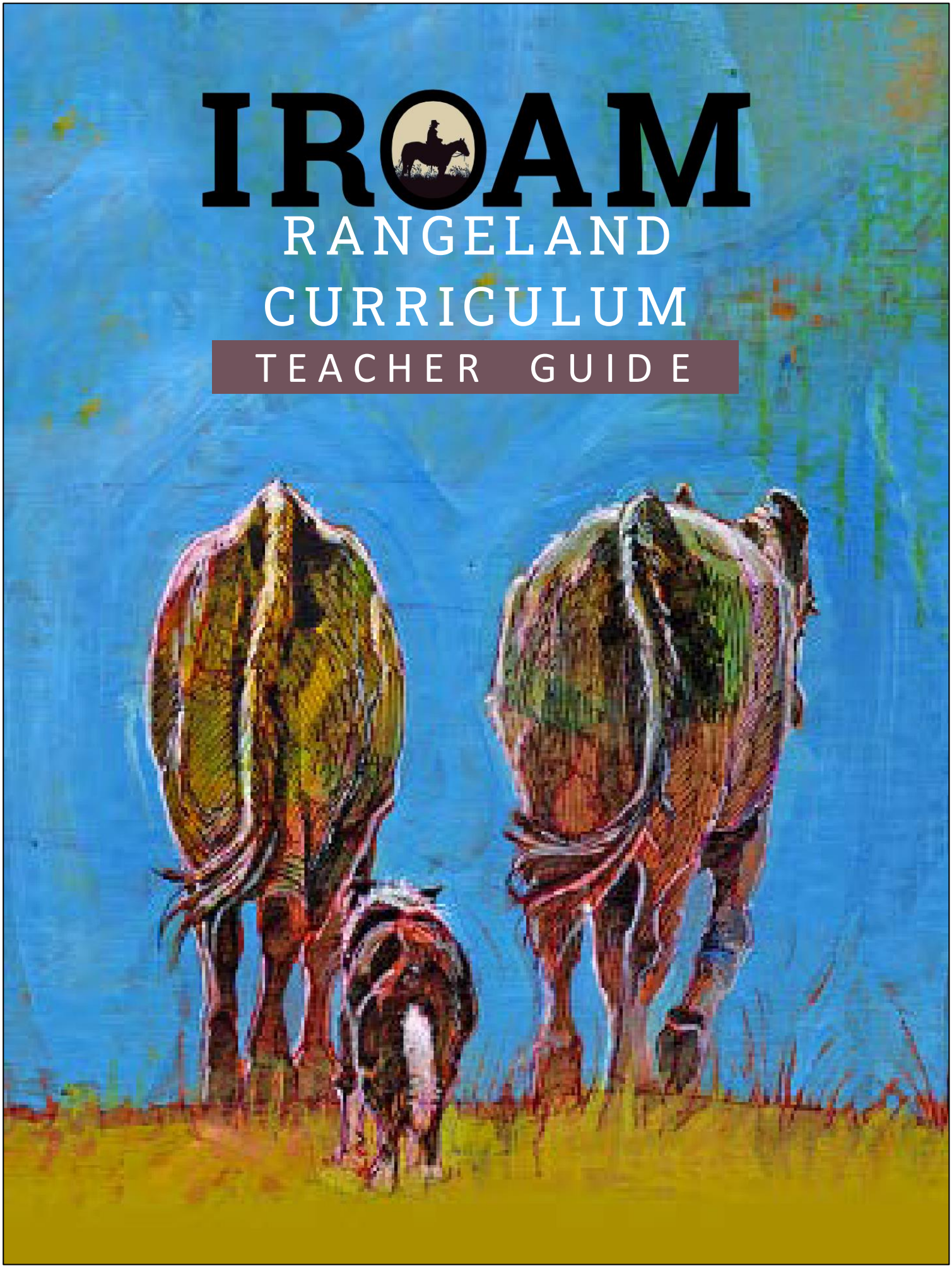
IROAM

RANGELAND CURRICULUM

TEACHER GUIDE



Idaho is a place of rich ecological diversity including forests, cultivated agricultural lands, urban areas, and rangeland. Rangeland is the largest natural resource in Idaho, comprising about 53% of the land cover, and has a legacy of multiple use that has affected where and how people live, work, and recreate. Idaho families have long built their lives on rangeland and act as land stewards to cultivate economic, social, and cultural values for generations to come. Despite these efforts, ranchers across the west struggle finding suitable successors to maintain and work on their ranches, preserve local knowledge, and care for the lands that support fish and fauna. Additionally, students seeking range degrees is steadily declining despite the high demand for professionals who can manage rangeland.

Knowing these trends, we can ask ourselves, how can we raise young people's awareness of the opportunities and challenges on rangeland? Moreover, how can we increase young people's awareness of the goods and services provided by rangeland including livestock forage, wildlife habitat, outdoor recreation, renewable energy, and open spaces?

To address these questions, the Idaho Rangeland Resources Commission and University of Idaho Extension creates youth education programs and materials designed to increase the public's understanding of rangeland ecology, and the goods and services provided by rangeland. One example is the **I-ROAM Rangeland Curriculum** which provides lessons and activities for K-12 students that can be used for outdoor schools and classroom lessons.

To further enhance educational opportunities for youth, the Idaho Rangeland Resources Commission and its partners built the **I-ROAM Traveling Educational Trailer** which focuses on teaching 5-8th grade students about rangeland ecology and management throughout Idaho. The educational trailer compliments the curriculum and can be easily integrated when teaching the various sections of the curriculum. Research shows that this age is the critical time to influence student's career trajectory, especially when experiential learning occurs. Thus, the educational trailer has interactive, hands-on learning activities inside, and is fully wrapped with an artful design on the outside that serves to raise awareness and understanding of the ecological and social implications of proper rangeland management.

See you on the range,

Gretchen Hyde and April Hulet

ACKNOWLEDGMENTS

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SPONSORS

The **Idaho Rangeland Resources Commission** (IRRC) is an Idaho state agency with the mission to provide educational materials and programs about rangeland to the public. Rangeland is more than half of Idaho and supports wildlife, local economies, and people. Understanding how rangeland ecosystems function, are managed, and change over time is important to all Idaho citizens. The IRRC and the University of Idaho created this curriculum to provide a foundation of knowledge to both youth and adults.

University of Idaho Extension strives to improve people's lives by engaging the University, professionals, and our communities through research-based education and outreach. Extension Specialists and Educators bring vital, practical information to producers, consumers, families, and youth to address public needs.

The **David Little Range-Livestock Endowment** was established in 1981 to organize research, extension and educational programs dedicated to the study of more efficient uses of Idaho's rangeland for livestock forage production. The endowment is managed by the University of Idaho Rangeland Center and provided startup funds to support the I-ROAM rangeland curriculum.

The **Laura Moore Cunningham Foundation** (LMCF) is dedicated to advancing the great State of Idaho through education. They believe Idaho is a wonderful place to live, work, and raise a family. The LMCF honors the Moore and Bettis families' legacy by providing support for educational materials such as the I-ROAM rangeland curriculum.

The **Adams Soil and Water Conservation District** and the **Idaho Soil and Water Conservation Commission** provided support funds for the development of the I-ROAM rangeland curriculum.

CONTENTS

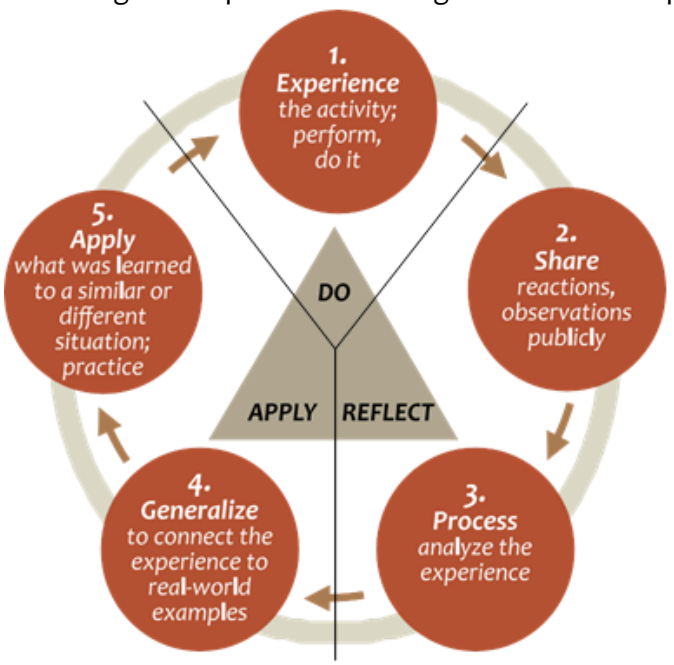
I-ROAM Rangeland Curriculum—Introduction and Guidelines

The **I-ROAM Rangeland Curriculum Teacher Guide** is designed to guide educators through various rangeland principles including an introduction to rangeland, rangeland soils, rangeland plants, water on the range, wildlife habitat, wildfire, and plant and animal interactions. This guide includes background information, activities, words to explore that are in **bold** print within the sections, and reference materials necessary for outdoor and classroom lessons.

All participating students and teachers will have the opportunity to "*learn by doing*" through application; sections are broken into multiple learning activities and rangeland skill challenges. We recommend using the materials in the order presented in the guide.

Curriculum Format

This curriculum incorporates many ideas from the 4-H program, which is one of the largest youth development organizations in the United States. 4-H promotes youth and adults working together as partners to learn and master project-specific skills and essential life skills through experiential learning. The experiential learning model[1] has three phases, **do**, **reflect**, and **apply**.



The **do** phases includes learning about a challenge and experiencing an activity (*perform or do it*).

During the **reflect** phase, students *share* their experience (*what happened?*) and *process* what they learned. By sharing their experience, students learn there are different interpretations of reality. By *processing* the experience, students will determine what was most important and identify common themes.

The final phase, or the **apply** phase, allows the students to connect the discussion and experience to the larger world (*so what?*) and *apply* what they learned to a new situation and/or other part of life (*now what?*).

Additionally learning materials can be found at:

idrange.org

[1]National 4-H Learning Working Group. 2016. Experiential Learning Model.

I-ROAM Rangeland Certificate—Rangeland Skills Checklist

As students and teachers work through the activities and lessons, they will gain rangeland management skills, as well as many life skills. Once the activities and skills have been completed, students will be qualified for the I-ROAM Rangeland certificate and pin that will be issued by the Idaho Rangeland Resources Commission.

Required Activities and Skills

Rangeland Activities and Skills	Teachers Initials
1. Define rangeland.	
2. Hand texture at least 2 soil types.	
3. Identify by sight at least 20 rangeland plants. (*this includes the common name, growth-form, life span, and origin*)	
4. Build your watershed.	
5. Identify by sight at least 20 rangeland animals. (*animal identification may be based on sight, pelts/feathers, skulls, scat, tracks, and calls*)	
6. Draw and describe the fire triangle.	
7. Calculate stocking rates.	
8. Complete the "Rangeland Toolbox" activity.	

Life Skills *(may be complete with a group or individually)*	Teachers Initials
1. Research the special topic and work with a group to create a solution.	
2. Create a 3-D diorama of rangeland that is related to the special topic.	
3. Participate in an oral presentation.	
4. With the guidance of your teacher, plan and organize one of the learning sections.	
5. Teach someone about rangeland.	
6. Explore rangeland careers.	

Rangeland Special Topic

Because of the wide-array of rangeland challenges across the West, a special topic that addresses a particular rangeland challenge should be selected prior to working through the I-ROAM rangeland curriculum by the teacher, or as a class. This topic will serve as a "theme" for lessons and activities, for the oral presentations, and for the 3-D dioramas. Suggested topics include (but are not limited to):

- Grazing livestock near wolves
- Protecting sage-grouse habitat from wildfire
- Protecting endangered fish species in streams and rivers that are used for irrigation and water for
- ranches
- Invasive annual grasses and wildfire frequency
- Managing rangelands for recreational purposes and livestock grazing
- Pinyon-Juniper encroachment and sage-grouse habitat

Oral Presentation and 3-D Diorama (guidelines and scoring rubric)

Oral presentations and speaking are important life skills to master. After completing the I-ROAM rangeland curriculum, each group should give an oral presentation that describes the rangeland challenge associated with the special topic, and propose a solution to the challenge (may be completed individually).

Oral presentation guidelines:

- Presentations should be between 6-8 minutes, with 2 minutes for questions.
- Each presentation should use a 3-D diorama to aid in the presentation.
- Each member of the group must speak during the oral presentation.

3-D diorama guidelines:

- Groups should create a 3-D diorama using the special topic and key concepts from the various learning sections. The diorama should include animals and plants that are found within the habitat they are learning about and should demonstrate an understanding of key rangeland characteristics (may be completed individually).

Examples of 3-D dioramas created by youth with the special topic "protecting endangered fish species in streams and rivers that were used for irrigation and water for a ranch."

Suggested Grading Rubric for Oral Presentation/3-D Diorama (sample on page 8)

Groups will be scored on a scale of 1-5 (5—Excellent, 4—Good, 3--Average, 2—Fair, 1—Poor) in four areas:

1. Content: knowledge and understanding of the special topic.
2. Organization: overall organization and flow of the presentation.
3. Delivery: eye contact, speaks clearly.
4. 3-D Diorama: visually eye appealing, readable, neat.

	EXCELLENT	GOOD	AVERAGE	FAIR	POOR
CONTENT					
Group demonstrated a solid understanding of the special topic.	5	4	3	2	1
Group identified different players/interest groups affected by the special topic.	5	4	3	2	1
Group addressed the relationship between the environment, livestock, wildlife, and natural resource management strategies.	5	4	3	2	1
Group referenced resources used in the presentation.	5	4	3	2	1
Group presented one viable solution to the challenge/special topic.	5	4	3	2	1
			Content Total Points		***_____/25***
ORGANIZATION					
The presentation was well organized with a clear introduction and strong conclusion.	5	4	3	2	1
The main points were clearly stated and supported.	5	4	3	2	1
The presentation had smooth transitions between main points.	5	4	3	2	1
			Organization Total Points		***_____/15***
DELIVERY					
Presenters maintained good eye contact.	5	4	3	2	1
Presenters were appropriately animated (e.g., gestures, moving around, etc.).	5	4	3	2	1
Presenters used clear, audible voices.	5	4	3	2	1
Good language skills and pronunciation were used.	5	4	3	2	1
Visual aids (3-D diorama) were used to make major points and were not distracting.	5	4	3	2	1
All group members participated in the presentation.	5	4	3	2	1
Questions were answered logically and concisely.	5	4	3	2	1
Presentation was the appropriate length of time.	5	4	3	2	1
Information was well communicated.	5	4	3	2	1
			Delivery Total Points		***_____/45***
3-D DIORAMA					
The 3-D diorama showed a solution to the special topic.	5	4	3	2	1
The group adequately explained the model during the presentation.	5	4	3	2	1
The 3-D diorama was visually appealing.	5	4	3	2	1
			3-D Diorama Total Points		***_____/15***

NOTES:

FINAL SCORE:_____/100

Section 1: Introduction to Rangeland

1. Introduction-What is Rangeland? 20-25 minutes
2. Skills Challenge: Describe Rangeland; 15-20 minutes
3. Rangeland Stewardship, Can You Have it All? Uses and Values of Rangeland; 30-35 minutes

Key Learning Objectives:

- Use a map legend to evaluate rangeland around the world and rangeland characteristics.
- Describe rangeland
- Understand that rangeland is managed for multiple uses to meet the desires and needs of society

Idaho General Education Performance Standards

- LS2-5-3, LS2-5-4, ESS3-5-1, LS2-MS-1, ESS3-MS-3

1. What is Rangeland?

Introduction:

What is rangeland, and why does it matter? Although rangeland covers more than 40% of the earth's land area, most people do not know much about these unique and valuable landscapes.

Time: 30-35 minutes
Supplies: "What is Rangeland" quiz for each student, maps (PowerPoint)

Do:

Take the "What is Rangeland" quiz*

*The "What is Rangeland" quiz should serve as a discussion tool and be used when exploring the map, pictures, and describing major rangeland characteristics. Answers are provided at the end of the section. Printable quiz and maps (PowerPoint) can be found at https://idrange.org/education-2/iroam/.

Reflect/Apply: (Description for each map can be found below).

- Using the "Rangelands of the World" map, have students describe what rangeland is (use the map legend for a general description). This will be discussed further in the *Skills Challenge: Describe Rangeland* activity below. Discuss "What is Rangeland" quiz questions 1-3.
- Using the "Rangelands of the U.S." map, have students identify what rangeland vegetation type(s) are found in Idaho. Discuss "What is Rangeland" quiz question 4.
- Using the "Variation in Annual Precipitation across the U.S." map, have students identify the precipitation range where they live. Determine the average annual precipitation that most rangeland receive. Discuss "What is Rangeland" quiz question 5.
- Using the "Who Owns the West" map, have students identify how much land the federal government manages in the state they live. Use the map to discuss "What is Rangeland" quiz question 6.
- Using the "Land Cover in Idaho" map, discuss "What is Rangeland" quiz question 7.
- Using the "Rangeland Stewardship" map, have students identify the primary management agencies/ownerships in Idaho. Discuss quiz questions 8.
- BONUS: Describe the difference between public and private lands, how can YOU be a better steward of public land? Public lands are generally described as lands that are open to the public and managed by the government.

What is Rangeland?

Rangeland Quiz

1. What is rangeland?
Check all that apply
- ☐ Shrublands
- ☐ Dense Forests
- ☐ Woodlands and Savannas
- ☐ Barren Desert
- ☐ Tundra
- ☐ Grasslands
- ☐ Irrigated Pastures
- ☐ Deserts

2. How much of the earth's land area is rangeland?
- ☐ Less than 20%
- ☐ 21 to 40%
- ☐ 40 to 50%
- ☐ More than 51%

3. Which continent has the greatest % of land classified as rangeland?
- ☐ Africa
- ☐ South America
- ☐ Australia
- ☐ Asia

4. What are the types of rangeland found in Idaho? *Check all that apply*
- ☐ Sagebrush Steppe
- ☐ Oak Woodland
- ☐ Pinyon-Juniper Woodlands
- ☐ Salt Desert Shrublands
- ☐ Tallgrass Prairie
- ☐ Intermountain Grassland

5. What is the average annual precipitation that most rangeland receives?
- ☐ Less than 6 inches
- ☐ 6 to 28 inches
- ☐ 29 to 48 inches
- ☐ More than 48 inches

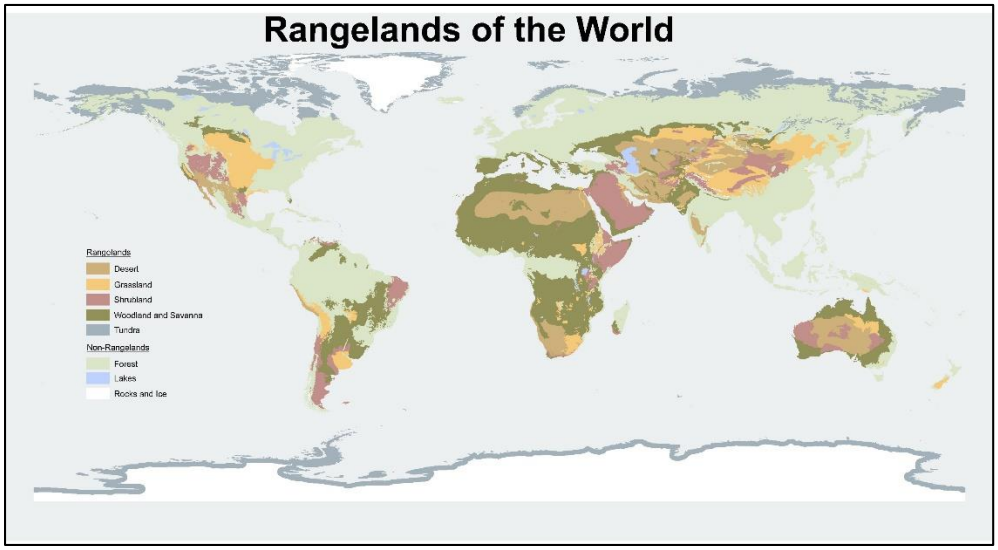
6. Which state has the highest % of its land managed by federal land management agencies?
- ☐ Texas
- ☐ Nevada
- ☐ Wyoming
- ☐ Montana

7. How much of Idaho is rangeland?
- ☐ Less than 20%
- ☐ 21-40%
- ☐ 40-50%
- ☐ More than 51%

8. Rangeland in Idaho are primarily managed by what federal agency?
- ☐ Bureau of Land Management (BLM)
- ☐ U.S. Forest Service (USFS)
- ☐ National Park Service (NPS)
- ☐ Bureau of Indian Affairs (BIA)

Answer Guide:

1. Shrublands, Woodlands and Savannas,Tundra, Grasslands, Deserts
2. 40 to 50% (most estimate 47% of the earth's land area is rangeland)
3. Australia (86%+ of Australia is considered rangeland)
4. Sagebrush Steppe, Pinyon-Juniper Woodlands, Salt Desert Shrublands, Intermountain Grassland
5. 6 to 28 inches (climatic conditions do not typically favor cultivations or provide enough precipitation for most trees)
6. Nevada (80%)
7. More than 51% (54% of Idaho is classified as rangeland)
8. Bureau of Land Management (38.1%)



Rangelands of the World

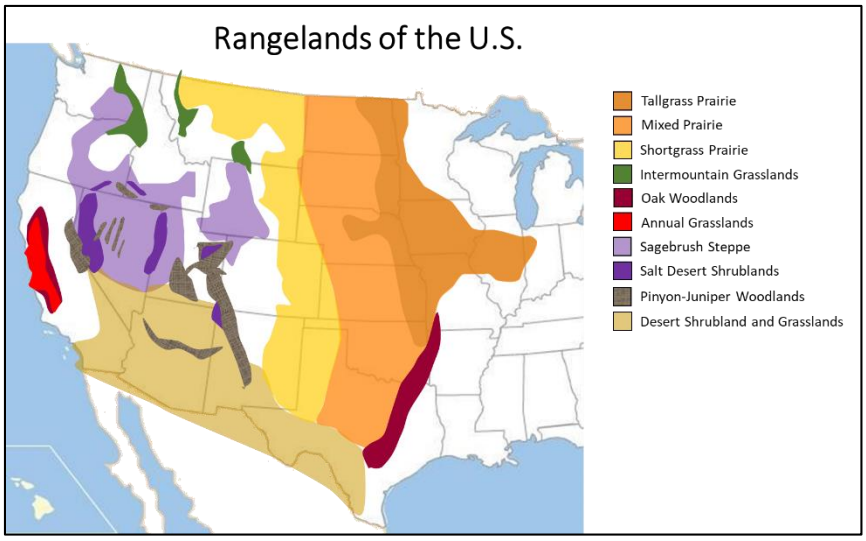
Deserts, grasslands, shrublands, woodlands, savannas, and tundra are rangeland that occur in a diverse array of forms across the globe, and extensively on every continent.

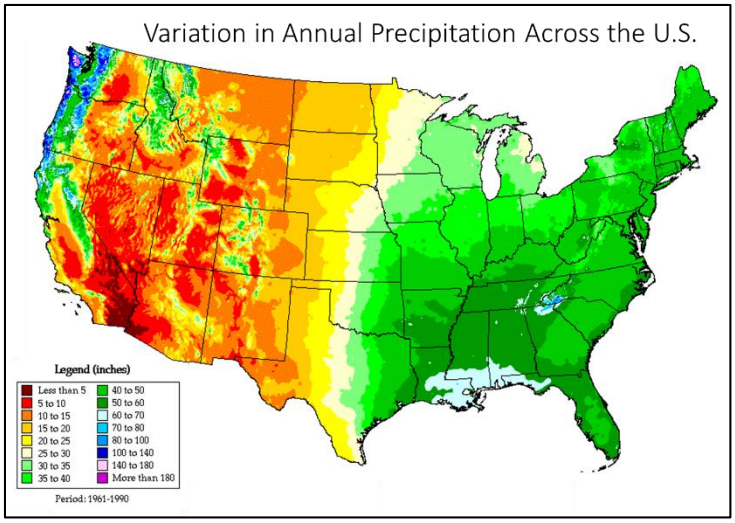
- **Deserts** are the driest rangelands. Vegetation on these lands is often sparse and dominated by shrubs and succulent cactus plants.
- **Grasslands** are lands dominated by grasses and grass-like plants.
- **Shrublands** are lands dominated by shrubs that have an understory of grasses and forbs.
- **Woodlands and Savannas** are lands dominated by widely-spaced trees with an understory of grasses and forbs.
- **Tundras** are treeless plains in the arctic or high-elevation (cold) regions.

Rangeland of the U.S.

Examples in North America:

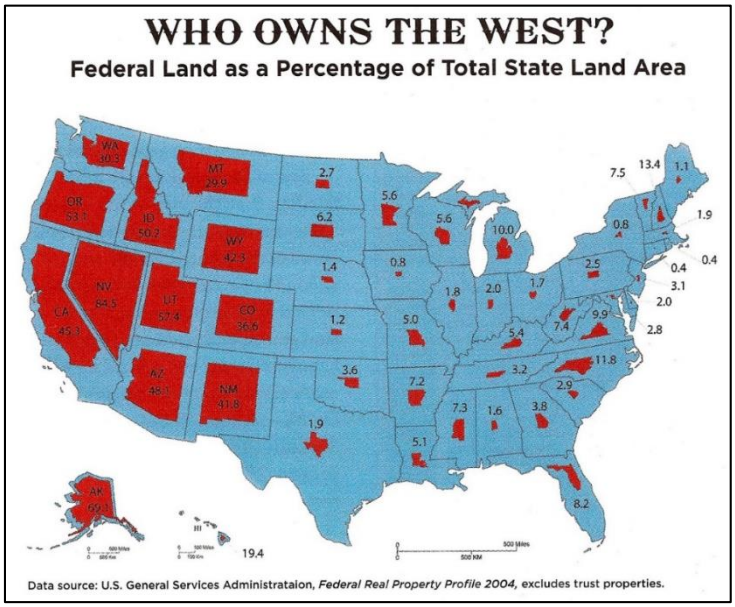
- **Desert Shrubland and Grasslands:** Mojave, Sonoran, and Chihuahuan deserts
- **Grasslands**: Tallgrass Prairie, Mixed Prairie, Shortgrass Prairie, Intermountain Grasslands (e.g., Palouse Prairie), and Annual Grasslands
- **Shrublands:** Sagebrush-**Steppe**, and Salt- Desert Shrublands
- **Woodlands and Savannas:** Pinyon-Juniper Woodlands and Oak Woodlands





Variation in Annual Precipitation across the U.S.

- Rangeland receives between 6-28 inches of annual (yearly) precipitation.
- The Sierra Nevada Mountains and Rocky Mountains create an orographic barrier which means they intercept moisture heading east from the Pacific Ocean; this creates a dry area (red and orange on the map) on the east or leeward side of the mountain. This effect is known as a **rain shadow**.



Rangeland Stewardship

Public lands are lands that are managed by federal and state land management agencies. Private lands are owned by individuals, corporations, or non-governmental organizations (NGOs).

Federal Lands:

- Federal lands are 26% of all U.S. land. Almost half (48.6%) of the thirteen western states are federal lands, most of which are rangeland.
- Federal public land is to be managed for "multiple use" (discussed later) and for the greatest good of all Americans. These federal lands belong to all U.S. citizens and they are managed and cared for on our behalf by various federal agencies such as the Bureau of Land Management (BLM), U.S. Forest Service (USFS), National Park Service (NPS), U.S. Military and a few others.

State Endowment Lands

- Through the *Morrill Act* in 1862, a portion of federal lands were granted to states. This act created the checkerboard pattern across much of Idaho's landscape (red squares in the Rangeland Stewardship map).
- State lands are actively managed to "secure the maximum long-term financial return" to public schools and other beneficiaries.
- State endowment lands are managed to be sustainable (remain healthy, productive, and resilient) and promise to generate returns for generations to come.

Private Lands:

- Private lands include those owned by individuals, corporations, or non-governmental organizations (NGOs). Just like people own homes and yards in the city, rangelands were homesteaded in the mid-1800s and many have been purchased since.
- Prior to the 1930s, government policies encouraged the settlement of the West. The *Homestead Act* opened public lands to settlers and pioneers; U.S. citizens willing to settle on and improve the land for at least five years were given between 160-640 acres.
- Private lands tend to be in areas where there is water; pioneers homesteading the land needed water for themselves, animals, and to grow crops. Lands with limited water were difficult to homestead and tend to be the lands managed by state and federal agencies today.

Land Cover in Idaho

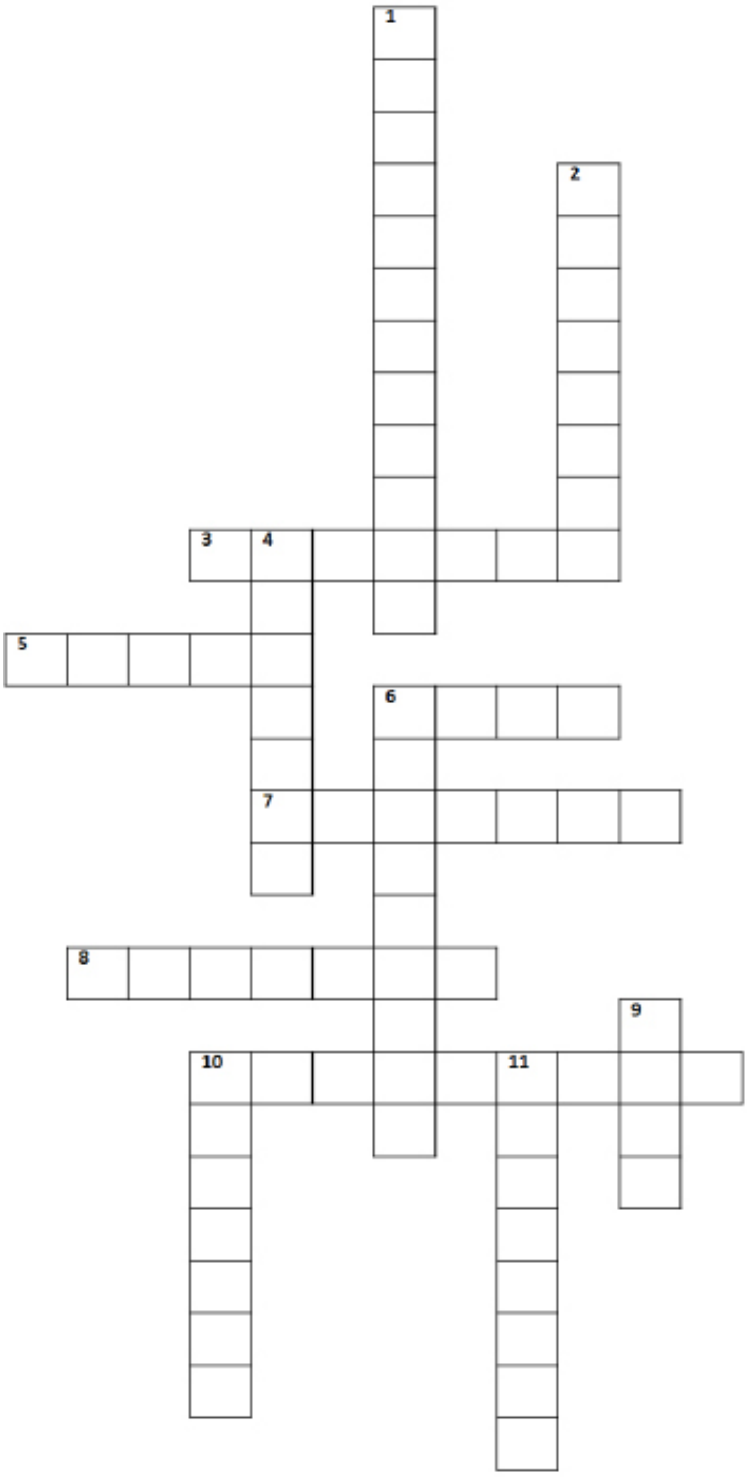
Land cover describe the characteristics of the land surface (for example, urban, agriculture, forest, and rangeland). Land cover can change over time, for example as agricultural lands are development into urban properties, however, this changes often take time. In Idaho, land cover is as follows:

- Rangeland = 54.4% or 28,793,382 acres
- Forest = 32.0% or 16,950,807 acres
- Cultivate Crops (or agricultural lands) = 9.3% or 4,898,404 acres
- Urban = 1.7% or 918,048 acres
- Irrigated Pastures = 1.7% 879,739 acres
- Water = 0.9% or 491,743

Rangeland Stewardship in Idaho: Who manages or owns Idaho rangelands?

- Federal rangeland = 68.8%; Primarily managed by the
  - Bureau of Land Management (BLM)—38.1% or 10,961,030 acres (yellow)
  - US Forest Service (USFS)—25.9% or 7,443,705 acres (green)
- State rangelands = 5.6%
- Private rangelands = 24% or 6,827,264 acres (blue)

Rangeland Stewardship Crossword Puzzle



Across

3. U.S. citizens willing to settle on and _____ the land for at least five years were given between 160-640 acres.
5. Private lands tend to be in areas where there is _____.
6. Almost_____of the thirteen western states are federal lands, most of which are rangelands.
7. Lands with_____water that were difficult to homestead, tend to be the lands managed by state and federal agencies today.
8. _____lands include those owned by individuals, corporations, or non-governmental organizations.
10. State lands are actively managed to "secure the maximum long-term _____return" to public schools and other beneficiaries.

Down

1. The Morrill Act created the _____ pattern across much of Idaho's landscape.
2. Federal public land is to be managed for _____use and for the greatest good of all Americans.
4. Through the_____Act, a portion of federal lands were granted to states.
6. The_____Act opened public lands to settlers and pioneers.
9. A federal agency that manages the majority of rangelands in Idaho is the Bureau of_____ Management (BLM).
10. Public lands are lands that are managed by _____ and state land management agencies.
11. Most federal lands belong to all U.S. _____ and they are managed and cared for on our behalf by various federal agencies.

Answer Guide:

Rangeland Stewardship Crossword Puzzle:

Across

3. U.S. citizens willing to settle on and **improve** the land for at least five years were given between 160-640 acres.
5. Private lands tend to be in areas where there is **water**.
6. Almost **half** of the thirteen western states are federal lands, most of which are rangelands.
7. Lands with **limited** water that were difficult to homestead, tend to be the lands managed by state and federal agencies today.
8. **Private** lands include those owned by individuals, corporations, or non-governmental organizations.
10. State lands are actively managed to "secure the maximum long-term **financial** return" to public schools and other beneficiaries.

Down

1. The Morrill Act created the **checkerboard** pattern across much of Idaho's landscape.
2. Federal public land is to be managed for **multiple** use and for the greatest good of all Americans.
4. Through the **Morrill** Act, a portion of federal lands were granted to states.
6. The **Homestead** Act opened public lands to settlers and pioneers.
9. A federal agency that manages the majority of rangelands in Idaho is the Bureau of **Land** Management (BLM).
10. Public lands are lands that are managed by **federal** and state land management agencies.
11. Most federal lands belong to all U.S. **citizens** and they are managed and cared for on our behalf by various federal agencies.

2. Skills Challenge: Describe Rangeland

Time: 15-20 minutes
Supplies: "Describe Rangeland" table for each student, PowerPoint

Identify which pictures are rangeland?
Look at the pictures and fill out the table. Describe why the photos are rangeland, or why they are not. *Printable table can be found at* https://idrange.org/education-2/iroam/

Bonus: *After identifying which photos are rangeland, use the categories from the "Rangelands of the World" map to determine what type of rangelands are represented.*

	Yes, this is Rangeland	No, this is not Rangeland
A		
B		
C		
D		
E		
F		
G		

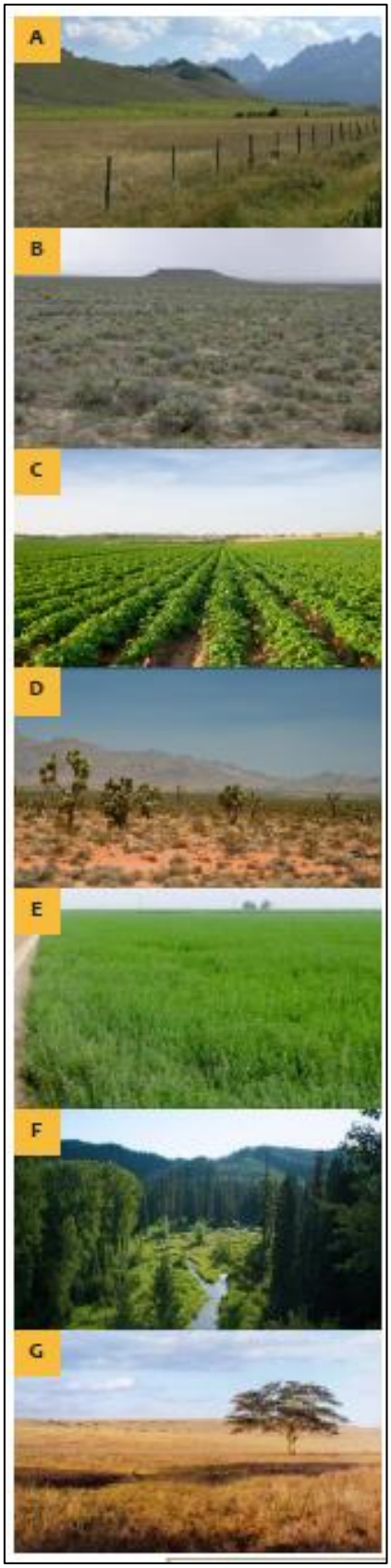


Photo	Yes, this is Rangeland	No, this is not Rangeland
A	Yes, this is a photo of semi-arid rangeland with diverse topography. On the hills, you have sagebrush-steppe, at the base of the hills you will find a riparian area in green (green means water!), and native and non-native grasses in brown near the fence. Topography often determines which plants grow where. **Bonus: Mix of Shrubland/Grassland**	
B	Yes, this is a photo of a low-elevation sagebrush-steppe rangeland. Although this may look "unhealthy" this is a good example of rangelands. Rangeland are limited by precipitation and often have sparse vegetation. **Bonus: Shrubland**	
C		No, rangelands are not farmed lands (no irrigation or fertilizers). Rangelands typically have highly variable soils that are shallow and have low-nutrients (plus, soils are frequently salty or saline) limiting what can grow.
D	Yes, this is an example of the Mojave desert with Joshua trees, shrubs, and lots of bare ground. Fire is rare in the desert because of the bare ground, the plants are not touching so fire doesn't spread very well which ultimately helps all the slow moving critters (like a tortoise) survive. **Bonus: Desert**	
E		No, rangelands are not cultivated (farmed). They are typically not monocultures (one plant species) like in photo C and E.
F		No, rangelands are not dense forests like in much of this photo. Sometimes, people do consider wet meadow to be rangelands because they are often grazed by livestock.
G	Yes, this is an example of a savanna in Africa. Notice the sparse trees and lots of grass. This rangeland type depends on fire and it occurs often. Fire removes shrubs and trees which allow for more grasses to feed large mammals. **Bonus: Savanna**	

3. Rangeland Stewardship, Can You Have It All? Uses and Values of Rangelands

Time: 30-35 minutes
Supplies: "Can You Have It All" table for each student, PowerPoint

Introduction:
Rangeland provides natural beauty, a diversity of wildlife, recreational opportunities like hunting, hiking, and camping, and economic values including ranching, mining, and electric power. Because rangeland is important for their diverse array of uses and values, they are managed under the principle of multiple use. Multiple use means that several uses and values of rangeland are managed simultaneously and with care to avoid overuse and/or destruction of natural resources. This is one of the biggest challenges we face when managing rangeland.

Directions: Show students the collage of "Uses and Values of Rangelands" and ask them which of these pictures look like something they would like to see more of where they live. Rangelands can and have been used for all the things in the pictures and many more.

Uses and Values of Rangelands

Do:
How do you value rangeland? Have team members rank how they **value land uses** using the table below. Write the ranking in the "Individual Ranking" column. *Each number can only be use once!* ***Remember, there is NO right answer on the ranking chart--every use has potential negative and positive consequences.*** *Printable table can be found at idrange.org*

- Rank of 1 = highest value of rangeland
- Rank of 11 = lowest (or least) value of rangeland

Directions: Once students have completed their survey, have each member write their ranking on a large piece of paper (see example below). Add the scores together for each value (remember, the smallest numbers have the most value).

Land Use	Individual Ranking	Group Rankings	Total
Wildlife Habitat			
Livestock Grazing			
Native Plant Harvest			
Hunting/Fishing			
Non-motorized Recreation			
Motorized Recreation			
Aesthetic (Beauty)			
Rural Housing Development			
Agriculture			
Urban Development			
Energy Development			

Top 3 Most Valued Land Use
(lowest numbers in the "Total" column)

1. _____
2. _____
3. _____

Least Valued Land Use
(highest number)

1. _____

Do:
Once individual team members have completed their survey, have each member write their rankings under the "Group Rankings" column. Add the scores together for each value and place in the "Total" column. Rank the "Top 3 Most Valued Land uses" and "Least Valued Land Use". Remember, that the lowest numbers have the most value!

Example

Land Use	Individual Ranking	Group Rankings	Total
Wildlife Habitat	4	3 + 2 + 2	11
Livestock Grazing	1	2 + 1 + 1	5
Native Plant Harvest	10	9 + 10 + 6	35
Hunting/Fishing	3	4 + 7 + 3	17
Non-motorized Recreation	9	5 + 6 + 4	24
Motorized Recreation	5	6 + 5 + 7	23
Aesthetic (Beauty)	8	7 + 4 + 5	24
Rural Housing Development	7	10 + 8 + 8	33
Agriculture	2	1 + 3 + 9	15
Urban Development	11	11 + 11 + 11	44
Energy Development	6	8 + 9 + 10	32

Top 3 Most Valued Land Use
(lowest numbers in the "Total" column)

1. __Livestock Grazing_____
2. __Wildlife Habitat____
3. ___Agriculture_____

Least Valued Land Use
(highest number)

1. __Urban Development___

Reflect:

- According to the ranking, how does your team value rangeland? If you surveyed a larger group, how might this ranking change (i.e., if you surveyed a group of realtors or developers, might the value of rangeland change)? Do your results represent society's needs and desires?
- Based on your rankings, do you think it would be easy or hard to manage for multiple uses on rangeland?

Words to Explore*:

- **Diversity:** The distribution and abundance of different plants and animal communities within an area.
- **Multiple Use:** Use of range for more than one purpose, i.e., grazing of livestock, wildlife production, recreation, watershed and timber production. Not necessarily the combination of uses that will yield the highest economic return or greatest unit output.
- **Rain Shadow:** The region of diminished rainfall on the leeward side of a mountain range, where the rainfall is noticeably less than on the windward side.
- **Steppe:** semi-arid grassland characterized by grasses occurring in scattered bunches with other herbaceous vegetation and occasional woody species.

*Definitions from the Society for Range Management Glossary of Terms

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.

Section 2: Rangeland Soils—Under the Surface

1. Introduction to Rangeland Soils and Soil Particle Size Demonstration; 15-20 minutes
2. Skills Challenge: Soil Texturing; 25-30 minutes

Learning Objectives:

- Understand the relationship between soil, water, and plants
- Learn how to hand texture soils

Idaho General Education Performance Standards

- LS2-MS-6, LS2-5-4, LS2-5-3, ESS3-MS-3

1. Introduction to Rangeland Soils

Time: 25-30 minutes
Supplies:

- 3, large clear vases or clear tubes
- Tennis balls, marbles, and BBs (to represent sand, silt, and clay)
- "Soil Particle Size" worksheet for each student

Fun Fact: the time needed to form soil depends on climate (precipitation and temperature). In mild climates, it take 200 to 400 years to form 1 cm of soil. In wet, tropical areas it takes around 200 years to form 1 cm of soil… that's why we worry about erosion, or soil loss on rangeland.

Soil is a complex mix of weathered rock, air, water, and organic matter (which includes organisms like bacteria, and the decaying remains of once-living things like plants and animals).
Understanding soil characteristics like texture, helps us better understand how much water and nutrients are available for plants, and determine how human impacts (e.g., recreation, grazing) may influence what plants and animals are on the range. Understanding soils also helps us predict how much water may run-off when it snows or rains, and how much water we can store in the soil for later use (we'll discuss this more in the Water section).

Soil Particle Size Demonstration

Background:
Soil texture and structure strongly influences the vegetation types that occur on rangeland. Soil texture is related to weathering (i.e., natural process that breaks apart or changes rocks) and parent material (rocks). In other words, soil texture depends on how much of the rock has broken down over time by wind, water, freezing/thawing, glaciers, and plants and animals. Wind and water move soils around the landscape. A little erosion is natural, however, it can become excessive if vegetation is removed. For example, following a wildfire soil erosion often increases because no plants are there to keep the topsoil stable when the wind blows or it rains.

The **texture** of a soil depends upon the proportion of sand, silt, and clay that are in the soil. The texture and soil structure (how the soil particles are arranged), influence the amount of pore spaces (or air) found within the soil. Pores are important conveyors of water, nutrients, and air, as well as provide space for roots to grow.

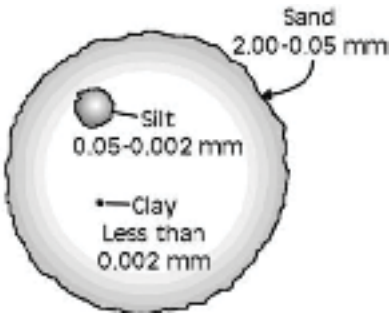
In some locations, the soil will form a barrier (often called a hardpan) that may stop water **infiltration** and root penetration. These restrictive layers may be natural, or may be induced by land

management/human practices. For example, a soil may become compacted due to high foot traffic on a hiking trail. When it is compacted, pore space is lost reducing water, nutrients, and air needed for plants to grow.

Soil Particle Size Demonstration:
To emphasize the different sizes of soil particles, fill one clear tube or glass vase with tennis balls, another with marbles, and the last one with BBs (you do not need to fill the tube/vase completely). Show the students the "Relative Soil Particle Sizes" diagram and vases to facilitate the following discussion.

Do:

- Have students determine what soil particle is represented by the BBs, marble, and tennis ball (*answer: BBs = clay, marble = silt, tennis balls = sand*).
- Have students compare the size of the objects, as well as the pore space between the objects and fill out the "Soil Particle Size Worksheet." Remind students that pore space is very important (pores hold water, nutrients, and air, as well as provide space for roots to grow).



Reflect:

- Discuss each component of the table with the students (each section has a question to start the discussion). Ask students how this may affect plant growth? Ask how humans may influence soil properties (i.e., how might humans impact soil compaction, positively and/or negatively?)?

	Particle Sizes		
	SAND	SILT	CLAY
Size of Particles (Small, Medium, or Large)	Large—tennis ball	Medium—marble	Small—BBs
Describe the pore space for each particle size (also called porosity). Are they large or small, or somewhere in the middle?	Large—large pore spaces allow water to easily run through it and beyond the reach of roots.	Medium	Small—pore spaces are smaller and hold more water, however, small particle sizes also form strong bonds making water and nutrients unavailable for root uptake.
Water-Infiltration Capacity: how well will water enter the soil? Poor, Medium, or Good	Good	Medium	Poor (see note under erodibility)
Water Percolation: how well will water flow through the soil? Poor, Medium, or Good	Good	Medium	Poor (see note under erodibility)
Water-Holding Capacity: how much water will the soil hold before it is moved too low by gravity and plant roots can't reach it? Poor, Medium, or Good	Poor—sandy soils are more drought-prone	Medium	Good—as particle size decreases, surface area increases. Clay has about 10,000 times as much surface area as sand.
Aeration: how much air is in the soil? Poor, Medium, or Good	Good	Medium	Poor
Erodibility: how likely is wind and water going to be able to move the soil? Low, Medium, or High	Low	High	Low—clay particles combine to create large masses (or aggregates). Aggregates also decrease the ability of water to infiltrate the soil and drain.
Compactability: if you were to make a ball of the soil, how likely would it stay in the ball shape without falling apart? Low, Medium, or High	Low	Medium	High

2. *Skills Challenge: Soil Texturing*

Time: 30-35 minutes
Supplies:

- Samples of sand, silt, and clay soils
- Water (a spray bottle works best as you don't need a lot of water to test soil texture, but a regular water bottle also works).
- Paper towels between samples to clean hands
- Hand Texturing of Soils Flowchart (students can share flowchart)

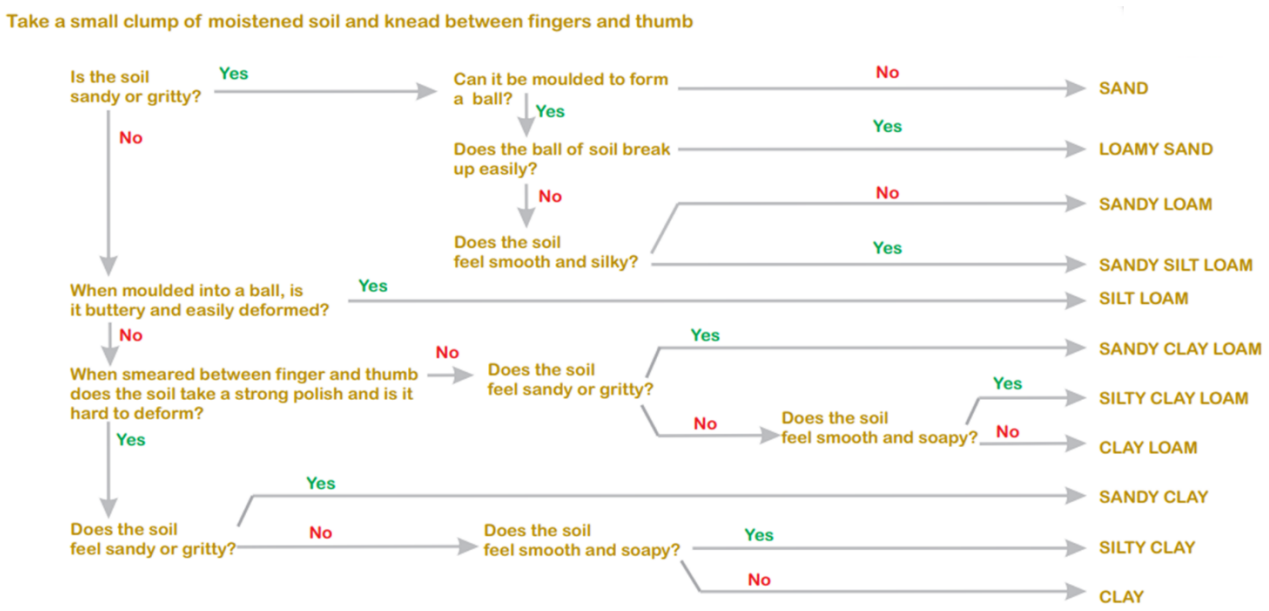
Transition to Soil Texture:
In the clear tube/vase with the tennis balls, add the marbles, then the sand. Teach students that a mix of sand, silt, and clay is optimal for rangeland productivity (*you may want to ask students "why?" at this point, the answers are provided under the "Reflect" section below*). By hand texturing the soil, we can start to understand the proportions of each of the soil particles and better understand how to manage the rangeland.

Do:
For each of the soils, do the following steps:

- Place about 25 g (~ 1 Tablespoon) soil in your palm
- Add a few drops of water (or slowly mist soil) and knead to break down all clumps (or aggregates). Knead the soil until it feels like moist putty.
- *If the soil is too wet, add more dry soil*
- *If the soil is too dry, add more water*

If you have a soil that has a lot of sand, you likely will not get to the "moist putty" consistency. However, it should be noted that kneading the soil does take time! Don't give up too soon.

Now that you have soil that feels like moist putty, proceed to "Hand Texturing of Soil Flowchart[1]". The flowchart gives the step-by-step instructions on how to texture an unknown soil type.



Reflect:

- According to the "Hand Texturing of Soil Flowchart", what type of soil do you have?
- Does your soil name include loam?

Loam soil is a mixture of clay, silt, and sand which gives you the best characteristics of all three! Clay and silt help hold water in the soil, while sand keeps it from compacting too much. Sand helps with drainage so roots don't get waterlogged, and the clay and silt provide stability so the soil doesn't just crumble.

- What does it mean when you name includes a particle size and loam?

All this means is that the soil mixture contains more of that particle size than the other two. For example, if you have a "clay loam" soil, your soil contains more clay than sand and silt.

Repeat the steps to Soil Texture the other two soil types.

Particle Size	Soil Texturing Hints
SAND	• Gritty feel • Particles can be seen with the naked eye • Hand sampling: little to no residue should be left on hand
SILT	• Dry: Powdery smooth/velvety feel • Wet: Creamy slick, slippery feel • No sticky or plastic feel • Particles can be seen with a hand lens or microscope • Hand sampling: coats hand, able to brush off
CLAY	• Dry: hard feel • Wet: sticky, plastic feel • Can not been seen with the naked eye or with a hand lens • Hand Sampling: thick film residue.

Words to Explore*:

- **Erosion:** (v.) Detachment and movement of soil or rock fragments by water, wind, ice, or gravity.
- **Infiltration:** The flow of fluid into a substance through pores of small openings. It connotes flow into a substance in contradistinction to the word percolation.

*Definitions from the Society for Range Management Glossary of Terms

Additional Resources:

Visit the https://idrange.org/education-2/iroam/ to see videos and other additional educational links and materials.

References:

[1]**Hand Texturing of Soil,** http://www.soil-net.com/sm3objects/activities/Activity_HandTexturing1.pdf

Section 3: Rangeland Plants

1. Introduction to Rangeland Plants and Plant Classification
2. Plant Scavenger Hunt
3. Skills Challenge: Plant Identification

Learning Objectives

- Students will learn how to tell the difference between forbs, shrubs, grasses, and grass-like plants.
- Students will collect and identify characteristics of rangelands plants.

Idaho General Education Performance Standards

- LS4-MS-2, LS4-MS-3, LS2-5-2, LS2-5-2, LS4-MS-4, LS2-5-3, LS2-MS-4, LS2-MS-6, PS1-5-2, PS1-5-3, LS1-5-1, LS2-5-4

1. Introduction to Rangeland Plants

Most management decisions on rangelands are made by first knowing the various plants inhabiting them. Knowing the types of plants in an area can help people monitor whether changes on the rangeland are positive or negative. Correctly identifying rangeland plants requires knowledge of plant characteristics and plant types.

Plant Classification

Time: 40-45 minutes
Supplies:

- "Growth Form" worksheet
- "Life Span" worksheet
- "Plant Morphology" worksheet

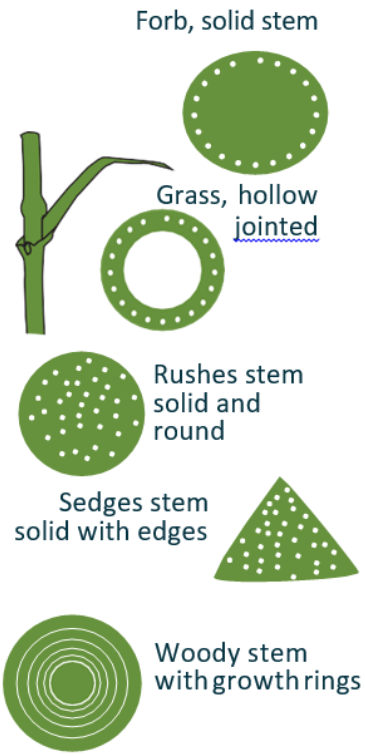
Range plants can be classified and grouped in many different ways, including growth form, life span and origin. We use the morphology of range plants, which describes the physical form and/or external structures of a plant, to help us correctly identify what plants are growing on the rangeland.

Growth Form

We will learn four plant types, or growth forms, that are used to describe rangeland plants. The growth forms include grasses, grass-likes, forbs and shrubs. Rangeland plants can also be described in terms of how much woody tissue they contain (woody vs. herbaceous). This is important because it affects forage value, watershed characteristics of the landscape, habitat characteristics, and fire fuel loads.

Do:

- Using the images below, have students fill out and/or draw plant characteristics in the following table to emphasize the differences between the four growth forms.

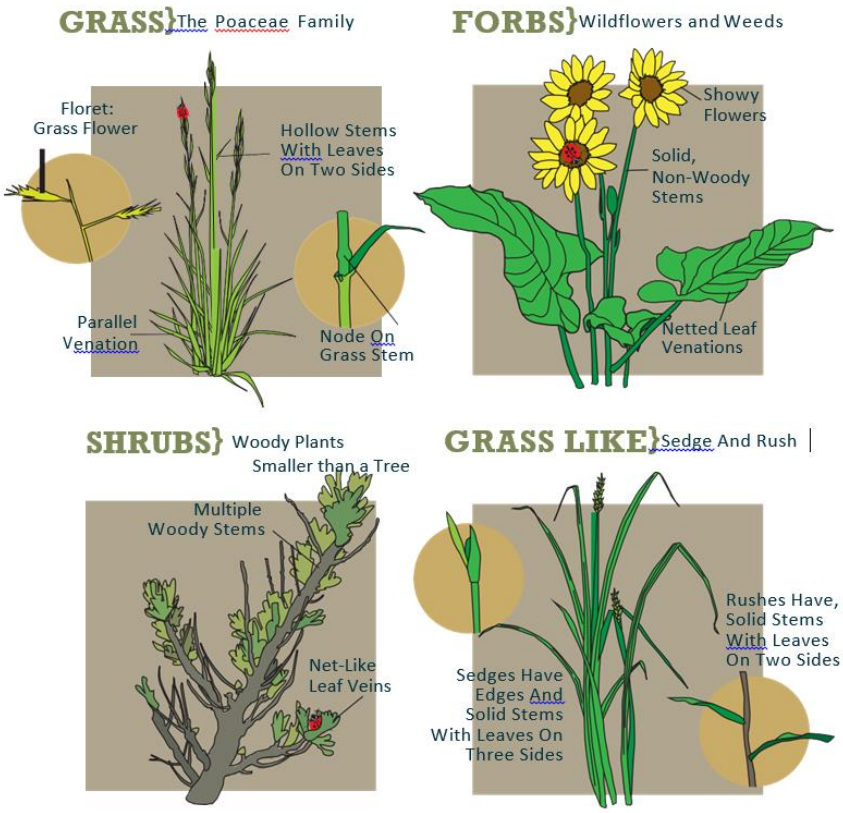


Forbs are plants such as dandelions with showy flowers, netted veins in the leaves, non-woody stems that are also solid, and a taproot. Sometimes we call forbs "broadleaf" plants – they include wildflowers and weeds. Forbs have leaves and stems that die back to the ground each year.

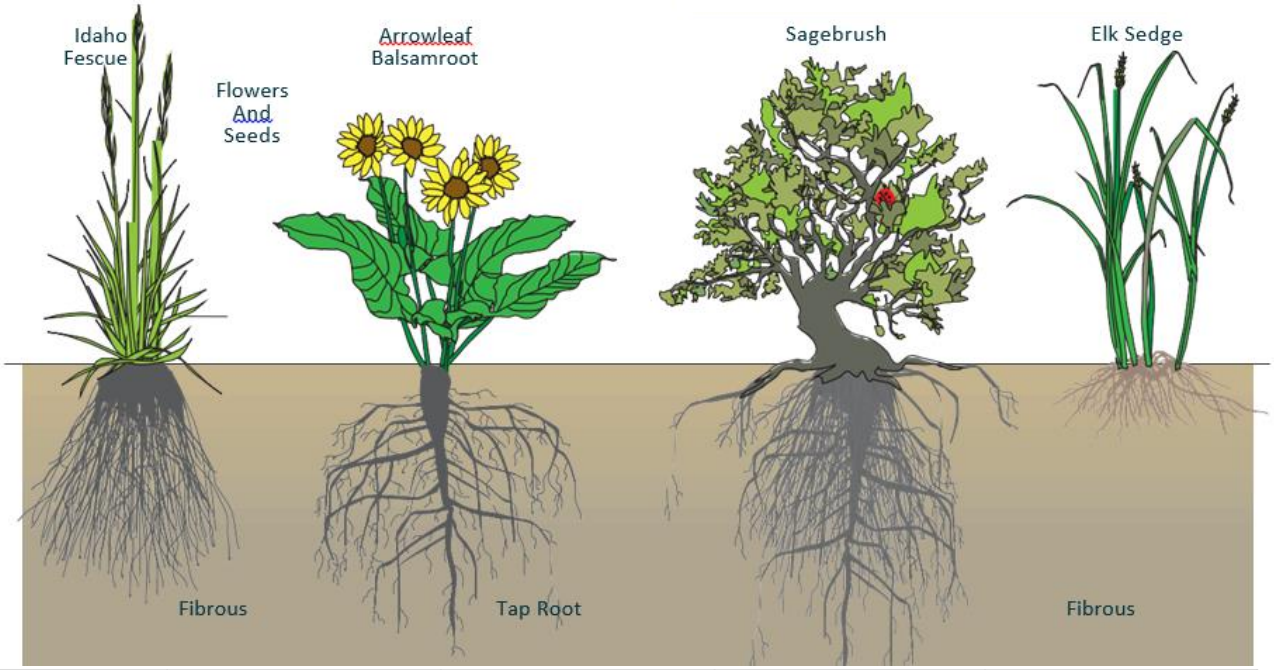
Grasses have hollow, jointed stems that are **herbaceous**, parallel veins in the stems and leaves, and fibrous roots. Grasses do not have colored flowers and they produce grain-like seeds. Sometimes plants we would not think of as grasses, such as wheat and corn are actually grasses.

Grass-like plants look like grasses but have solid stems without joints. They have parallel veins in the leaves. Sedges and rushes are in this group of plants. One of best ways to tell the difference between sedges and rushes is the shape of the solid stems; Sedges have edges (are triangles), and rushes are round.

Shrubs are woody plants that re-grow leaves and flowers on the same stems year after year. Shrubs usually have broad leaves, seeds, and berries that are forage for wildlife. Shrubs differ from trees because they typically have several main stems instead of one main trunk.



ROOTS} Deliver Food and Water



Plant Characteristics	GRASSES	GRASS-LIKES	FORBS	SHRUBS
STEMS --is the stem herbaceous or woody?				
LEAVES --are the leaf veins parallel or netted?				
ROOTS --are the roots fibrous or a tap root				
FLOWERS --are the flowers showy?				

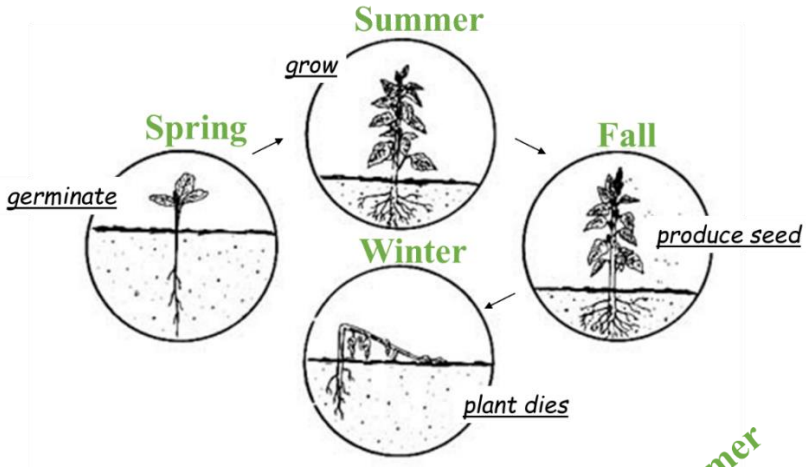
Life Span

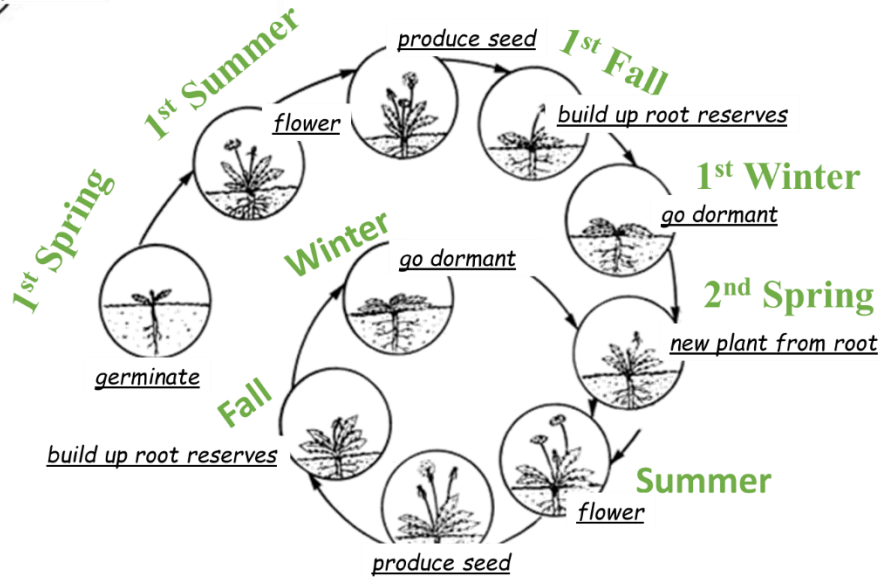
The lifespan of a plant refers to the length of time from the germination and sprouting of the plant to the natural death of the plant. In other words, this is how long it takes the plant to grow, flower, produce seeds, and die. Rangeland plants can be classified as **annuals, biennials,** or **perennials.** We will focus on annuals and perennial right now.

Do:

Using the illustrations of the annual and perennial life span have students draw the life cycle for annuals and perennials.

- **Annual** plants live only one growing season. Summer annuals germinate in the spring, complete all growth by the end of the summer, and then die.
- **Biennial** plants live for two growing seasons. During the first growing season, these plants normally form a basal cluster or rosette of leaves. During the second year, they send up a seed stalk that flowers before the plant dies back to the ground at the end of the growing season.
- **Perennial** plants live for several years, and some live up to hundreds of years. The plants produce leaves and stems from the same crown for more than two years. Most range plants are perennials.





Origin

The "origin" of a rangeland plant is the area where it developed and evolved. Knowing the origin of a plant is important because it can affect the way the plant responds to the environment or help predict the spread of species. Rangeland plants can be characterized as either **native** or **introduced** (sometimes introduced species are also called exotic).

- **Native** plants originated where they now occur without the help of humans. They are well adapted to the local climate, soils, animals, and microbes.
- **Introduced** plants are plants occurring outside their natural home range. They have typically been introduced by humans.

Natives and introduced plants may be considered **invasive species**. Invasive plant species spread and establish over large areas and are often more competitive than other plants (e.g., they use the water and nutrients in the soil before desirable species have a chance to grow). Many invasive plants produce a lot of seeds that survival in the soil longer than most desirable plant species and cause economic and/or environmental harm.

Two examples of invasive species on Idaho rangelands are cheatgrass (an invasive, introduced, annual grass), and juniper (an invasive, native, perennial tree).

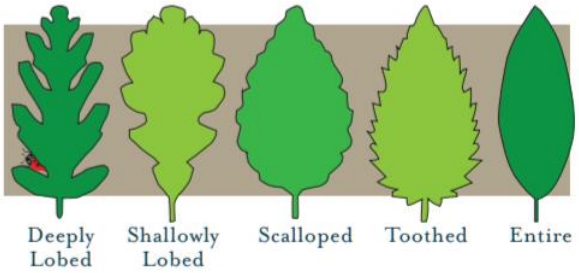
Plant Morphology

When identifying rangeland plants, it is important to pay careful attention to the plant's **morphology.** Here are some of the basic morphological characteristics you should use when identifying plants. *It is much easier to identify plants when their various parts can be described accurately!*

Do:

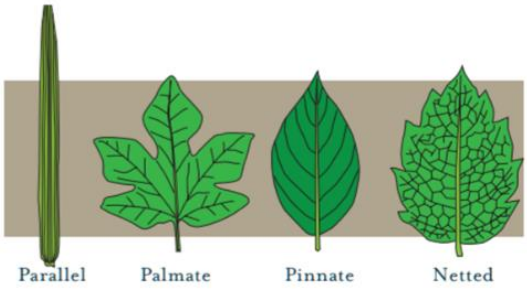
- Review the following characteristics and have students draw each characteristic for practice.

Leaf Edges (or margins)



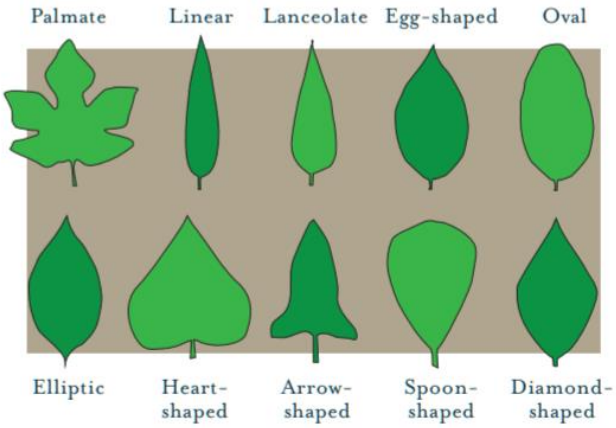
Deeply Lobed	Shallowly Lobed	Scalloped	Toothed	Entire

Leaf Venation



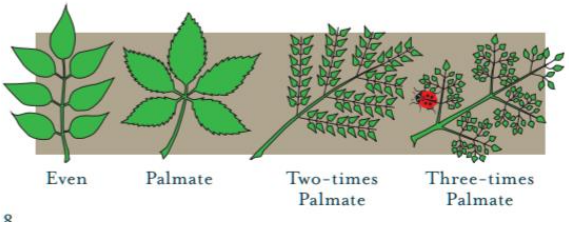
Parallel	Palmate	Pinnate	Netted

Leaf Shapes



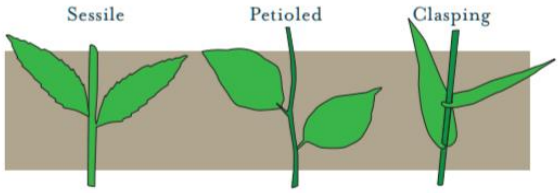
Palmate	Linear	Lanceolate	Egg-shaped	Oval
Elliptic	Heart-Shaped	Arrow-Shaped	Spoon-Shaped	Diamond-Shaped

Leaf Type



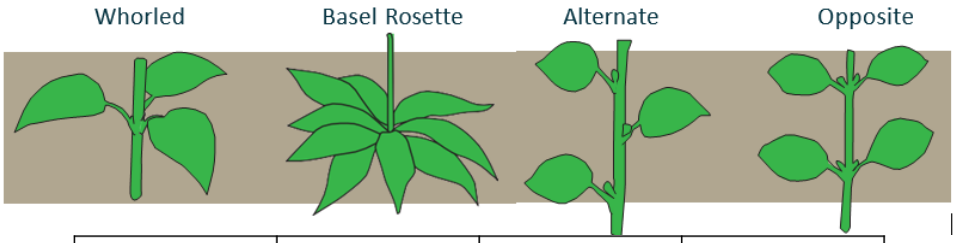
Even	Palmate	Two-times Palmate	Three-times Palmate

Leaf Attachment



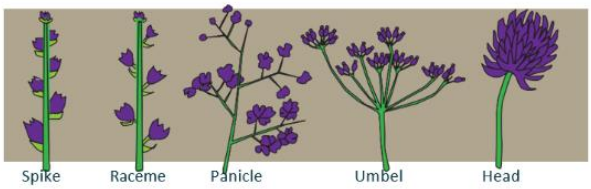
Sessile	Petioled	Clasping

Leaf Arrangement



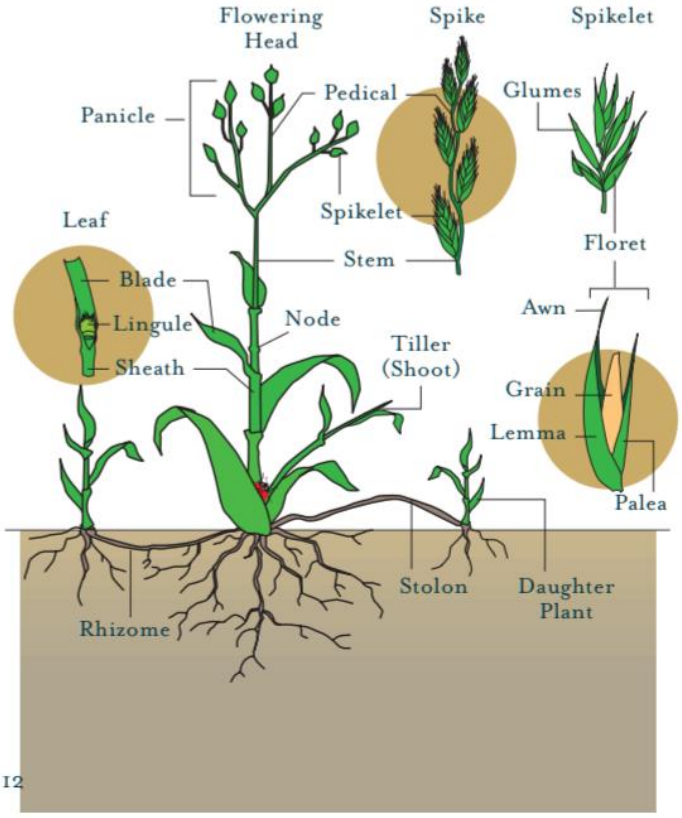
Whorled	Basel Rosette	Alternate	Opposite

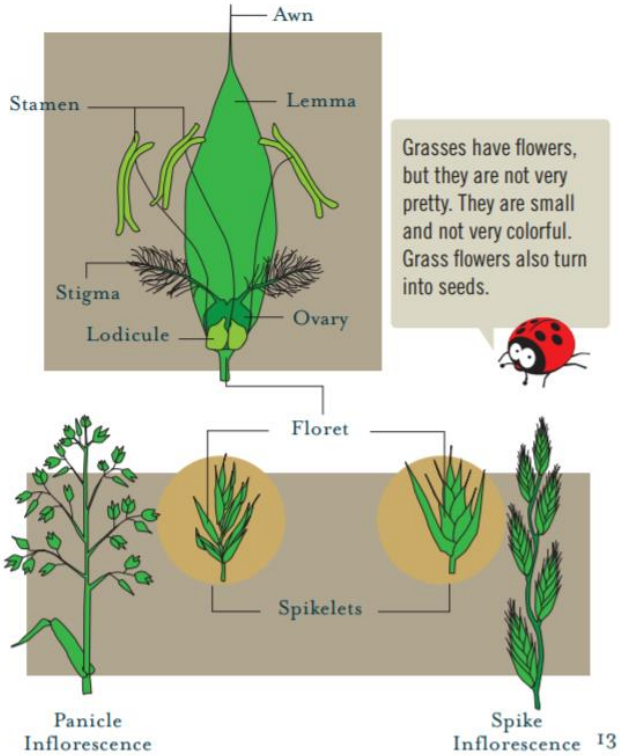
Inflorescence Types



Spike	Raceme	Panicle	Umbel	Head

Grasses have their own set of morphological characteristics.





2. *Plant Scavenger Hunt*

Time: 30 minutes-1 hour
Supplies

- Plastic bags (e.g., Ziploc sandwich bags)
- Markers to number the bags
- Scavenger Hunt List

Directions:
Introduce the scavenger hunt activity. Students will need to find the items listed on the scavenger hunt guide (or as many as possible in the time allotted… this could also be a homework assignment). Students may use any books or other resources to help gather these items.

Do:
Collect as many of the scavenger hunt items as possible in the allotted time (*some of the characteristics are really hard to find so don't worry too much if you can't complete the list!*). When collecting examples, be gentle with the plants and don't take more than needed! *You may also use one item to fulfill up to three characteristics but NO more than that!*

- Once an item is collected place in a Ziploc bag and using a marker write the identifying characteristic(s)
- Once complete return items to your coach for a discussion.

Reflect:
Review what the students found and discuss how plant characteristics help identified plants.

PLANT CHARACTERISTICS
Scavenger Hunt

GROWTH FORM	LEAF SHAPE
☐ Grass	☐ Linear
☐ Forb	☐ Egg-Shaped
☐ Shrub	☐ Heart-Shaped
LIFE SPAN	**LEAF ARRANGEMENT**
☐ Annual	☐ Alternate
☐ Perennial	☐ Opposite
LEAF EDGES	☐ Whorled
☐ Lobed (deep or shallow)	**INFLORESCENCE TYPE**
☐ Toothed	☐ Spike
☐ Entire	☐ Panicle
LEAF VENATION	☐ Umbel
☐ Parallel	☐ Head
☐ Palmate	**GRASSES ONLY**
☐ Pinnate	☐ Awn
☐ Netted	☐ Node
LEAF ATTACHMENT	**BONUS**
☐ Sessile	☐ Palmate Leaf
☐ Petioled	☐ Even Leaf

3. Skills Challenge: Plant Identification

Identifying plants is an important job in rangeland management and knowing what plants are growing where is a primary factor when making land management decisions. Land managers work closely with botanists (botanists study plants and how they work) to make sure they identify plants correctly. Once they know what the plant is, they can then explore ways to manipulate them to achieve the goals on the rangelands.

Identifying plants can be a challenge but with practices it can also be fun! Identification starts with observing the plant characteristics—as described above—and then distinguishing between different plants. Every plant is unique, the questions is, can you find how they are unique?

Do:
Study the plants from the plant list (on the next page). Learning to identify plants by sights is an excellent skills to have! Links to herbarium mounts for each plant can be found at idrange.org

Plant Apps (*available on Apple and Android products)*

Idaho Wildflowers Search

Idaho Grasses

PictureThis

Words to Explore*:

- **Herbaceous:** Non-woody plant growth
- **Monitor:** The orderly collection, analysis, and interpretation of resource data to evaluate progress toward meeting management objectives. This process must be conducted over time in order to determine whether or not management objectives are being met.
- **Morphology:** The form and structure of an organism, with special emphasis on external features.
- **Woody:** A term used in reference to trees, shrubs or browse that characteristically contain persistent ligneous material.

*Definitions from the Society for Range Management Glossary of Terms

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.
- Visit: plants.usda.gov for more information on each plant.

I-ROAM Plant List

COMMON NAME	SCIENTIFIC NAME	GROWTH FORM	LIFE SPAN	ORIGIN
Grass and Grass-like				
1. Baltic Rush	*Juncus balticus*	Grass-like	Perennial	Native
2. Basin Wildrye	*Leymus cinereus*	Grass	Perennial	Native
3. Bluebunch Wheatgrass	*Pseudoroegneria spicata*	Grass	Perennial	Native
4. Cheatgrass (or Downy Brome)	*Bromus tectorum*	Grass	Annual	Introduced
5. Crested Wheatgrass	*Agropyron cristatum*	Grass	Perennial	Introduced
6. Elk Sedge	*Carex garberi*	Grass-like	Perennial	Native
7. Foxtail Barley	*Hordeum jubatum*	Grass	Perennial	Native
8. Idaho Fescue	*Festuca idahoensis*	Grass	Perennial	Native
9. Indian Ricegrass	*Achnatherum hymenoides*	Grass	Perennial	Native
10. Kentucky Bluegrass	*Poa pratensis*	Grass	Perennial	Introduced
11. Medusahead Rye	*Taeniatherum caput-medusae*	Grass	Annual	Introduced
12. Needle-and-Thread	*Hesperostipa comata*	Grass	Perennial	Native
13. Purple Threeawn	*Aristida purpurea*	Grass	Perennial	Native
14. Sandberg Bluegrass	*Poa secunda*	Grass	Perennial	Native
15. Squirreltail	*Elymus elymoides*	Grass	Perennial	Native
Forbs				
16. Arrowleaf Balsamroot	*Balsamorhiza sagittata*	Forb	Perennial	Native
17. Curlycup Gumweed	*Grindelia squarrosa*	Forb	Perennial	Native
18. Goathead (or puncturevine)	*Tribulus terrestris*	Forb	Annual	Introduced
19. Indian Paintbrush	*Castilleja sp.*	Forb	Perennial	Native
20. Lupine	*Lupinus sp.*	Forb	Perennial	Native
21. Russian Thistle (or Tumbleweed)	*Salsola tragus*	Forb	Annual	Introduced
22. Sego Lily	*Calochortus nuttallii*	Forb	Perennial	Native
23. Tall Larkspur	*Delphinium occidentale*	Forb	Perennial	Native
24. Tapertip Hawksbeard	*Crepis acuminata*	Forb	Perennial	Native
25. Western Yarrow	*Achillea millefolium*	Forb	Perennial	Native
26. Wild Onion	*Allium sp.*	Forb	Perennial	Native
Woody				
27. Antelope Bitterbrush	*Purshia tridentata*	Woody	Perennial	Native
28. Big Sagebrush	*Artemisia tridentata*	Woody	Perennial	Native
29. Curl-leaf Mountain Mahogany	*Cercocarpus ledifolius*	Woody	Perennial	Native
30. Juniper (Utah, Rocky Mountain, or Western)	*Juniperus sp.*	Woody	Perennial	Native
31. Quaking Aspen	*Populus tremuloides*	Woody	Perennial	Native
32. Rabbitbrush (gray or rubber)	*Chrysothamnus sp.*	Woody	Perennial	Native
Noxious Weeds				
33. Canada Thistle	*Cirsium arvense*	Forb	Perennial	Introduced
34. Hoary Cress (or Whitetop)	*Cardaria draba*	Forb	Perennial	Introduced
35. Rush Skeletonweed	*Chondrilla juncea*	Forb	Perennial	Introduced
36. Spotted Knapweed	*Centaurea stoebe*	Forb	Perennial	Introduced

Section 4: Water on Rangeland

Learning Objectives:

- Learn how to read a topographic map and create a watershed
- Describe characteristics of uplands vs. riparian areas
- Evaluate the effect of precipitation on rangelands
- Learn about watering management tools and how they can be used to increase livestock grazing distribution

Idaho General Education Performance Standards

- ESS2-5-1, ESS2-MS-2, ESS2-MS-3, ESS2-MS-4, ESS2-MS-6, ESS3-MS-3, LS1-5-1, LS2-MS-all, ESS3-MS-1, PS1-5-2, PS1-5-3, ESS2-5-2, LS4-MS-6, LS2-5-4, ESS2-5-2, ESS3-MS-5, ESS3-5-1

1. What is a Watershed?

Time: 20-25 minutes
Supplies:

- "How to Read a Topographic Map" for each student

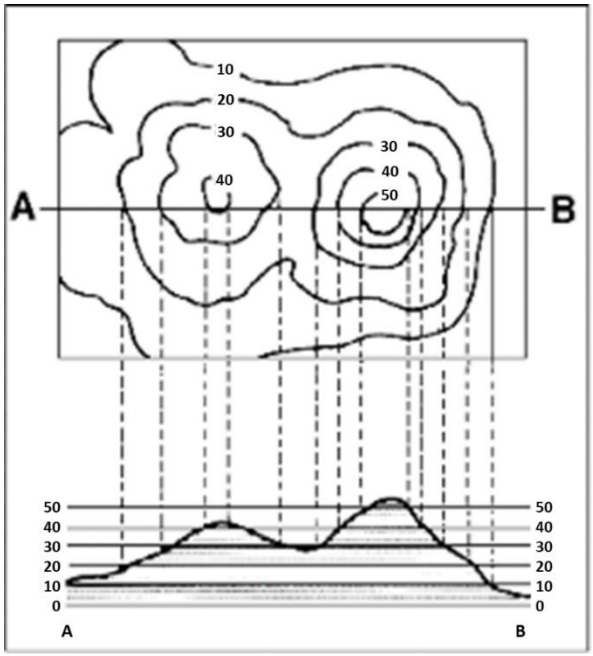
Background:
Land managers care for rangeland, forests, and croplands by managing the health of the watershed. A watershed is an area of land that drains water to the same endpoint. You can think of a watershed as a giant bowl. As water falls onto the bowl's rim and sides, it flows down inside the bowl. At the bottom of the bowl are rivers and lakes that catch and store water that has landed above. Watersheds can be seen at almost any scale, as small as a single hill/pond or as large as the Mississippi river and all its tributaries (tributaries are rivers and streams that flow into a larger river or lake).

Delineate a Watershed
(Modified from the USGS Science for a Changing World—Lesson 4: How to Read a Topographic Map)

The highest feature on the land, like a ridgetop, form the perimeter of the watershed (like the rim on your bowl). Water travels from the top and makes it way to the lowest point.

Do:

- Discuss with students what watersheds are and how they can be defined at almost any scale.
- Using the "How to Read a Topographic Map" below, have students answer the questions and trace the contour lines with their finger. The lines on the map are contour lines (a contour line on a map joins points of equal height above sea level). Ask students to trace with their fingers around the 40-foot contour line on the map. Then ask them to look at the picture of the hill and draw their fingers around the 40-foot contour line. Do the same thing for the 20-foot line. Note: each contour line is 10 feet apart.



USGS

Lesson 4—How to Read a Topographic Map

The top of this drawing is a contour map showing the hills that are illustrated at the bottom.

On this map, the vertical distance between each contour line is 10 feet.

Learning to use a topographic map is a difficult skill. It requires us to visualize a 3-D surface from a flat piece of paper. It takes practice!

Answer Guide: **How to Read a Topographic Map**
1. Hill B
2. Hill B—Remind students that the closer the contour lines, the more steep the hill.
3. 10 feet
4. Hill A: ~42 feet, Hill B: ~54 feet

Apply:

1. Which is higher, hill A or hill B? _____
2. Which is steeper, hill A or hill B?_____
3. How many feet of elevation are there between contour lines?_____
4. How high is hill A?_____ Hill B? _____

Reflect:

- When would you use a topographic map? (e.g., creating a route for a hike)
- Why do rangeland managers need to understand watersheds?

Find your own watershed. Take a walk outside and look for the highest peak in your area. When it snows and rains, where does water flow?

Do: Using the pictures below, identify the highest points on the pictures and draw arrows indicating which way the water flows. *The pictures don't capture in the entire watershed as you can't see the full landscape but when you are outside, you can turn 360° to identify the entire watershed.*

2. Skills Challenge—Build your own watershed

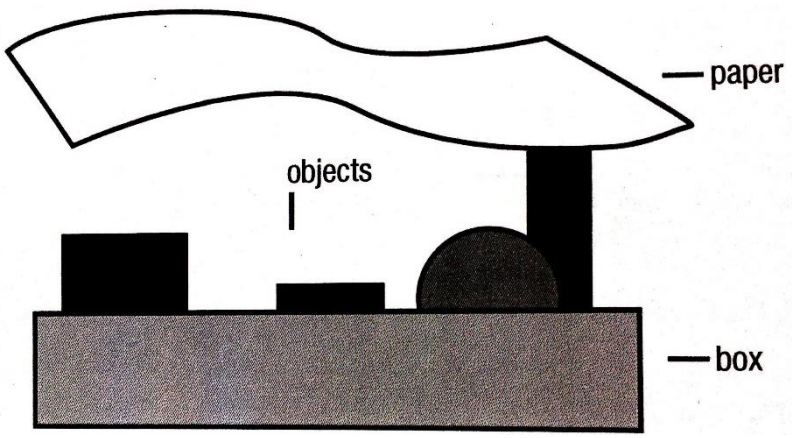
(Modified from www.miseagrant.umich.edu/flow)

Time: 30-35 minutes
Supplies:

- Box or tray
- Butcher Paper
- Objects of various shapes and sizes
- Tape
- Non-permanent markers
- Spray-bottle with water

Do: (may be done in groups or individually)

- On a tray (e.g., cookie sheet, shallow box), place objects of various shapes and size to represent mountains and hills.
- Crumple up a piece of butcher paper being careful not to rip any holes in the paper.
- Carefully cover the tall and short objects with the sheet of butcher paper, pressing the paper down so that it looks like tall and short hills. Use pieces of tape to keep the paper from lifting up from the tray.
- On the model, mark the high areas with a "X" using non-permanent markers (e.g., Crayola)



Reflect:

- Predict how the water will flow over the model if you spray water on it. Include where water will flow and accumulate.

Apply:

- Hold the spray bottle about 5 inches from your model and spray for several minutes until you get a continual flow of water.
- Explain how the water flowed over your model (what patterns occurred)? What caused the water to flow the way it did?
- Did you observations agree or disagree with your predictions? How were they similar or different?
- Why is this information important when you are managing rangeland?

3. Uplands vs. Riparian Lands

Time: 15-20 minutes
Supplies: Venn diagram Handouts, PowerPoint

Background:

Rangelands are generally classified into three types of areas that have distinct hydrologic (i.e., water) regimes and plant communities, these are *upland, riparian, and wetlands.* **Uplands** are drier and only wet for a short periods after it rains or snows. A **riparian** area is the vegetation adjacent, or next to, surface waters such as streams, rivers, or seeps. **Wetlands** are areas with soils that are permanently or seasonally saturated by water. Riparian areas are the transition zone between water and upland areas.

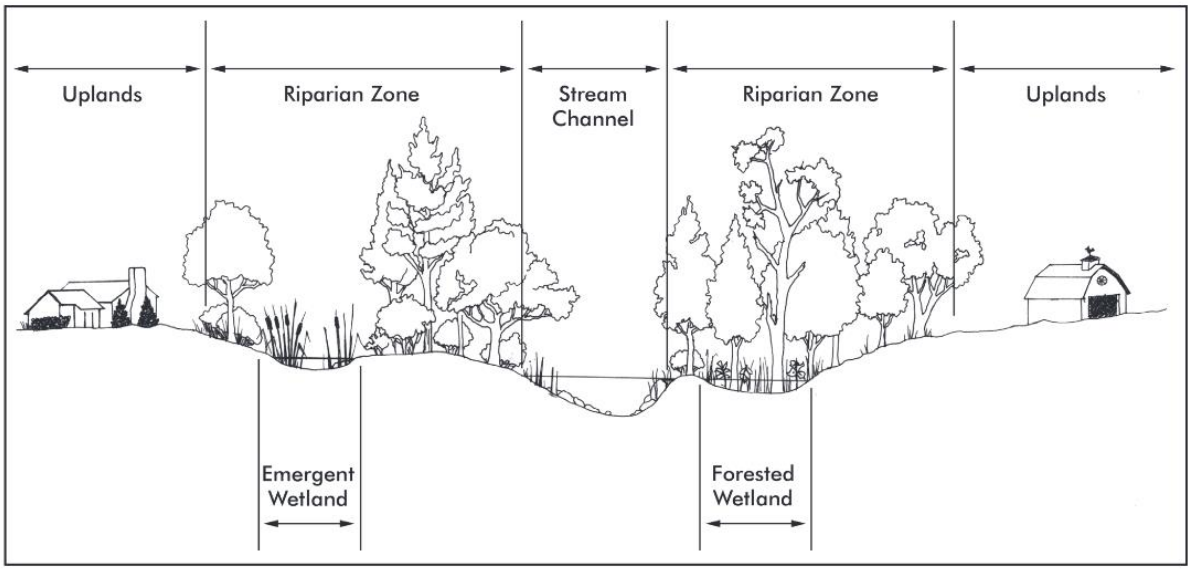


Figure 2-1. Relationship Between Wetlands, Uplands, Riparian Areas, and the Stream Channel

Both wetlands and riparian areas naturally function as water filters, removing sediment and pollutants from water. Riparian areas and wetlands stay green much longer into the season and produce more plant biomass than adjacent uplands. Plants found in wetlands and riparian areas require frequent water and are not killed when inundated by water (as in a flood). Some examples of these species include willows, rushes, and sedges. Riparian vegetation is important to sustain the function of streams; plants shade the water which maintains the cooler temperatures required by some fish and other aquatic species, and the plants' roots help hold soil in place and reduce erosion.

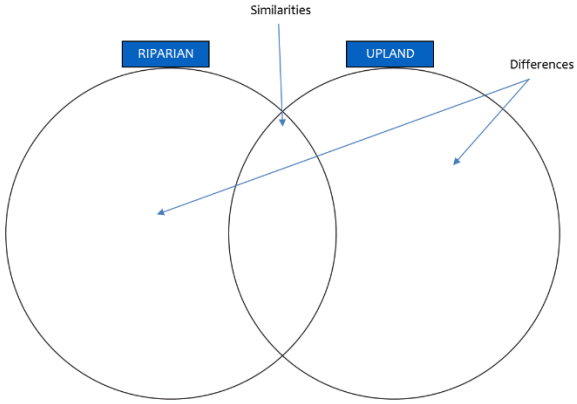
Upland sites are composed of plant species that have adapted to survive with minimal water reflective of the average precipitation of the region. Many rangeland plants have evolved strategies to maximize extraction of available soil water, such as the very deep root systems found in desert shrubs or the abundance of small roots of grasses found near the surface which captures rainfall as it soaks into the soil. Upland plants also have strategies to conserve moisture once it is absorbed. Some examples include waxy layers on the stems and leaves, narrow leaves, and the ability to go dormant during the hottest and driest season of the year.

Do:

- On the "Pictures of Rangelands", circle the riparian areas.
- Fill out the **Venn diagram** for Uplands vs. Riparian areas on rangelands. Venn diagrams use overlapping circles (or other shapes) to illustrate the relationships between two or more sets of items.
- Write details that tell how Uplands and Riparian areas are different in the outer circles. Write details that tell how Uplands and Riparian areas are alike where the circles overlap. Use the pictures to help!

Reflect/Apply:

- If you were a deer, or a bird, or a snake, or a cow, how would you use the uplands? How would you use the riparian areas?
- How can you be a good steward of both types of land?



Upland:
- Higher elevations of the watershed
- Less water availability
- Plants with either deep roots to access ground water or grass with shallow roots that quickly absorb rainfall.

Riparian:
- Lower elevations of the watershed
- More water than uplands and vegetation adjacent to areas that are stream or seeps at least seasonally.
- Plants provide stability to stream banks
- Plants create shade for fish and other aquatic species

Both:
- Both provide habitat (or homes) for wildlife species.
- Both grow plants that are good forage for wildlife and livestock.
- Both help conserve water and keep it on the land (vs. run-off)

4. Impacts of Precipitation on Rangelands—Photo Series

Time: 20-25 minutes
Supplies: Graph, PowerPoint

Background:

Rangelands are usually characterized by limited precipitation, often sparse vegetation, sharp climatic extremes, highly variable soils, frequent salinity, and diverse topography. Some of Idaho's rangelands receive as little as 10 inches of precipitation each year, so plants have adapted to survive long, hot, dry summers.

Weather and climate are highly influential factors determining how rangelands change over time. Water is the primary limiting resource on rangelands, and vegetation production depends heavily on both water availability and suitable growing temperatures. Idaho's rangelands, while for the most part are very dry and cool, can experience great variation in moisture and temperature depending on region, slope, and aspect. Idaho Precipitation that is received on a landscape can vary substantially from year to year.

These vast swings in the precipitation that a site receives each year result in massive variation in the amount of forage that the site can produce annually.

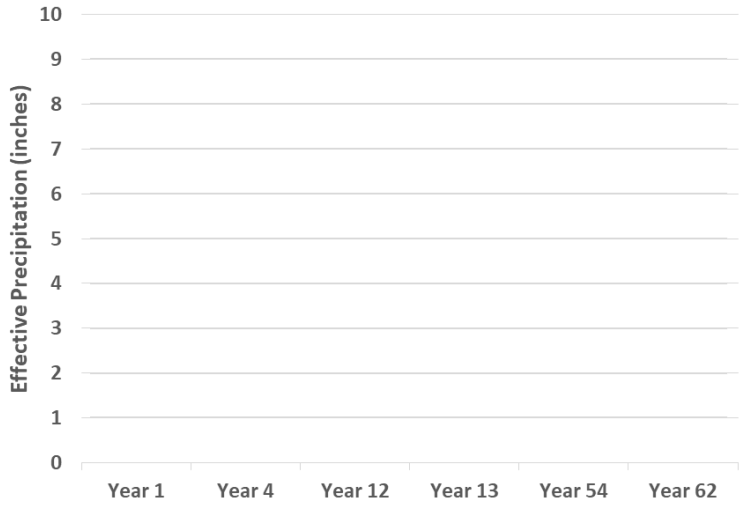
Do:

- Graph the amount of precipitation between April-June for each of the years as indicated in the photo series.

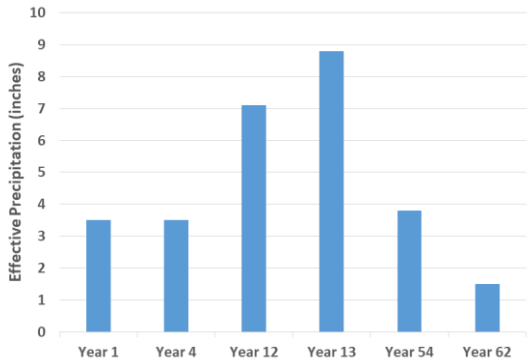
Reflect:

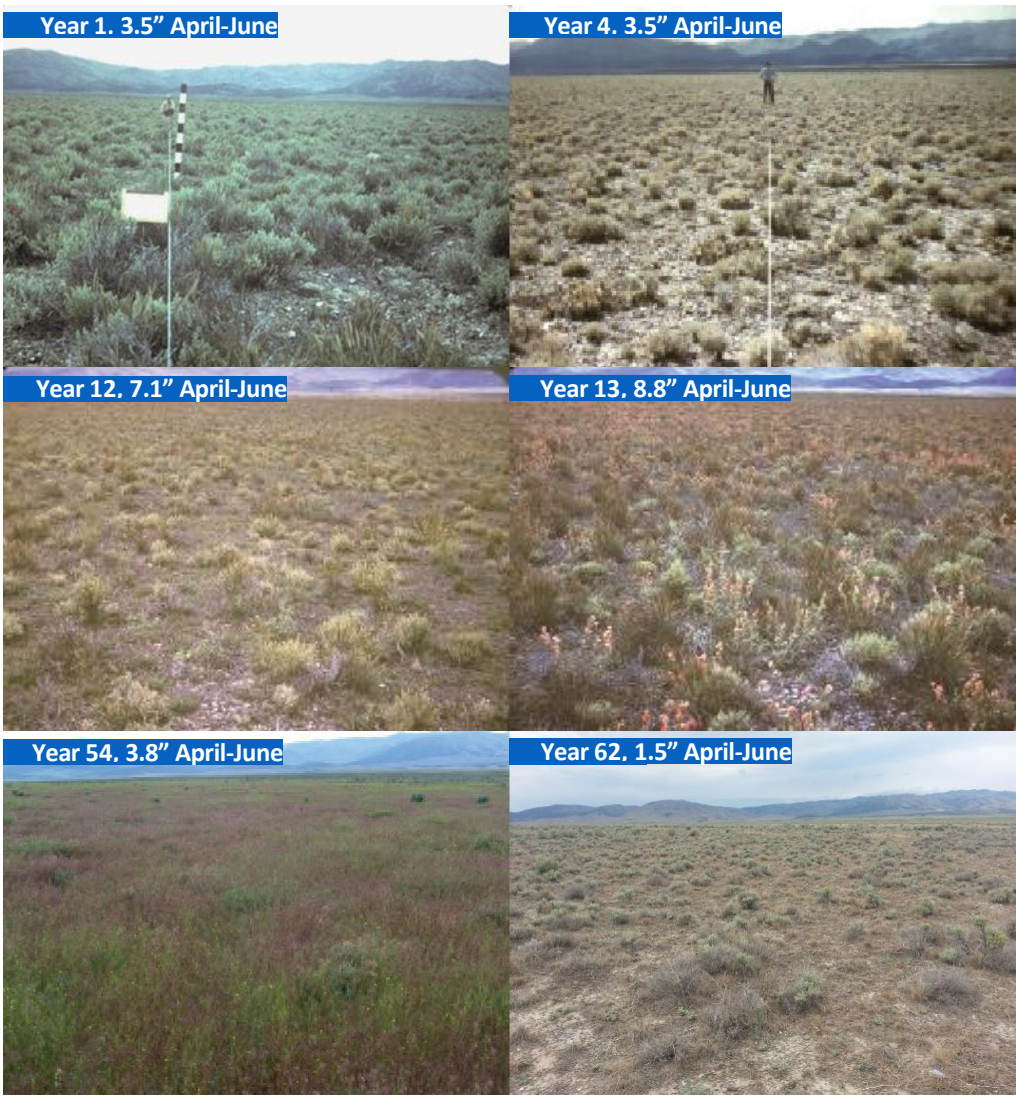
Observe the differences between the photos and answer the following question:

- How does effective precipitation influence the plant community? For example, what year(s) had the greatest amount of visible forbs? What year(s) had the greatest amount of bare ground? What year(s) had the greatest amount of grasses? What year(s) had the greatest amount of shrubs?



Answer:





Description of each photo:

- **Year 1:** Shadscale (the dominant shrub in the photo) appears to be very healthy. Precipitation was near average during the spring.
- **Year 4:** After a very dry year 2 and 3, the shadscale had very little current year production.
- **Year 12:** Precipitation was above normal in the spring. A number of shadscale seedlings gave rise the shadscale recovery. Note the globemallow (orange flowered plants) and grass (squirreltail) throughout the stand.
- **Year 13:** Spring precipitation was even greater than in the previous year. This was the best globemallow expression in 50 years. Squirreltail grass was also very productive.
- **Year 54**: The plant community shifted from native shrubs, forbs, and grasses to a cheatgrass community that has a high wildfire risk.
- **Year 62:** A cold dry winter took a toll on the cheatgrass on the site. Now the site looks much like it did in the past with shadscale, and some perennial grasses. Cheatgrass and forbs are nearly absent.

5. Management Options—Water Developments and Grazing Distribution

Time: 10 minutes
Supplies: Graph, PowerPoint

Background:
Because rangeland is located mostly in arid climates with relatively low precipitation, water is precious. Ranchers and land management agencies such as the Natural Resources Conservation Service (NRCS), develop water sources for both wildlife and livestock on private and public lands. These developments can be used to entice animals to use different areas of forage that they may typically avoid.

Note: One of the most important factors when managing livestock is to distribute animals across the landscape. To improve livestock distribution, there are recommended distances between watering points that vary based on terrain, species of animals, and breed of livestock.

General Recommendations for Distance from Water for Improved Livestock Distribution	
Rough country	~0.5 mile max
Rolling country	1.0 mile max
Flat sandy country	~1.5 mile max
Flat country	~2.0 mile max

Here are a few examples of water developments that benefit both wildlife and livestock. In many places, surface water alone does not provide a dependable source of water, this can be due to water runoff and/or soil types. In these areas, rancher may choose to drill wells and/or pump water into stock tanks, or other large water storages for livestock.

Watering troughs benefit both livestock and wildlife, especially during the summer. Although they benefit most wildlife species, some can be deadly for animals that can get in, but can't get out. Hence, bird ladders or wildlife escape ramps, are placed in troughs for wildlife such as sage-grouse to use to climb out ultimately reducing accidental drowning.

Spring-feed trough between two pastures

Stock ponds can be used to water livestock (this will require management), and also to collect run-off that can be piped or pumped to different locations. The methods used to move water around the rangeland will depend on the topography. If you can use gravity to move water from the pond to tanks, you can save money.

Streams are sources of water for animals. Land managers create hardened crossings to encourage concentrated use in small areas to minimize impact on vegetation.

Words to Explore:

Topography: described the physical features of an area of land. These features include natural or manmade features such as mountains, hills, valleys, rivers, roads, and cities. Topography often records the elevations of an areas using a **topographic map**.

Topographic maps: represent a 3-D surface on a flat piece of paper by showing elevation changes on the land using **contour lines**.

Contour lines: a contour line drawn on a map represents a given elevation. Every point on the map touching the line should be the same elevation. On some maps, numbers on the lines will let you know what the elevation is for that line. *The closer the contour lines are to each other, the steeper the slope of the land.*

Effective Precipitation*: That portion of total precipitation that becomes available for plant growth. It does not include precipitation lost to deep percolation below the root zone or to surface runoff or to evaporation or which falls during the dormant season unless stored in the soil for later use during the growing season.

*Definitions from the Society for Range Management Glossary of Terms

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.

Section 5: Home on the Range—Wildlife and Livestock

1. What is Habitat?
2. What's for Dinner?
3. Ice Cream Plants and Animal Skull Discovery
4. How Much Food do Animals Eat?
5. Skills Challenge—Animal Identification

Learning Objectives:

- Identify and describe the four essential components of habitats: food, water, cover, and space.
- Describe factors that limit habitat
- Recognize that rangeland plants are a renewable resource
- Analyze the effect of different types of forage on different grazing animals.

Idaho General Education Performance Standards

- LS2-5-3, LS2-4-4, LS2-MS-2, LS2-MS-5, LS2-MS-3, LS2-MS-1

1. What is Habitat?

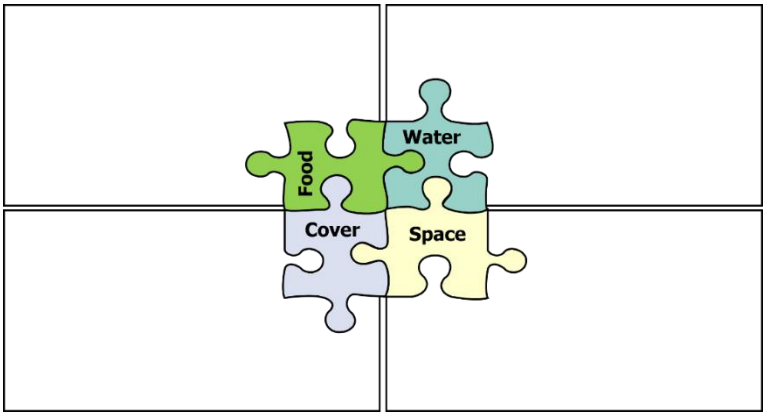
Time: 20-25 minutes
Supplies: Habitat worksheet for each student.

Introduction:
Rangelands (both private and public) provide essential **habitat** for livestock and wildlife. Their rich ecological diversity provides food, cover, and rearing-ground necessary for countless mammals, birds, amphibians, reptiles, fishes, and insects. A great majority (84%) of mammals found in North America spend at least a portion of their life in rangeland ecosystems. Large hoofed animals, called ungulates**,** are perhaps the most iconic rangeland animals. Wild grazing animals such as elk, pronghorn, and deer, as well as livestock species including cattle, sheep, goats, and horses, all inhabit rangeland landscapes. Other mammals commonly found on rangelands include rodents and rabbits.

A variety of birds make their home on the range, either seasonally or year-round. Large game birds such as grouse, pheasants, and chukars call rangelands home. Migratory songbirds including meadowlarks, buntings, sparrows, and doves fill the grasslands, shrublands, and woodlands with color and song. Raptors such as hawks and falcons can often be found in the rangeland skies. Some birds are so attached to rangelands that vegetation types are in their name: prairie falcon, meadow lark, sage thrasher, and scrub jay. All wildlife and livestock require four basic habitat elements in order to survive, thrive and reproduce: food, water, cover, and space. The specific combination of food, water, cover, and space required by a given species, called its niche, is unique to every species that lives on rangelands. Because of these specific and varied requirements, any time the habitat is altered, it is improved for some species but made worse for others.

Do:

- Describe the components of a habitat. Explain why each component is essential, just like each piece of a puzzle is essential.



- **Food:** requirements for all animals, including those on rangelands, include energy, nutrients, and minerals. Energy in plants comes from starches, sugars, fats, and cellulose. Nutrients include protein and vitamins. Mineral requirements include phosphorus and potassium. The types of vegetation on the land, the diet preferences of animals, and the arrangement of available food plants must be assessed to determine the food or forage value of rangeland habitat.
- **Water:** requirements vary depending on the animal species and weather conditions. In general, sheep and goats require 1-1½ gallons of water once every two days; donkeys require 3-4 gallons of water every day; horses require 5-8 gallons of water each day; and cattle and bison require 8-10 gallons of water every day or two. Wildlife, such as whitetails need about ½-3/4 a gallon of water per day per 100 pounds of body. Black bears need large amounts of water to process the large amounts of food consumed and rid the body of waste; daily urine volumes for one bear averages 1-2 gallons! Rangeland animals meet their water requirement by drinking fresh water and obtaining water from forage. Green plants can contain significant amounts of water. For example, immature grasses may be up to 75% water by weight. If an animal eats 28 pounds of immature forage, it will consume about 2.5 gallons of water.
- **Cover:** is required for shelter from weather conditions and from predators. Thermal protection is provided by plants when animals are shaded in the summer and sheltered from cold in the winter. Thermal cover for rangeland animals is provided mostly by trees and shrubs. Plants can also offer hiding cover for animals to protect them from predators. Many animals use large plants to hide under or to gain protection through visual obstruction. However, other animals, like pronghorn and prairie dogs, gain protection from predators by a lack of visual obstruction. These animals prefer to be out in the open where they can see predators coming and escape by running away or retreating underground.
- **Space:** is an important consideration for breeding and nesting, home range, and disease transmission. An animal's home range is the area in which an individual animal conducts its normal daily and yearly activities. This area can be shared with members of its own species, or with other species. The home range of an animal is directly related to its body weight: larger animals generally have a larger home range. Home ranges also vary by foraging habits: carnivores have very large home ranges, while the home ranges of herbivores are comparatively smaller.

Reflect/Apply:

Location and size of home ranges and habitats are set by **limiting factors** such as water, food, climate, and topography. These factors are basic requirements that restrict the size, growth, and/or vigor of an animal population.

- Rangeland habitats can be influenced by human activities that either add or remove limiting factors.

Have students brainstorm ideas of how they can positively or negatively influence habitat.

- For example, when ranchers add water tanks to pastures, they may remove a habitat-limiting factor (i.e., access to water) for wild and domestic animals. On the other hand, building roads and housing subdivisions may create factors that limit access to food and cover. However, habitat modification does not always affect a wildlife species' ability to survive, thrive, and reproduce.

2. *What's for Dinner?*

(Modified from "Please Pass the Wheatgrass")

Time: 20-25 minutes

Supplies:

- Pie pan, wrapped candy (one students have a strong preference for, and one that may not automatically select). You will need approximately equal numbers of candy so each student could choose either type.
- Kidney beans, black beans, lima beans, cookie sheet.

Background:

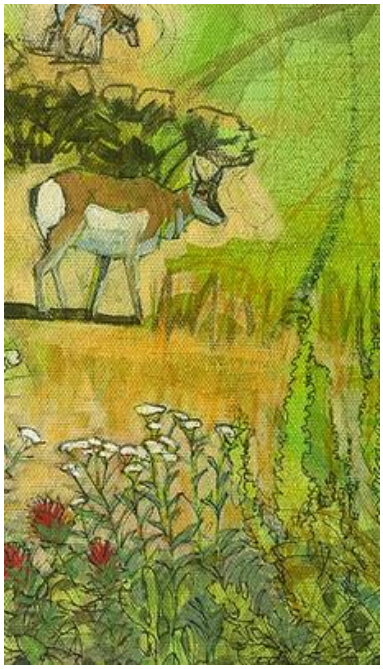
In natural ecosystems, each animal species occupies its own niche, **which enables the animals to share the same habitat.** Some niches overlap, leading to competition between animals. Most animals, however, have food or other habitat preferences slightly different than those naturally occurring in the same area. Domestic animals (sheep, cattle, horses, goats) likewise have preferences depending on their species. Some strongly prefer grass, forbs (weeds and flowers), or the leafy parts of shrubs.

Depending on which animals live in a particular area, which types of forage grow there, the amount of precipitation, and numerous other conditions as well, the amount of food available may grow quickly or slowly. In attempting to manage the land for a variety of animals, land managers must monitor the forage and water as well as the number and types of animals present. Adjustments must be made so that the animals do not suffer and the rangelands don't deteriorate.

Directions:

1. Pass around a pie pan with an approximately equal numbers of wrapped candied likely to elicit a strong preference toward one type. *Count out enough candies that each student could choose either type and place them on the pie plate.*
2. Instruct students to take one candy as the pan is passed by, tell students to remember which type they take, and let them eat their candy. While eating their candy, answer the following questions:
   - What are **renewable resources**?
   - Are rangeland plants a renewable resource? (*Yes, if managed carefully, plants will continue to grow back (just like your lawn!). What do rangeland plants (any plants) need to grow? Sunlight, water, soil nutrients.*
3. Review how to identify forbs, grasses, and shrubs (see Section 3: Rangeland Plants). Ask students the following questions (if necessary).
   - If a plant has a hollow stem, what would it be? *Grass*
   - If a plant had a pretty flower and non-woody stems, it would be? *Forb*
   - If a plant has long leaves with parallel veins, what would it be? *Grass*
   - If a plant is woody with leaves that may be eaten by livestock and wildlife, what would it be? *Shrub*
4. In this activity, beans represent grasses, forbs, shrubs (*may consider writing what each bean represents in a prominent location for reference*),
   - Kidney beans (red) are grasses
   - Black beans are forbs
   - Lima beans (white) are shrubs

5. Show the students the candies remaining in the pie plate—comment, "I see that you like _____most". Just like the candies, different rangeland animals prefer certain types of plants to eat. Write in a prominent location the food preference of each type of animals.



- **Cattle** prefer grasses
- **Elk** have a similar diet to cattle
- **Horses** may consume slightly less grass and more forbs and shrubs than cattle
- **Deer** tend to prefer forbs and shrubs
- **Goats** also prefer forbs and shrubs
- **Sheep** (domestic or wild) tend to select shrubs in the winter, forbs in the spring, and grasses in the summer.

6. Assign each student to one of these animals (e.g., 2 cow, 1 deer, 2 sheep, etc.). Have students stand around the cookie sheet with the beans in the middle.

7. All the animals are now on the range. The members of each animal type now goes to the feeding area—one at a time. The first animal will take one bean at a time—choosing their preferred type of food. This process continues until the supply of one type of food is exhausted. Stop and note which type of food is gone first. You can continue until animals are no longer able to find any food, or stop for discussion.

Reflect:

- What do you think animals are likely to do if their preferred food supply runs out in a single growing season? *(Animals could eat something else, move to another part of the range, or go hungry and die).*
- What would happen if the number of horses in the area doubled? *(The amount of food in the area—particularly their favorite foods, such as grasses and shrubs—would decline more rapidly).*
- How would this affect the food supply of cattle and elk? *(Their food supply would decline as well)*
- How might the situation change if the dominant form of wildlife in the area was deer, which tend to eat more forbs and shrubs? *(The supply of grass for horses and cattle would last longer)*
- What other factors might alter the situation? *Many answers are possible, including drought, fire, and a prolonged winter)*

  Remind students that this situation showed what would happen in a single summer. Show them that the next growing season would produce… a second tray of beans! *You could repeat the activity with different ratios of plants (beans) of different numbers of each type of animal.*

3. Ice Cream Plants and Animal Skull Discovery

Time: 20-25 minutes
Supplies:

- At least 3 pieces of wrapped candy for each student.
- Skulls or skull pictures
- Skulls worksheet

Background:

Who likes ice cream? What kinds of ice cream do you like? Are there flavors that you don't like?

Animals are the same way. Cows will eat plants that deer won't and that's why they can coexist on the range. They eat different plants, so they don't always compete.

Directions:

1. Tell students that they are NOT to eat the candy; they are going to do an activity first.
2. Hand each student at least 3 pieces of candy (1 from each flavor)
3. Have the students split the candy into 2 different groups.
    - Group 1: their **favorite** flavor.
    - Group 2: the candies that they **like the least**.
4. Plants that the animals like are what we are going to call ice cream plants—because it is their favorite. These plants are the tastiest for some animals just like ice cream is tasty to us. Plants they don't like as much are going to be called celery plants.

5. Explain to students that land managers use different grazing management systems (you will learn more about grazing systems in Section 7) so that the ice cream plants will have time to grow back and reseed so that there will always be enough ice cream plants.
    - For example: one grazing system you will learn more about is the "Rest Rotation" grazing system. This rotation allows one pasture to rest (i.e., no grazing) for one whole year allowing the plant to grow and reseed. This is great for ice cream plants.
    - Another example: "Continuous" grazing system. This is a good strategy when you have a lot of celery plants. It forces the animals to eat plants that are good for them (at least during part of the season) but is not their favorite. Continuous grazing is used on cheatgrass monocultures (dominated by one species) for example. Cheatgrass in the spring has high protein (nutritious) so with continuous grazing, we can reduce the amount of cheatgrass which may lower wildfire risk in the summer (learn more in Section 6).

Animal Skull Discovery:

Do:

Show the various skulls pictures and lead the following discussion:

- Discuss how **sheep** graze. Show students the sheep skull (*pictures will work*)—note that sheep teeth influence what they eat.
    - The split lip allows sheep to pick the preferred leaves off of the plant.

    - The bottom front incisors are sharp like knives, and the back teeth grind the plants.
- **Cattle** have similar teeth to sheep, but cattle chew their cud several times. How does that affect what they eat?
- The next skull is a **predator**.
    - What are predators? What are prey? Can an animal be both a predator and prey?
        - A predator is an organism that eats another organism; Prey is the organism that predators eat.
        - Top predators, like cougars and bears, are only predators. Most other wildlife species (carnivores) can be both.
        - *In this exercise, predators are carnivores, prey are herbivores (it should be noted that carnivores can eat carnivores as well, but for today's activity that is not the case).*

Have students compare the skulls. What is similar, what is different?

		
SHEEP	**COW**	**COYOTE**

Reflect:

- Why do predators have sharp teeth?
- Why does the coyote have more teeth than the sheep?
- How does the shape of the animals teeth affect the type of food it eats.

Explain to students the importance of both predator and prey in the environment. Without both, the ecosystem would be unbalanced.

Remind students that each animal species occupies its own niche (as learned in the last few sections), ***which enables the animals to share the same habitat.***

4. How much food do Animals Eat?

Time: 10-15 minutes

Supplies: Forage Demand of Animals worksheet for each student.

Introduction:

Different types of animals require different amounts of food each day. As a general rule, **ruminants** like bison, deer, cattle, and sheep will eat about 2.5% of their body weight per day (in dry weight of forage); **hind-gut fermenters** such as horses and rabbits will eat about 3.0% of their body weight each day; and **concentrate selectors** such as birds, bears, and mice will eat about 0.25% of their body weight daily.

Do:

- Fill in the Blank: Forage Demand of Animals.
- Calculate how much forage an 800 pound cow eats each day.
- Calculate how much forage a 1,200 pound horse eats each day.
- Calculate how much forage a 3 pound rabbit eats each day.

Example:

A 200 pound deer eats 2.5% of its body weight each day. In one day, it will eat 5 pounds

(200 pounds x 0.025= 5 pounds)

Forage Demand of Animals

RUMINANTS

Eat _____ of body weight/day in dry matter of forage.

HIND-GUT FERMENTERS

Eat _____ of body weight/day in dry matter of forage.

How much food do Animals eat *a day*?

A _____ pound cow eats _____% of its body weight each day. In one day, it will eat _____ pounds.

A _____ pound horse eats _____% of its body weight each day. In one day, it will eat _____ pounds.

A _____ pound rabbit eats _____% of its body weight each day. In one day, it will eat _____ pounds.

Answers:

- **Cattle:** 800 lbs X 2.5% = 20 pounds in one day.
- **Horse:** 1200 lbs X 3.0% = 36 pounds in one day.
- **Rabbit:** 3 lbs X 3.0% = 0.09 pounds in one day.

5. Skills Challenge: Animal Identification

Identifying animals is an important job in rangeland management. We need to know all the components of the habitat for each species so we can manage healthy populations.

Identifying animals can be a challenge, but with practice it can also be fun! Identification starts with observing animal characteristics—by sight, pelts/feathers, skulls, scat, tracks, and calls—and then distinguishing differences between different animals. Every animal is unique, the questions is, can you find how they are unique?

Do:

Study the animals from the animal list. Learning to identify animals by sight is an excellent skills to have when management rangelands.

COMMON NAME	SCIENTIFIC NAME
Mammals	
1. American Badger	***Taxidea taxus***
2. American Pine Marten	***Martes americana***
3. Bighorn Sheep	***Ovis canadensis***
4. Black Bear (American)	***Ursus americanus***
5. Bobcat	***Lynx rufus***
6. Canada Lynx	***Lynx canadensis***
7. Coyote	***Canis latrans***
8. Elk	***Cervus canadensis***
9. Grizzly Bear	***Ursus arctos***
10. Ground Squirrel	
11. Moose	***Alces americanus***
12. Mountain Lion (cougar or puma)	***Puma concolor***
13. Mule Deer	***Odocoileus hemionus***
14. Pronghorn Antelope	***Antilocapra americana***
15. Pygmy Rabbit	***Brachylagus idahoensis***
16. Red Fox	***Vulpes vulpes***
17. White-tailed Jackrabbit	***Lepus townsendii***
18. Gray Wolf	***Canis lupus***
19. Wolverine	***Gulo gulo***
Birds	
20. Burrowing Owl	***Athene cunicularia***
21. Chukar	***Alcetoris chukar***
22. Golden Eagle	***Aquila chrysaetos***
23. Great Gray Owl	***Strix nebulosa***
24. Greater Sage-grouse	***Centrocercus urophasianus***
25. Long-bill Curlew	***Numenius americanus***
26. Prairie Falcon	***Falco mexicanus***
27. Ring-necked Pheasant	***Phasianus colchicus***
28. Ruffed Grouse	***Bonasa umbellus***
29. Sharp-tailed Grouse	***Tympanuchus phasianellus***
Reptiles, Amphibians, and Invertebrates	
30. Common Gartersnake	***Thamnophis sirtalis***
31. Long-nosed Leopard Lizard	***Gambelia wislizenii***
32. Western Rattlesnake	***Crotalus oreganus***
33. Western Skink	***Plestiodon skiltonianus***
34. Columbia Spotted Frog	***Rana luteiventris***
35. Idaho Giant Salamander	***Dicamptodon aterrimus***
36. Northern Leopard Frog	***Lithobates pipiens***
37. Western Tiger Salamander	***Ambystoma mavortium***
38. Western Toad	***Anaxyrus boreas***
39. Burrowing Scorpion	***Anuroctonus phaiodactylus***
40. Giant Palouse Earthworm	***Driloleirus americanus***
41. Western Harvester Ant	***Pogonomyrmex occidentalis***
Fish	
42. Bull Trout	***Salvelinus confluentus***
43. Chinook Salmon	***Oncorhynchus tshawytscha***
44. Coho Salmon	***Oncorhynchus kisutch***
45. Sockeye Salmon	***Oncorhynchus nerka***
46. Steelhead (or rainbow trout)	***Oncorhynchus mykiss***

Words to Explore*:

Carnivore: means "meat eater", is an organism that derives its energy and nutrient requirements from a diet mainly or exclusively of animal tissue (i.e., meat).

Habitat: the natural abode of a plant or animal, including all biotic, climatic, and edaphic factors affecting life.

Herbivore: An animal that subsists principally or entirely on plants or plant material.

Limiting Factors: influences that prevent an animal population from reaching biotic (reproductive) potential. Examples of limiting factors are: food, water, shelter, space, disease, predation, climatic conditions, pollution, hunting, poaching, habitat destruction and accidents.

Omnivore: is an animal that has the ability to eat and survive (obtain energy and nutrients) on both plant and animal tissue.

Renewable Resources: A resource that is replaced by natural processes faster than their consumption.

Ruminant: Even-toed, hoofed mammals that chew the cud and have a 4-chamber stomach. Ruminants are herbivores.

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.

Section 6: Fire on the Range

1. Fire Triangle, Fire Behavior, and Fuel Management
2. What Burns Best?
3. Skills Challenge: Matchstick Rangeland

Learning Objectives:

- Describe each component of the fire triangle
- Describe the components of the fire behavior triangle
- Determine which types of fuels burn best
- Explain fuel management techniques, including the "Green and Brown" guide
- Identify and compare the effects of slope, woody species arrangement, and understory growth on fire behavior.

Idaho General Education Performance Standards

- ESS2-5-1, PSI-5-3, PSI-MS-2, ESS3-5-1, ESS3-MS-2, ESS3-MS-3, PS3-MS-2, PS3-MS-3, LS2-MS-6

Introduction: The Role of Fire on Rangelands

Fire is an important and natural part of rangelands. Many plant and animal species have adapted to fire and can benefit from it. Fires can clean out diseased or dead forage and trees. However, just like floods and other natural disasters, fire can produce dramatic change in a short period of time.

Beneficial fires in Idaho are relatively small and create a mosaic of age classes of plants (e.g., small areas of shrubs would burn and perennial grasses would grow for several years in the burned areas until shrubs became reestablished). These types of fire create openings that allow seeds to sprout in sunlight creating areas with high plant diversity, which ultimately creates habitat for a diverse mix of mammals, birds, fish, reptiles, and amphibians.

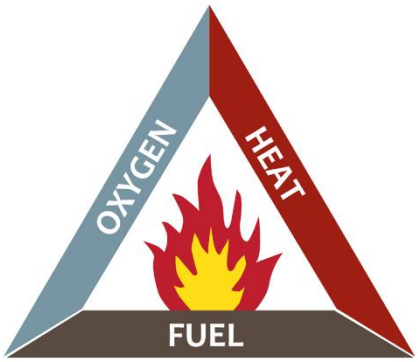
Wildfires over the last few decades, however, have shifted from being small to large. According to the National Interagency Fire Center (NIFC), across the nation the number of fires since 1960 has decreased by 46%, yet, the total acres burned has increased 28% or approximately 1.3 million acres. That means, there are less fires, but when it does burn, it burns a lot!

1. Fire Triangle, Fire Behavior Triangle, and Fuel Management

Time: 15-20 minutes
Supplies: Fire triangle (2 per student), "Green and Brown" chart

Do:
Ask students to describe what is fire? How does it burn?

- Explain that fire is a result of a chemical reaction that requires the presence of heat, fuel, and oxygen. Have students fill in the fire triangle with the 3 components and discuss each one:
    - **Fuel**: is any material that will burn. Ask team members what will burn on rangelands?
    - **Heat**: is provided by the ignition source (fire's ignition decomposes compounds, releasing the flammable gases that react with oxygen to burn). Ask team members how fire starts? See notes below:
    - **Oxygen**: With intense heat and adequate fuel, fires create their own winds which brings in more oxygen.



Ask students to describe common ignition sources.

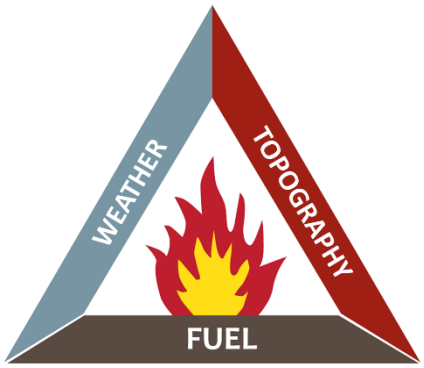
- **Humans**
    - Prescribed fire is an important tool on rangelands; when intentionally ignited and carefully timed and controlled, fire can be used to clean up old, dead trees and brush allowing for new plants to grow, and can also be used to control unwanted plants like junipers which can take over grasslands.
    - Fires that start by accident from fireworks, sparks from vehicles and equipment, target shooting, camp fires, smoking, etc. are not good and destroy a lot of wildlife habitat. Smokey Bear says "Only you can prevent forest fires", and YOU ACTUALLY CAN by being aware of your surroundings and making good choices when you recreate (e.g., if the vegetation is brown and dry, be extra careful of where you are setting off fireworks).
- **Lightening** is the number one, natural cause for wildfires!

Reflect:
If you remove one of the legs of a triangle, will it be a triangle? Just like all three sides are necessary for a triangle, all three components are essential for a fire. Without one of them, a fire will not start.

Fire Behavior Triangle

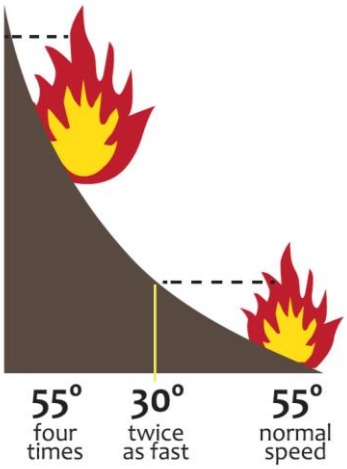
What makes a fire spread fast one day, and slow another day? What makes a wildfire burn "hot" or "cool"? Fuels, weather, and topography all contribute to the behavior of the fire.

Do:
Have students fill in the 3 components of the fire behavior triangle and discuss each component.



- **Fuel:** fuels are any living or dead plant material above the ground's surface that can burn. The amount, arrangement or continuity (e.g., can a flame that is burning one plant, reach another plant?), and fuel moisture (what percentage of the plant is water) all influence fire behavior.
- **Topography:** includes land features like slope and aspect
- (e.g., south/ north side of mountains). Steeper slopes will burn more rapidly, because the fire has more access to oxygen. Fire is further accelerated going uphill because ground fuels are closer to flames as steepness increases (see illustration to the right).
- **Weather:** affects fire because of the humidity (moisture in the air) and temperature of the atmosphere. This affects fuel moistures, which determines how quickly or slowly fuels will ignite and burn. For example, do you sweat more when it is hot or cold? When it is hot and dry, plants lose more water through transpiration than when it's cold and humid.

  Fire also creates its own weather! When the hot air from the fire rises, fresh air rapidly moves in producing wind, bringing more oxygen to the fire.



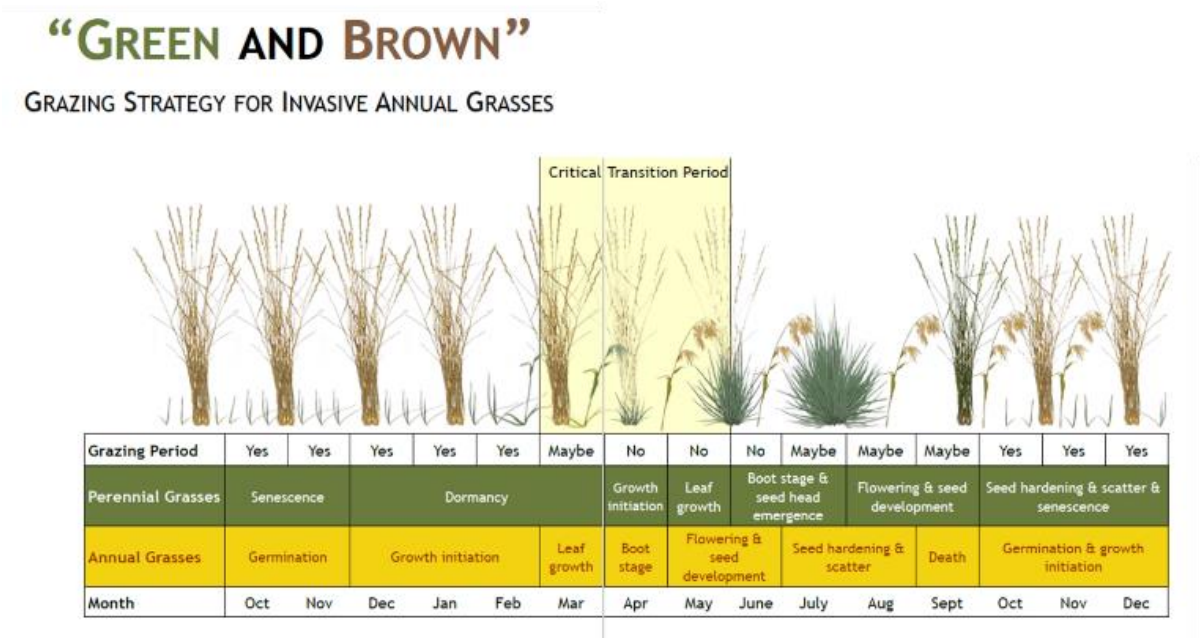
Apply:
- What is the common component between the two triangles? Fuel.
- As a rangeland manager, what component can you manage? Fuel. On rangelands, you can't change topography and you can't control the weather. Most of the time, you can't influence heat (although helping people be aware of fire risk can help!), and you can't control the oxygen. **You CAN MANAGE the FUELS!**

Fuel Management:
Fuel management on rangelands can change fire behavior by affecting the amount of ground fuels and the arrangement (or continuity) of fuels. Some of the different management treatments that can be used to manage fuels include:
- **Prescribed Burning:** this is the intentional application of fire when the weather conditions will not likely lead to an intense fire (often used in the early spring, late fall, or even when there is snow on the ground!). This can change the amount of fuel, and also where fires will or will not burn in the future.
- **Mechanical Treatments:** these treatment involve different mechanized tools to remove plants. Some examples include: tilling, chaining, mowing, and shredding or chipping woody plants. Often times with mechanical treatments, we are not removing fuels, but rather changing the fuel structure. For example, fuels burning on the ground are easier to control than when they are in the canopy of a tree.
- **Herbicides**: chemicals that kill or injure plants.
- **Manual Treatments:** the use of hand tools to remove plants

- **Livestock Grazing:** animals eat plants, which reduces fuel and recycles nutrients as manure. Depending on what your plant community looks like, you can target certain unwanted species (e.g., cheatgrass and medusahead) and have little to no effect on desirable plants like native bunchgrasses.

Do:
More and more research is supporting the use of livestock grazing to reduce fuels (i.e., grasses). One example is the "Grazing Invasive Annual Grasses: The Green and Brown Guide". In this guide, research discuss a simple method for managing livestock to reduce annual grasses while allowing perennial grasses (desired species) to grow. It also illustrates when grazing should be removed. Discuss the "Green and Brown" chart and answer the following questions:

- Annual Grasses should be grazed during what plant growth stages? *Germination and Growth Initiation (the goal is to stop annuals from producing seeds—remember, annuals grow and die the same season).*
- Why is the grazing period a "Maybe" or "No" during certain months? *When Perennial Grasses start to grow (Growth initiation, Leaf growth, Boot stage & seed head emergence, and Flowering & seed development), they are the most vulnerable to damage. Although it's okay to graze plants during those month periodically, you don't want to do it every year. That's one of the reasons we have rotational grazing systems. It allows for perennial grasses to flower and produce seed every few years sustaining the population.*



2. *What Burns Best?*

(Adapted from BLM's Fuels-What Burns Best? lesson)

THIS IS A TEACHER DEMONSTRATION ACTIVITY ONLY, WHEN WORKING WITH FIRE BE AWARE OF YOUR SURROUNDINGS AND HAVE WATER AVAILABLE.

For additional safety precautions, review the Safety Tips below.

Time: 20-25 minutes (plus time to gather plant materials)

Supplies:

- Metal bucket (you can do this activity with 1 bucket or with up to 4)
- Wooden matches (~28; 7 for each bucket)
- Plant materials placed inside labeled bags or boxes (you can also have students gather plant materials)
    - Green grasses and plants
    - Dead/dry grasses and plants (e.g., cheatgrass)
    - Sagebrush
- Large bucket of water
- Spray bottle filled with water
- Access to a hose
- Metal trash can

Background:

In the last section, you learned that immature plants can be made up of 75% water (page 47; FYI: a watermelon is about 92% water!). That's a lot of water! As the summer progresses, plants lose water through transpiration (which is the evaporation of water from plants primarily through pores on the leaves). As plants lose water, they turn from green to brown.

Do: In teams, assemble a mixture of fuels according to one of the recipes below.

ALL FUELS MUST FIT INSIDE THE BUCKETS, WITH NOTHING HANGING OUT OVER THE EDGES.

Use only the fuels included in each recipe, nothing else should be added.

Recipes:

1. Green grasses or plants (if these are gathered more than a day before the experiment takes place, they should be stored in a plastic bag in the refrigerator).
2. Dead and dry plants
3. Sagebrush
4. Dead and dry plants, but sprayed lightly with water.

- Have students write a hypothesis (what they think will happen when you drop the match in the bucket) for each recipe in a notebook (or lab book). *Hypothesis are not guesses, instead, students should use what they have learned so far to make an "educated guess" based on that material.*

- One approach to writing a hypothesis is to use this statement: "If ____ [I do this]_____, then__[this]__will happen."
    - Example: If I never water my plant, it will dry out and die.
    - Example: If a plant is green (has high fuel moisture), then it will not burn.

- Using the seven matches provided for each bucket, the TEACHER should attempt to light the fuels, one bucket at a time to allow the students to see how each fuel burns.
- Students should write observations in their notebook for each recipe.
- Questions to consider:
    - Did the fuel burn slowly or quickly?
    - Were there big or small flames?
    - Did it just smolder?
    - How much smoke was produced?

Apply:

Students will most likely note that it was difficult to ignite the "green" fuels and the fuels that had been sprayed with water.

- Challenge students to explain why, potential answers:
    - They had more moisture than the other fuels; the heat from the flame first has to evaporate the moisture before it can ignite the fuel.
    - Once the green fuels started burning, they actually burn quite well, why? *They have plenty of stored energy—more, in fact, than dead plant materials. Pine needles also contain oils and other compounds that burn well.*
- Have students compare and contrast the ability of large and small materials to burn.
    - Why would the smaller pieces ignite more easily? *The smaller pieces have more surface areas exposed to the heat of the flame and to oxygen).*

Safety Procedures:

- Notify, in advance, any individual or agencies (principal, local fire protection unit, and/or maintenance staff) that would want to know that your activities involve fire.
- BE AWARE OF YOUR SURROUNDINGS!
- Choose open, well ventilated, debris and vegetation free location for this activity to reduce the chances of fire alarms being triggered.
- Be aware of wind direction and force. Postpone this activity if it is too windy and you will be working outdoors.
- Instruct students on the use of the spray bottles and fully charged fire extinguishers that must be in the activity area. Assign 1-2 students with firefighting duty—they should have spray bottles/hose in hand prior to lighting anything on fire.
- Instruct all students to NOT attempt this activity without an adult present.
- Student and teacher should wear safety goggles; tuck in loose clothes and tie back long hair.
- Have emergency phone numbers readily available
- Inform the students that they should never use fire without an adult present.

3. Skills Challenge: Matchstick Rangeland

(Adapted from Forest Service Fire Trunk Activities. You may choose to have each student create a rangeland or work in teams.)

Time: 30-45 minutes
Supplies: Supplies for 1 matchstick rangeland

- 30 wooden matches, toothpicks, or short pieces of wheat straw
- 1 craft Styrofoam block (about 6x6x1")
- 1 aluminum baking pan large enough to place foam block in bottom
- 1-2 water-filled spray bottle
- 1 watch/clock with a second hand
- Hot pads/oven mitts
- Newspaper and scissors
- Safety goggles or eye glasses
- Fire Extinguisher, large bucket of water, and/or access to a hose

This can be done as a demonstration for younger audiences.
IT MUST BE SUPERVISED BY THE TEACHER

Do:

- Review Safety Procedures
- Have each student/team build one of the following rangelands:
  - **Rangeland 1**: Build a matchstick rangeland on a flat slope
  - **Rangeland 2 and 3**: Build a matchstick rangeland on a 20 degree slope (ignition will vary)
  - **Rangeland 3:** Build a matchstick rangeland on a 40 degree slope

Detailed instruction for building a matchstick rangeland:

1. Place aluminum pans on a heat resistant surface (sidewalk, table, etc.)
2. Place the Styrofoam board in the aluminum pan to create a base for the rangeland (you can cover your Styrofoam board with aluminum foil if you plan to do this more than once)
3. Place the untreated ends of the unlit matches into the boards so the tips are about ½ inch apart. (You can also use toothpicks and/or straw for this step).

   For round 1, the same amount of matches (density) should be used in each of the rangelands. Round 2 is described under the "optional" section below.
4. Establish the slope of the matchstick rangeland (to create the slope, find a rock, or piece of wood, etc. to put under one side of the Styrofoam board):
   - Rangeland 1 should be flat
   - Rangeland 2 and 3 should be elevated about 20 degrees (~3-4 inches)
   - Rangeland 4 should be elevated about 40 degrees (~6 inches)
5. Once all have been set-up, bring students together and discuss the next step.
6. Ask students to look at the set-up and predict how and why fire behavior will differ among them based on how they are ignited (write hypothesis in lab book or notebook). Remind them that any inaccurate predictions are celebrated because it shows participants are learning something new.

7. Ignition:
    - Rangeland 1: light the edge row of matches
    - Rangeland 2: light the matches at the bottom edge of the slope
    - Rangeland 3: light the matches at the top of the slope
    - Rangeland 4: light the matches at the bottom edge of the slope
8. Assign one student to be the timekeeper (they will say go when you are ready to ignite the matchstick rangeland) and will stop the timer when there is no longer fire.
9. Light one pan at a time so all students can observe what happens to each model. When the timekeeper says "go," light one row of matches. All students should record the following observations about fire behavior:

    - Density (number) of the fuel (matches)
    - Topography (slope)
    - Point of ignition (i.e., bottom or top of the slope)
    - Time to burn
    - The density of unburned matches
    - Any other observations to explain fire behavior

Apply:

After all the rangelands have been set on fire, have the team members share their observations of different fire behavior.

Discussion Questions:

- How did the slope affect each fire's spread?
- How well did fire burn downhill?

Optional: After you have completed the activity, have students create their own scenarios. For example, students could adjust how matchsticks are placed (perhaps there has been a fuels treatment that removed sagebrush (i.e., matchsticks) from a portion of the rangeland). Perhaps there are invasive annual grasses creating a continuous fuel load (e.g., this can be mimicked using shredded newspaper or dried plants). Students may want to adjust the ignition source (e.g., unsupervised campfire), or perhaps they will use grazing to create a fuel break. The possibilities are endless.

Section 7: Plant and Animal Interactions

1. Web of Life
2. Skills Challenge: Calculating Stocking Rates
3. Livestock Grazing Systems

Learning Objectives:

- Demonstrate an understanding of food webs, discover the many ways that plants and animals on rangelands are connected.
- Describe livestock grazing systems
- Calculate Stocking Rates

Idaho General Education Performance Standards

- PS3-5-1, LS2-5-3, LS2-5-4, LS2, MS-1, LS2-MS-2, LS2-MS-4, LS2-MS-5, LS2-MS-6

Introduction: Plant and Animal Interactions

Rangelands are incredibly dynamic ecosystems. Drastic changes can be observed among seasons within a year and across years and over decades. There are many factors that cause rangelands to change over time—so far, you've learned about fire, invasive plants, and weather and climate. Another major factor that causes change is grazing which we will learn more about in this section. These factors change the plants and animals that inhabit rangeland sometimes in ways that land managers and users find desirable and other times, in ways that are considered adverse.

1. Web of Life

(Adapted from Project Learning Tree)

Time: 20-25 minutes
Supplies:

- Plant, animal, and rangeland tools cards
- Ball of string, yarn, or twine

Background:
Rangelands are complex, living systems that are composed of many different animals and plants that interact with and depend on each other. A **food chain** is a simplified way of showing these relationships between plants and animals on rangeland. For example, a food chain on rangelands may consist of the following components:

Sun > bluebunch wheatgrass seeds > ground squirrel > Prairie falcon

Food chain explanation: the bluebunch wheatgrass seed that uses the sun's energy to grow, is eaten by a ground squirrel, which in turn is eaten by a Prairie falcon
Note: In reality it is rare for an animal to eat only one type of food.

A **food web** represents the interactions of many food chains in an ecosystem. With your students, create a food web (i.e., Web of Life) on rangelands.

Do:

- Each student will pick (or randomly distribute) a plant, animal, or rangeland tool card
- Have the students form a circle around the "sun"
- Randomly hand the ball of string to one participant and have them throw (gently) the ball to someone with a card that links either as food, water, or shelter (habitat)
- Keep a hold of the string and throw to another "link" until everyone is a part of the web of life (some will have more than one connection)

Reflect/Apply:

- Once everyone is connected, tug gently to find who is connected to who
- What happens if one species is removed from the web? How many other connections are impacted?
- What happens if the water development is removed?
- Do many of these animals compete for habitat?
- How does the habitat change from year to year? How can this be demonstrated?

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^2 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 call **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.*

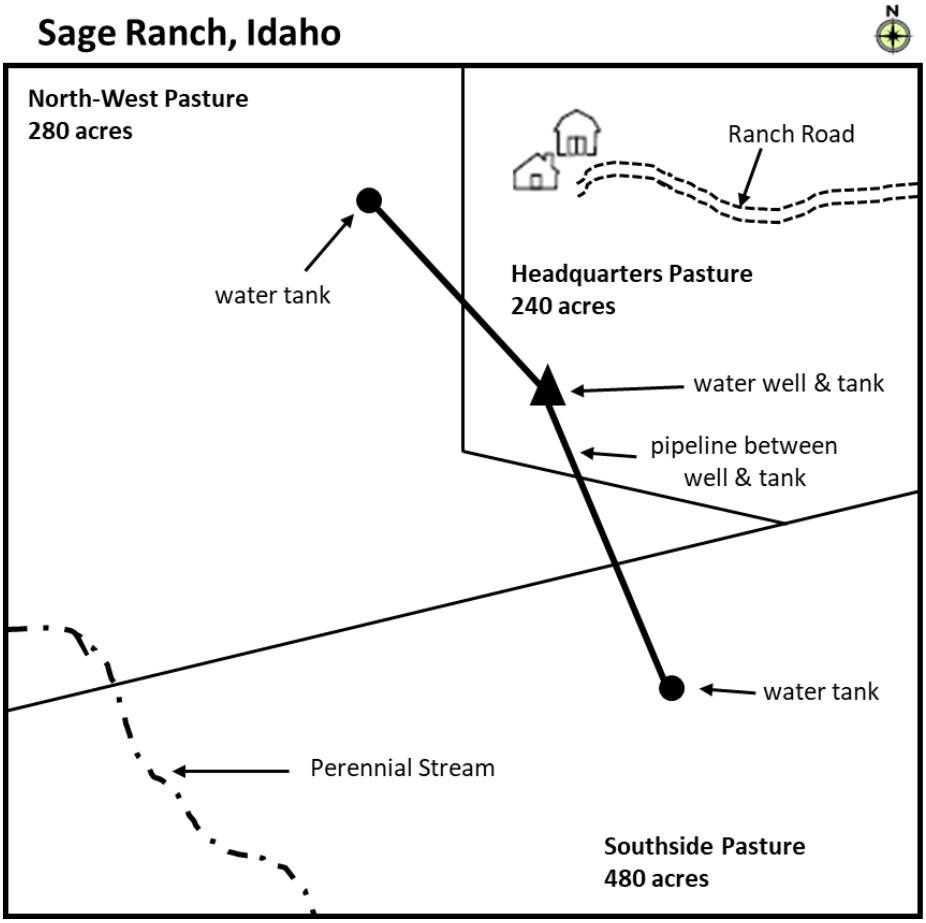
  An AUM is usually based on a 1,000 pound grazing animal. If you have a 1,000 pound cow, how much food will the each in 1 day? _____ (1000 lbs X 2.5% = 25 pounds).

  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** (t*his 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!*



North-West Pasture
Mix of bluebunch wheatgrass and crested wheatgrass. Produces about 1,100 lbs/acre of forage with a proper use of 50%

Headquarters Pasture
Native bunchgrasses (60%), Forbs (35%), and native shrubs (5%). Produces about 750 lbs/acre of forage with a proper use of 40%

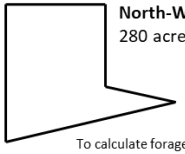
Southside Pasture
Bunchgrasses (50%), Forbs (30%), and native shrubs (20%). Produces about 600 lbs/acre of forage with a proper use of 30%

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

North-West Pasture
280 acres (ac)



To calculate forage demand, you will need the following numbers from the information provided:

- Size of pasture: _____ acres
- How much forage is produced: _____lbs/acre of forage
- Proper use: _____ %

Step 1: Calculate the total amount of forage (supply) in the pasture *(multiple the size of pasture by how much forage it produces).*

_____ ac X _____ lbs/ac = _____ lbs of forage

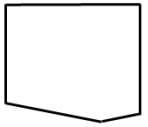
Step 2: Calculate the forage supply for the livestock (multiple the forage calculated above by the proper use percentage).

_____ lbs of forage X _____ % = _____ lbs of available forage.

Step 3: Convert the forage supply to AUMs
(*Remember that 1 AUM = 750 lbs).*

_____ lbs of available forage / 750 lbs = _____AUMs

Headquarters Pasture
240 acres



- Size of pasture: _____ acres
- How much forage is produced: _____lbs/acre of forage
- Proper use: _____ %

Use the space below to calculate the available forage for the Headquarters Pasture

Southside Pasture
480 acres

- Size of pasture: _____ acres
- How much forage is produced: _____lbs/acre of forage
- Proper use: _____ %

Use the space below to calculate the available forage for the Southside Pasture

Total forage available for livestock grazing at the Sage Ranch (add together forage supply for each pasture)
Forage supply = _____ pounds, which is _____ AUMs

FORAGE DEMAND

To calculate forage demand, you will need the following numbers from the information provided:

- Number of cows at the ranch: _____
- Average weight of each cow:_____ lbs
- % of body weight eaten daily: _____%
- Number of grazing days: _____days

Step 1: Calculate how much each cow will each per day *(multiple the weight of one cow by the % of body weight it will eat in one day).*

_____ lb cow X _____ % = _____ lbs/day

Step 2: Calculate how many pounds of forage all the cows on the ranch will eat in one day (multiple the amount for one cow X number of cows on the ranch).

_____ lbs/day X _____ cow = _____ lbs forage demand for one day.

Step 3: Calculate how much forage is needed for 90 days (multiple total forage needed by 90 days)

_____ lbs forage demand for one day X _____days = _____ lbs total forage demand for the entire grazing period.

Step 4: Convert the forage demand to AUMs
(*Remember that 1 AUM = 750 lbs).*

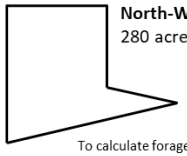
_____ lbs of forage demand / 750 lbs = _____AUMs

Total forage demand at the Sage Ranch
Forage demand = _____ pounds, which is _____ AUMs

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



North-West Pasture
280 acres (ac)

To calculate forage demand, you will need the following numbers from the information provided:

- Size of pasture: __280_____ acres
- How much forage is produced: _ 1,100_____lbs/acre of forage
- Proper use: _50_ %

Step 1: Calculate the total amount of forage (supply) in the pasture *(multiple the size of pasture by how much forage it produces).*

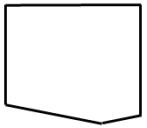
__280_ ac X _1,100___ lbs/ac = _308,00____ lbs of forage

Step 2: Calculate the forage supply for the livestock (multiple the forage calculated above by the proper use percentage).

__308,000___ lbs of forage X _50_ % = __154,000__ lbs of available forage.

Step 3: Convert the forage supply to AUMs
(Remember that 1 AUM = 750 lbs).

_154,000_ lbs of available forage / 750 lbs = __205_AUMs



Headquarters Pasture
240 acres

- Size of pasture: ____240_____ acres
- How much forage is produced: __750_____lbs/acre of forage
- Proper use: ___40 %

Use the space below to calculate the available forage for the Headquarters Pasture

Answer:
240 acres X 750 lbs X 40% =
72,000 pounds OR 96 AUMs

Southside Pasture
480 acres

- Size of pasture: ___480____ acres
- How much forage is produced: __600____lbs/acre of forage
- Proper use: __30 %

Use the space below to calculate the available forage for the Southside Pasture

Answer:
480 acres X 600 lbs X 30% =
86,400 pounds OR 115 AUMs

FORAGE DEMAND

To calculate forage demand, you will need the following numbers from the information provided:

- Number of cows at the ranch: _180_____
- Average weight of each cow:__600___ lbs
- % of body weight eaten daily: _2.5%
- Number of grazing days: ___90__days

Step 1: Calculate how much each cow will each per day *(multiple the weight of one cow by the % of body weight it will eat in one day).*

___600__ lb cow X _2.5__ % = __15__ lbs/day

Step 2: Calculate how many pounds of forage all the cows on the ranch will eat in one day (multiple the amount for one cow X number of cows on the ranch).

__15____ lbs/day X _180_ cow = __2,700__ lbs forage demand for one day.

Step 3: Calculate how much forage is needed for 90 days (multiple total forage needed by 90 days)

__2,700_ lbs forage demand for one day X __90__days = __243,000___ lbs total forage demand for the entire grazing period.

Step 4: Convert the forage demand to AUMs
(Remember that 1 AUM = 750 lbs).

_243,000 lbs of forage demand / 750 lbs = __324_AUMs

Total forage available for livestock grazing at the Sage Ranch (add together forage supply for each pasture)
Forage supply = ___312,400_____ pounds, which is ___416_____ AUMs

Total forage demand at the Sage Ranch
Forage demand = ___243,000____ pounds, which is __324_____ AUMs

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.

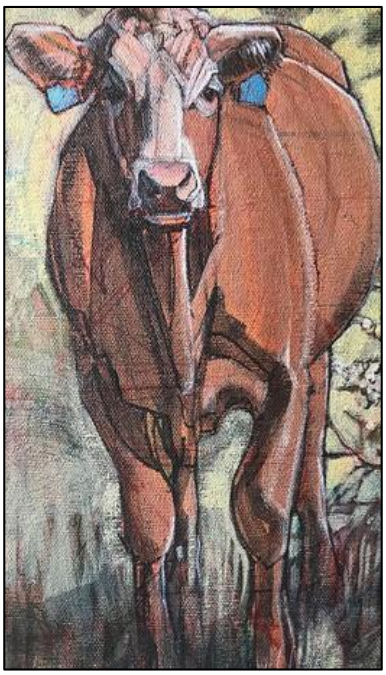
Stocking Rate: The relationship between the number of animals and the grazing management unit utilized over a specified time period. May be expressed an animal units per unit of land area.

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.

3. Livestock Grazing Systems



Time: 40-45 minutes
Supplies:

- Plastic toy cows and sheep OR different color beans to represent livestock
- String or yarn, six pieces ~ 10" long (to be used as fencing)
- Tin foil that can be formed into water developments

Introduction:
Rangelands produce various types and amounts of vegetation every year. The amount of annual vegetation growth varies depending on plant type, topography, precipitation, localized climate, and soils. There are few tools that rangeland managers can use which can improve rangeland conditions such as grazing systems.

Managed grazing systems incorporate grazing to remove unwanted plants (invasive or noxious weeds), excess plant growth, and dead plant material while allowing time for the plants to rest and grow. Other tools to remove unwanted plants such as noxious weeds are chemicals or mechanical tools. Grazing management systems incorporate soils, watersheds, water availability, plants, wildlife, and livestock into a plan. Using fences, gates, stock water (both natural and man-made), salt licks and herding, a pre-specified number of livestock animals are put into a pasture at a pre-determined time of year for a limited amount of time. Identifying the type of livestock should correlate to the type of vegetation available.

The location and timing of the livestock grazing must be coordinated with the vegetation availability in the pasture. Livestock can only be moved so far so fast. Moving through pastures sometimes replicates the green-up of plants. Spring grazing patterns typically mean moving up in elevation as the snow melts and plants green-up. Fall grazing are typically reversed back to the home ranch (as it turns colder, grazers move back to lower elevations). Winter can include rangeland grazing or supplemental feeding with hay reserves.
Common livestock grazing management strategies are as follows:

- **Continuous** is a grazing system that keeps livestock in one pasture for a whole year or grazing season. This system requires keeping fences, gates, and water systems working all year. The plants are not given "rest" to re- grow without livestock impacts. The livestock are not moved so it requires less cattle stress and labor costs. It's important to make sure there is enough feed for the livestock all season. Calculating AUM's for a full season should not include regrowth.

- **Herding** means moving livestock (mostly sheep but can include cattle) through grazing areas (which may have fences). This is a labor-intensive option because it requires a full-time person(s), horse (or off-road vehicle), and a dog to keep the livestock in the correct area. Daily access to water is also part of the challenge. Since there is more oversight of the grazing, calculating AUM's is not as detailed.

- **Three pasture rest-rotation** means that rangeland is divided into three pastures by fences. The livestock (typically cattle) are moved through the pastures in a pattern that allows for rest of pastures at different times every year. An example is starting in pasture 1 in spring through early summer then moving to pasture 2 after "seed ripe" (which is when the perennial plants have set their annual seed-which depends on climate and elevation) and returning to a late summer-fall grazing pasture after the plants are dormant. The rotation includes areas of complete rest for one year (pasture 3). This rotation changes each year. Each pasture will need access to fresh water during the season of use. Fences and gates are required to keep the animals in the correct pastures.

- **Deferred-rotation** means the livestock alternate between two pasture (spring-summer use and fall use). This allows alternating seasons of rest. Stocking rates (AUM's) are set at a moderate rate. This system is designed to increase grazing pressure in a specific pasture to improve livestock distribution. Alternating seasons of use allow for plants to increase root systems after grazing. Access to fresh water and good fences is also a concern in this system. Post seed-ripe grazing encourages native seeds to be "planted" (pushed into the soil) by the livestock hooves.

Do:

- Describe each grazing management system
- Design a grazing system with the string (fences), water systems, and livestock on the worksheet or large paper for demonstration.
- Identify tools (e.g., water trough, fence, horse, etc.) to manage livestock on rangeland and describe their purpose

Reflect/Apply:

- Present your plan with description of impact on the rangeland
- Compare and contrast the different systems