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

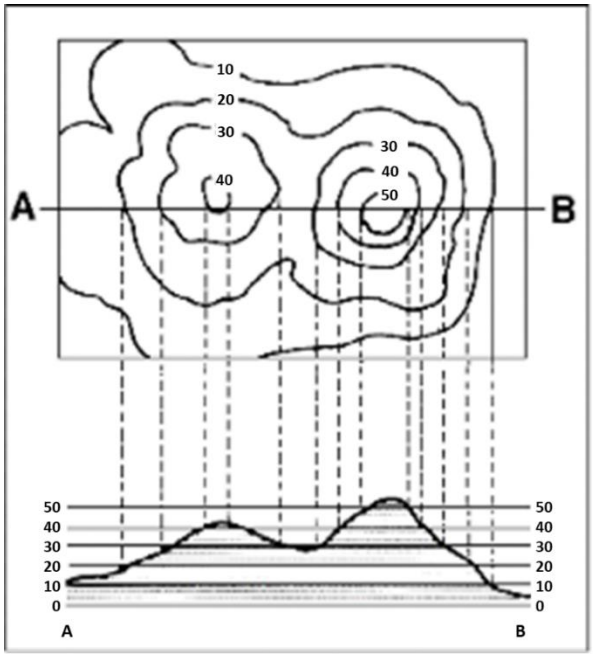
Background:
Land managers care for rangeland, forests, and croplands by managing the health of the watershed. A watershed is an area of land that drains water to the same endpoint. You can think of a watershed as a giant bowl. As water falls onto the bowl's rim and sides, it flows down inside the bowl. 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

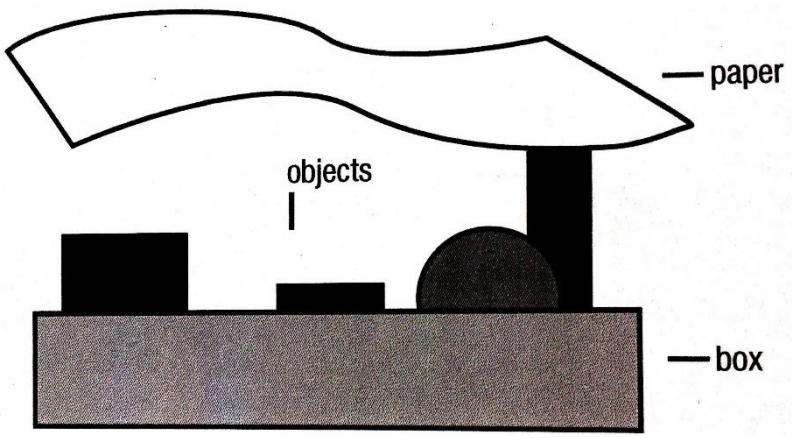
(Modified from www.miseagrant.umich.edu/flow)

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.

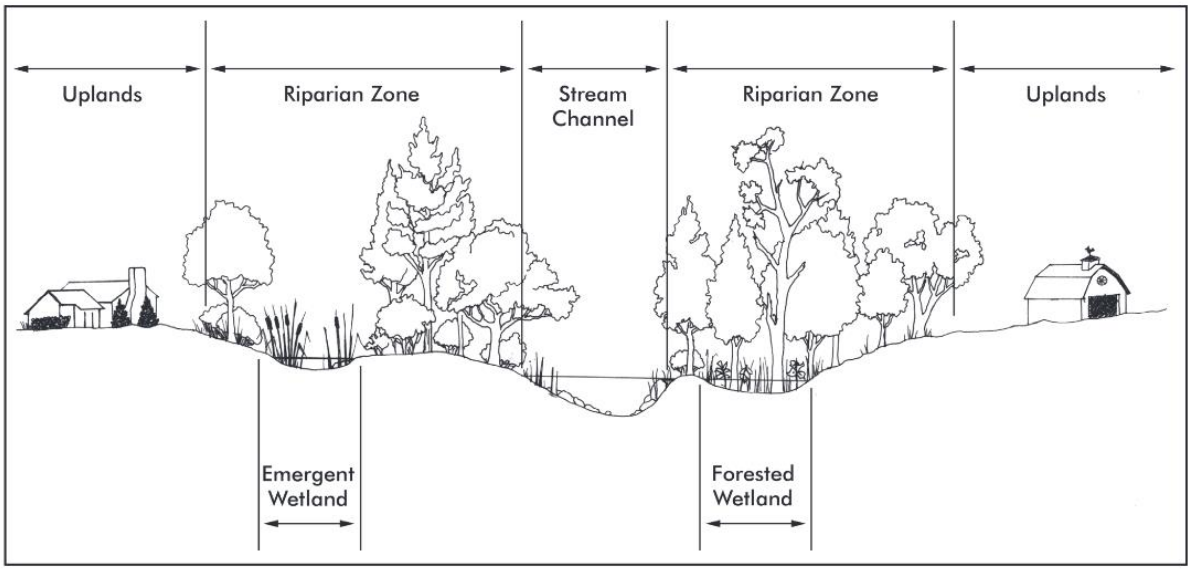


Figure 2-1. Relationship Between Wetlands, Uplands, Riparian Areas, and the Stream Channel

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.

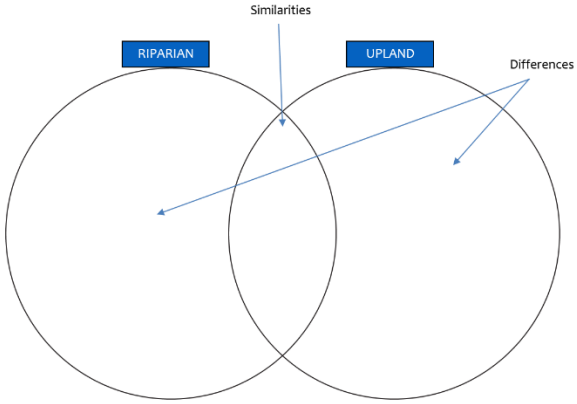
Upland sites are composed of plant species that have adapted to survive with minimal water reflective of the average precipitation of the region. Many rangeland plants have evolved strategies to maximize extraction of available soil water, such as the very deep root systems found in desert shrubs or 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.

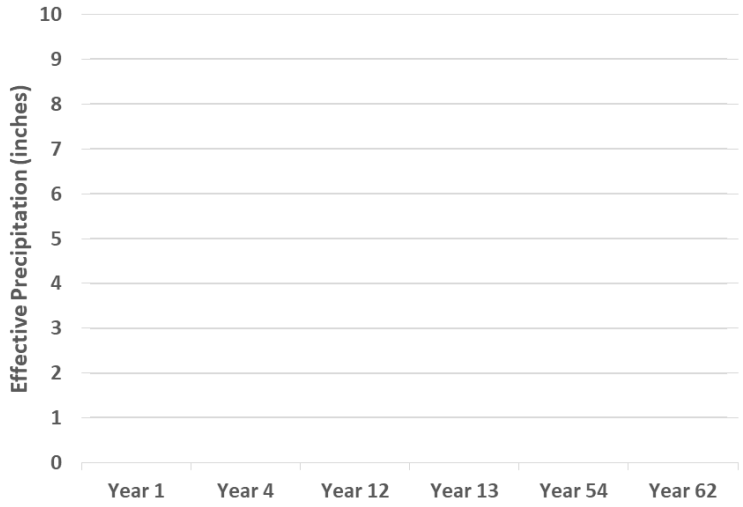
Do:

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

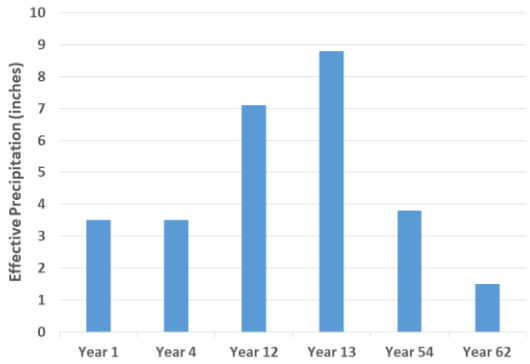
Reflect:

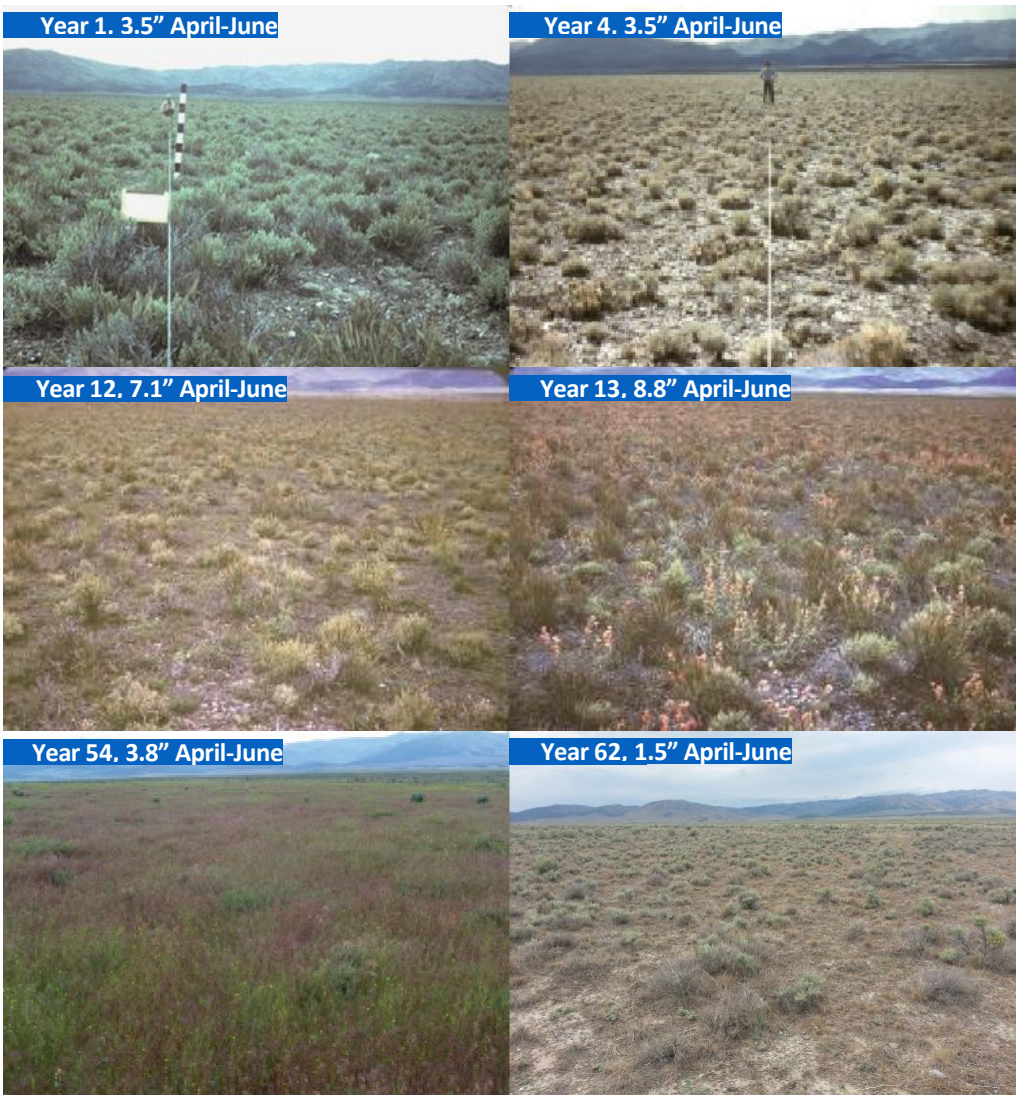
Observe the differences between the photos and answer the following question:

- 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.