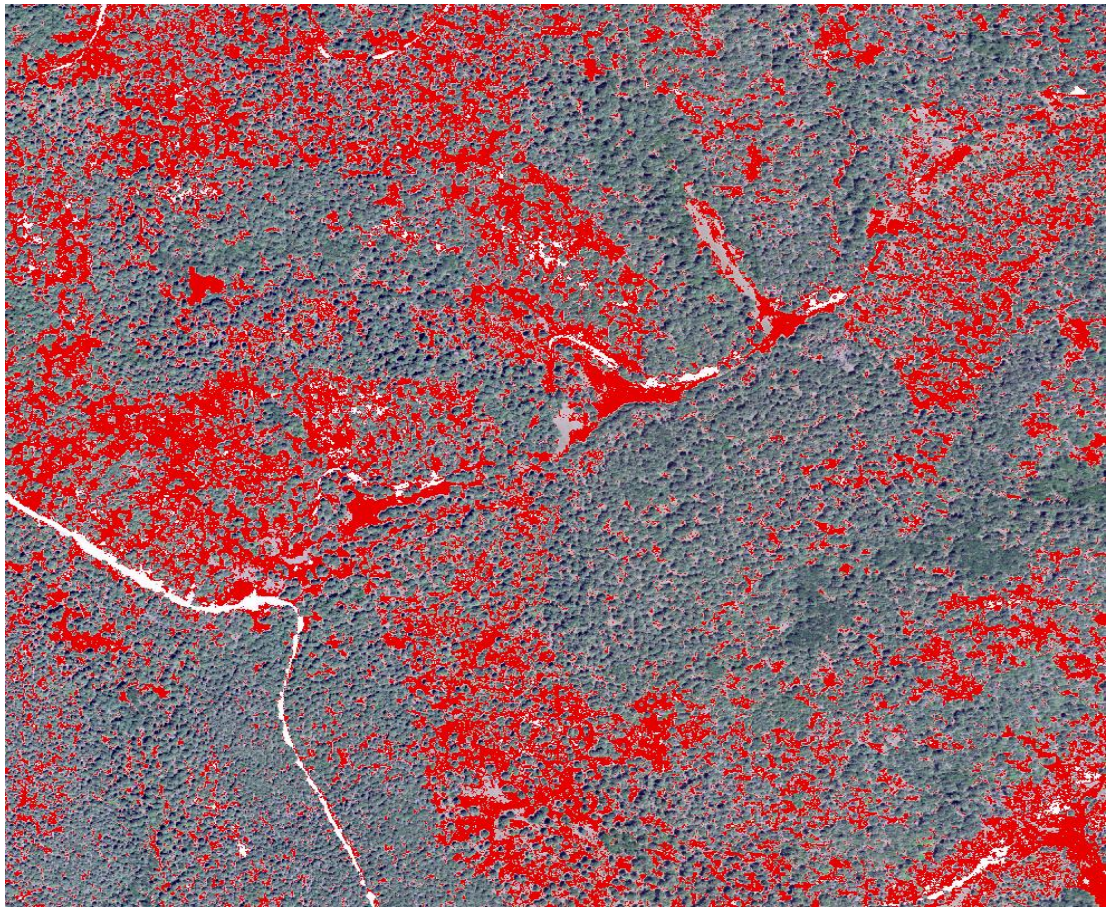


How big is the area

Grazable Acres vs. Actual Acres

How big is the area (Only 67% is grazable)

Grazable Acres vs. Actual Acres



How big is the area

- Actual acres and reductions to Grazable acres

Table 5. 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)	

Table 4. 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)	

How much are you allocating to an animal

- Utilization allowance

Table 2. Defoliation intensity categories

Defoliation Intensity Category	Percent Forage Use	Defoliation 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 half of primary forage show defoliation in key areas.
Moderate	41-50	Majority of area shows use. Key areas appear patchy with half to two thirds show defoliation. Area between 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 noticeable at >1.5 miles from water.
Severe	Over 61	Key areas show a mowed or severely 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)

How much food will the animal eat

- Cattle are the Standard

Table 3. 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)

Calculations

(Total Available Forage X Percent Utilization) ÷ (Animal Forage Demand) = Animal Unit Equivalent

1. 20,000 acre ranch produces 550 pounds of forage annually per acre and has a desired utilization of 35%. How many cows can they run in a year-long grazing system?

Calculations

(Total Available Forage X Percent Utilization) ÷ (Animal Forage Demand) = Animal Unit Equivalent

1. 20,000 acre ranch produces 550 pounds of forage annually per acre and has a desired utilization of 35%. How many cows can they run in a year-long grazing system?

20,000 acres X 550 lbs = 11,000,000 lbs Total Available Forage

20 lbs X 365 days = 7300 lbs a year per cow (demand)

(11,000,000 X 0.35) ÷ 7300 = **527 cows** (Animal Unit Equivalent Year; AUY)

Calculations

(Total Available Forage X Percent Utilization) ÷ (Animal Forage Demand) = Animal Unit Equivalent

1. 20,000 acre ranch produces 550 pounds of forage annually per acre and has a desired utilization of 35%. How many cows can they run in a year-long grazing system?
2. Only 75% of the ranch is grazable. How many cows now?

Calculations

(Total Available Forage X Percent Utilization) ÷ (Animal Forage Demand) = Animal Unit Equivalent

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2. Only 75% of the ranch is grazable. How many cows now?

(20,000 acres X 0.75) X 550 lbs = 8,250,000 lbs Total Available Forage

20 lbs X 365 days = 7300 lbs a year per cow (demand)

(8,250,000 X 0.35) ÷ 7300 = **395 cows** (AUY)

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or

527 cows X 0.75 = **395 cows** (AUY)

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3. What if the ranch was rotational and only wanted to graze each pasture for 30 days?

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20 lbs X 30 days = 600 lbs a month per cow (demand)

(8,250,000 X 0.35) ÷ 600 = **4812.5 cows** (Animal Unit Equivalent Month; AUM)

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or

no alternative to this!!!!!!

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4. What if you wanted a 50% utilization on that rotational strategy?

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4. What if you wanted a 50% use on that rotational strategy?

(20,000 acres X 0.75) X 550 lbs = 8,250,000 lbs Total Available Forage

20 lbs X 30 days = 600 lbs a month per cow (demand)

(8,250,000 X 0.50) ÷ 600 = **6875 cows** (AUM)

Decision-making

- **USE THE CALCULATIONS WITH CAUTION!!!!**
  - Inherit errors with clipping samples from cages (generally over estimates)
  - Inherit errors with clipping samples due to lack of landscape representation (sample number)
  - Timing, Intensity, Distribution, Duration (TIDD)
  - Desired utilization is only a guide not a set threshold
  - Beware of other uncontrolled grazers with livestock (Elk, Rabbits, Grasshoppers)
  - **Always use professional experience and judgement**

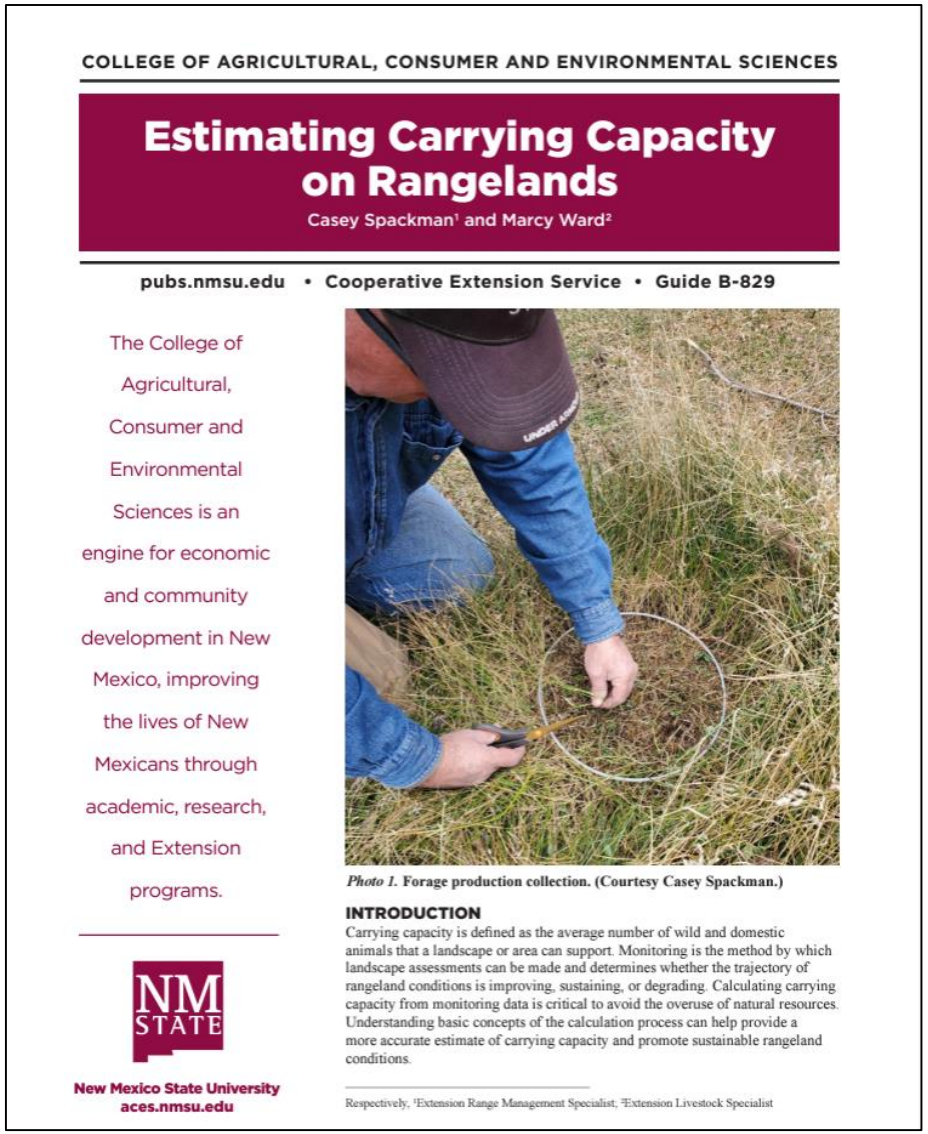

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Photo 1. **Forage production collection. (Courtesy Casey Spackman.)**

INTRODUCTION

Carrying capacity is defined as the average number of wild and domestic animals that a landscape or area can support. Monitoring is the method by which landscape assessments can be made and determines whether the trajectory of rangeland conditions is improving, sustaining, or degrading. Calculating carrying capacity from monitoring data is critical to avoid the overuse of natural resources. Understanding basic concepts of the calculation process can help provide a more accurate estimate of carrying capacity and promote sustainable rangeland conditions.

Respectively, [1]Extension Range Management Specialist; [2]Extension Livestock Specialist

NMSU Guide B-829

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Thank You

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