

## 2. Skills Challenge: Calculating Stocking Rates

**Time:** 40-45 minutes

**Supplies:**

- Stocking Rate Calculations worksheet (including map)
- Calculator

**Background: How many animals can graze on the range?**

Grasses, forbs, and shrubs that grow on rangeland are important sources of forage for grazing animals. Rangeland plants photosynthesize, using energy from the sun to turn carbon dioxide, water, and nutrients into organic compounds such as carbohydrates and proteins. When herbivores consume plant material, these compounds are digested providing energy and nutrients for consumers via meat (as well as many other products such as leather!).

Grazing is a natural ecological process that occurs on most rangeland. Since the passage of the **Taylor Grazing Act in 1934**, ranchers, land managers, researchers and rangeland specialists have worked together to develop grazing practices that sustain healthy ecosystems while supporting livestock production. In order to design sustainable grazing plans for a given landscape, rangeland managers and ranchers need to answer some fundamental questions:

- Which animals are grazing? (livestock species, type, and age)
- How many animals are grazing? (stocking rate)
- When to graze? For how long? When to rest? (grazing system)
- Where to graze? (animal distribution)

America's rangelands are in much better condition today than they were one hundred years ago, when uncontrolled first-come-first-serve access to open range led to overgrazing.

*Remember, that different animals prefer to eat different types of plants so land managers and ranchers determine the type of livestock to graze based on what is compatible with the vegetation that is available on the range! Review section 5 if needed (specifically, the “What’s for Dinner?” activity to understand what vegetation different animals prefer and “How much food do Animals Eat?” to determine how much food in pounds animals eat).*

**Do:**

- Review the background information with students (including the activities in section 5 mentioned above).
- Look at the “Sage Ranch” map with the students, identify each component (e.g., water tank, pastures, etc.). Review the scenario, you will use this information when determining the stocking rate. See bottom of this section for “Sage Ranch” details.
- Describe **Stocking Rates** (the balance of forage supply with forage demand).
  - **Step 1: Forage Supply**
    - Describe forage supply and how it is collected (biomass; a great video resource can be found here: <https://youtu.be/OlCps23NBGs>).
    - Describe Proper Use.
    - Have each student calculate the **FORAGE SUPPLY** sections of the Stocking Rate Calculations worksheet.

- **Step 2: Forage Demand**
  - Describe AUMs with your students.
  - Have each student calculate the **FORAGE DEMAND** section of the Stocking Rate Calculations worksheet.
- **Step 3: Determine the Stocking Rate** and answer the questions under the “Reflect” section.

### Stocking Rates:

Once you’ve determined the best animals to graze your rangeland, you need to determine the stocking rate. The stocking rate determines how many animals the forage (i.e., food) will support over a given period of time. Basically, we want to balance the forage supply (i.e., how much food we have available) with forage demand (i.e., how much food the animals will eat), while making sure we keep enough in reserve to have sustainable rangelands year after year.

- **Forage Supply**  
When calculating the amount of forage that is available, there are a few things to consider. To calculate how much food we have (i.e., forage supply), land managers and ranchers will collect **biomass**. Biomass is basically how much the plant weighs once it is dried (remember how much water plants can have?). To do this, we will go to the range and collect plants in a known area (for example: we will collect all the plants in a 1 X 1 ft<sup>2</sup> square frame and place it in brown paper bags). After it is collected, we put the brown bags in a drying oven or leave it outside so all the moisture in the forage can evaporate. Once dry, we weigh and calculate how vegetation is available and express it as a weight per unit area (for example, 600lbs/acre). Experienced range managers can often estimate the weight of forage on a site visually, but this takes practice!

*Estimating biomass needs to occur each year (and maybe multiple times throughout the year!). Biomass is strongly influenced by the amount of precipitation (snow and rain) that we receive in the winter and spring. If we have a dry spring, we will have low biomass. If we have a wet spring, we have high biomass.*

Another factor that we consider when estimating the forage supply is how much of the supply can we use while also making sure that our plants stay healthy and that there is enough for all the animals on the range. This term is called **Proper Use**. This typically ranges from 20-50%, depending on the precipitation, plant types, and soils at the specific location.

- **Forage Demand: Animal Unit Months (AUM)**  
An animal unit month (AUM) is the amount of forage an animal can eat in a month. Remember in section 5 when we learned that a ruminant animal eats about 2.5% of its body weight each day? Let’s build on that idea.

An AUM is usually based on a 1,000 pound grazing animal. If you have a 1,000 pound cow, how much food will the each in 1 day? \_\_\_\_\_ (1000 lbs X 2.5% = 25 pounds).

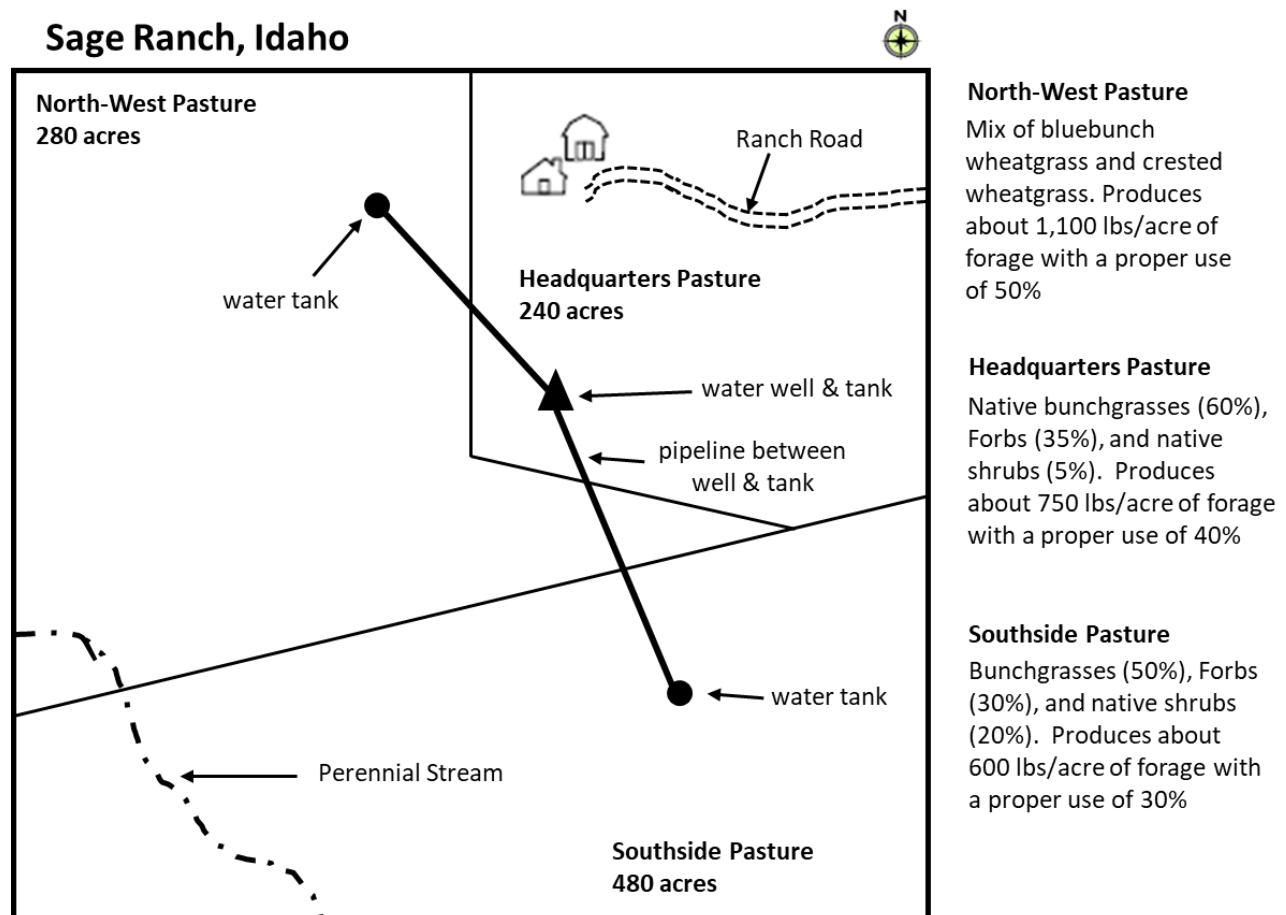
If the cow eats 25 pounds a day for one month (or 30 days), how much will it eat in one month? \_\_\_\_\_ lbs (25 pounds X 30 day = 750 pounds/ month). If you calculated 750 pounds a month, you are correct. Therefore, we say that **1 AUM = 750 pounds of forage** (this is the standard we will use, it should be noted that some managers use estimates of 780 or 800 pounds for stocking rate depending on the locations, plant types, and animal).

## Sage Ranch—Stocking Rate Scenario:

(see *Stocking Rate Worksheet* for step-by-step instructions).

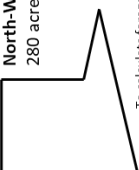
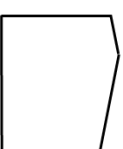

The Sage Ranch located in Southern Idaho was homesteaded in the 1860s. It covers 1,000 acres of rangeland. The ranch is split into 3 pastures, each one producing different amounts of forage and having different proper use percentages. The ranch is a commercial Angus steer operation, and implements a deferred-rotation grazing system between all three pastures. The ranch runs 180 head with an average size of 600 pounds. The pastures are grazed under a moderate intensity for 3 months (90 days) of the year (June 1 through August 29) and then sold to a feedlot to finish.

Your job is to calculate the **FORAGE SUPPLY, FORAGE DEMAND**, and **determine if the stocking rate is appropriate for the site** (should the Sage Ranch increase the number of cattle on the ranch? Decrease the number of cattle on the ranch? Or keep the rate the same?). Use the worksheet, the map, and the ranch description above to answer the questions!



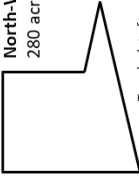
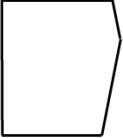

## Stocking Rate Calculations Worksheet

Stocking rate is the balance between forage supply and forage demand. For the Sage Ranch, we need to calculate both to determine if the current stocking rate is appropriate for the ranch. This worksheet (and the description of the ranch) will guide you through the process. We will start by calculating the forage supply for each pasture, then calculate the forage demand of the ranch, and finally, use those numbers to determine if our stocking rate is okay or if we need to change it (increase or decrease). Follow the step-by-step guide for the North-West Pasture and then do it for the Headquarters and Southside Pasture. To calculate forage demand you will need to know what types of animals are grazing, the size of the animals, and the grazing period (or number of days they spend on the ranch). The Sage Ranch has 180 cows that weigh on average 600 pounds. They graze EACH pasture for 1 month (or 30 days).

FORAGE SUPPLY			FORAGE DEMAND
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>North-West Pasture</b> 280 acres (ac)</p>  <p style="font-size: small;">To calculate forage demand, you will need the following numbers from the information provided:</p> <ul style="list-style-type: none"> <li>Size of pasture: _____ acres</li> <li>How much forage is produced: _____ lbs/acre of forage</li> <li>Proper use: _____ %</li> </ul> <p><b>Step 1:</b> Calculate the total amount of forage (supply) in the pasture (multiply the size of pasture by how much forage it produces).</p> <p>_____ ac X _____ lbs/ac = _____ lbs of forage</p> <p><b>Step 2:</b> Calculate the forage supply for the livestock (multiply the forage calculated above by the proper use percentage).</p> <p>_____ lbs of forage X _____ % = _____ lbs of available forage.</p> <p><b>Step 3:</b> Convert the forage supply to AUMs (Remember that 1 AUM = 750 lbs).</p> <p>_____ lbs of available forage / 750 lbs = _____ AUMs</p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>Headquarters Pasture</b> 240 acres</p>  <ul style="list-style-type: none"> <li>Size of pasture: _____ acres</li> <li>How much forage is produced: _____ lbs/acre of forage</li> <li>Proper use: _____ %</li> </ul> <p style="font-size: x-small;">Use the space below to calculate the available forage for the Headquarters Pasture</p> </div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center;"><b>Southside Pasture</b> 480 acres</p>  <ul style="list-style-type: none"> <li>Size of pasture: _____ acres</li> <li>How much forage is produced: _____ lbs/acre of forage</li> <li>Proper use: _____ %</li> </ul> <p style="font-size: x-small;">Use the space below to calculate the available forage for the Southside Pasture</p> </div>	<p style="font-size: small;">To calculate forage demand, you will need the following numbers from the information provided:</p> <ul style="list-style-type: none"> <li>Number of cows at the ranch: _____ lbs</li> <li>Average weight of each cow: _____ lbs</li> <li>% of body weight eaten daily: _____ %</li> <li>Number of grazing days: _____ days</li> </ul> <p><b>Step 1:</b> Calculate how much each cow will eat per day (multiply the weight of one cow by the % of body weight it will eat in one day).</p> <p>_____ lb cow X _____ % = _____ lbs/day</p> <p><b>Step 2:</b> Calculate how many pounds of forage all the cows on the ranch will eat in one day (multiply the amount for one cow X number of cows on the ranch).</p> <p>_____ lbs/day X _____ cow = _____ lbs forage demand for one day.</p> <p><b>Step 3:</b> Calculate how much forage is needed for 90 days (multiply total forage needed by 90 days)</p> <p>_____ lbs forage demand for one day X _____ days = _____ lbs total forage demand for the entire grazing period.</p> <p><b>Step 4:</b> Convert the forage demand to AUMs (Remember that 1 AUM = 750 lbs).</p> <p>_____ lbs of forage demand / 750 lbs = _____ AUMs</p>
<p style="text-align: center;">Total forage available for livestock grazing at the Sage Ranch (add together forage supply for each pasture) Forage supply = _____ AUMs</p>			<p style="text-align: center;">Total forage demand at the Sage Ranch Forage demand = _____ pounds, which is _____ AUMs</p>

## Stocking Rate Calculations Worksheet

Stocking rate is the balance between forage supply and forage demand. For the Sage Ranch, we need to calculate both to determine if the current stocking rate is appropriate for the ranch. This worksheet (and the description of the ranch) will guide you through the process. We will start by calculating the forage supply for each pasture, then calculate the forage demand of the ranch, and finally, use those numbers to determine if our stocking rate is okay or if we need to change it (increase or decrease). Follow the step-by-step guide for the North-West Pasture and then do it for the Headquarters and Southside Pasture. To calculate forage demand you will need to know what types of animals are grazing, the size of the animals, and the grazing period (or number of days they spend on the ranch). The Sage Ranch has 180 cows that weigh on average 600 pounds. They graze EACH pasture for 1 months (or 30 days).

FORAGE SUPPLY			FORAGE DEMAND
<p><b>North-West Pasture</b> 280 acres (ac)</p>  <p>To calculate forage demand, you will need the following numbers from the information provided:</p> <ul style="list-style-type: none"> <li>• Size of pasture: <u>280</u> acres</li> <li>• How much forage is produced: <u>1,100</u> lbs/acre of forage</li> <li>• Proper use: <u>50</u> %</li> </ul> <p>Step 1: Calculate the total amount of forage (supply) in the pasture (multiply the size of pasture by how much forage it produces).</p> <p><u>280</u> ac X <u>1,100</u> lbs/ac = <u>308,000</u> lbs of forage</p> <p>Step 2: Calculate the forage supply for the livestock (multiply the forage calculated above by the proper use percentage).</p> <p><u>308,000</u> lbs of forage X <u>50</u> % = <u>154,000</u> lbs of available forage.</p> <p>Step 3: Convert the forage supply to AUMs (Remember that 1 AUM = 750 lbs).</p> <p><u>154,000</u> lbs of available forage / 750 lbs = <u>205</u> AUMs</p>	<p><b>Headquarters Pasture</b> 240 acres</p>  <ul style="list-style-type: none"> <li>• Size of pasture: <u>240</u> acres</li> <li>• How much forage is produced: <u>750</u> lbs/acre of forage</li> <li>• Proper use: <u>40</u> %</li> </ul> <p>Use the space below to calculate the available forage for the Headquarters Pasture</p> <p><b>Answer:</b> 240 acres X 750 lbs X 40% = 72,000 pounds OR 96 AUMs</p>	<p><b>Southside Pasture</b> 480 acres</p>  <ul style="list-style-type: none"> <li>• Size of pasture: <u>480</u> acres</li> <li>• How much forage is produced: <u>600</u> lbs/acre of forage</li> <li>• Proper use: <u>30</u> %</li> </ul> <p>Use the space below to calculate the available forage for the Southside Pasture</p> <p><b>Answer:</b> 480 acres X 600 lbs X 30% = 86,400 pounds OR 115 AUMs</p>	<p>To calculate forage demand, you will need the following numbers from the information provided:</p> <ul style="list-style-type: none"> <li>• Number of cows at the ranch: <u>180</u></li> <li>• Average weight of each cow: <u>600</u> lbs</li> <li>• % of body weight eaten daily: <u>2.5</u> %</li> <li>• Number of grazing days: <u>90</u> days</li> </ul> <p>Step 1: Calculate how much each cow will eat per day (multiply the weight of one cow by the % of body weight it will eat in one day).</p> <p><u>600</u> lb cow X <u>2.5</u> % = <u>15</u> lbs/day</p> <p>Step 2: Calculate how many pounds of forage all the cows on the ranch will eat in one day (multiply the amount for one cow X number of cows on the ranch).</p> <p><u>15</u> lbs/day X <u>180</u> cow = <u>2,700</u> lbs forage demand for one day.</p> <p>Step 3: Calculate how much forage is needed for 90 days (multiply total forage needed by 90 days)</p> <p><u>2,700</u> lbs forage demand for one day X <u>90</u> days = <u>243,000</u> lbs total forage demand for the entire grazing period.</p> <p>Step 4: Convert the forage demand to AUMs (Remember that 1 AUM = 750 lbs).</p> <p><u>243,000</u> lbs of forage demand / 750 lbs = <u>324</u> AUMs</p>
<p>Total forage available for livestock grazing at the Sage Ranch (add together forage supply for each pasture) <b>Forage supply = <u>312,400</u> pounds, which is <u>416</u> AUMs</b></p>			<p>Total forage demand at the Sage Ranch <b>Forage demand = <u>243,000</u> pounds, which is <u>324</u> AUMs</b></p>

### Reflect:

- What was the forage supply for the Sage Ranch? (312,400 pounds or 416 AUMs)
- What was the forage demand for the Sage Ranch? (243,000 pounds or 324 AUMs)
- Was the current stocking rate appropriate for the Sage Ranch (do they need to increase or decrease their stocking rate? Or, should it be keep the same?) Explain? *The ranch is producing more forage than what the livestock are eating—416 vs. 324 AUMS—therefore, they have increase their stocking rate).*
- What are the primary factor influencing food supply? (*precipitation*)
- When setting a stocking rate, we don't want to use all the forage available. Why do we want to leave some forage behind after the livestock leave the pasture?
  - *To allow plants to photosynthesize and recover/reproduce*
  - *To leave forage for wildlife*
  - *To leave plant cover on the soil to reduce erosion*

### Words to Explore:

**Biomass:** The total amount of living plants and animals above and below ground in an area at a given time.

**Proper Use:** A degree of utilization of current year's growth which, if continued, will achieve management objectives and maintain or improve the long-term productivity of the site. Proper use varies with time and systems of grazing.

**Stocking Rate:** The relationship between the number of animals and the grazing management unit utilized over a specified time period. May be expressed an animal units per unit of land area.

**Taylor Grazing Act:** The Taylor Grazing Act of 1934 was intended to “stop injury to the public grazing lands by prevent overgrazing and soil deterioration; to provide for their orderly use, improvement, and development; [and] to stabilize the livestock industry dependent upon the public range. Basically, it provided a mechanisms for managing grazing by establishing a system of grazing rights and fees, essentially ending homesteading.

### Additional Resources:

Visit the <https://idrange.org/education-2/i-roam-curriculum/> for each topic to see videos and other additional educational links and materials.