

Virtual Field Trip: Wild Biomes – From America’s Rainforest to America’s Desert

TEACHER’S GUIDE

Grades: 3-8

Subjects: Science and Geography

Description:

On this virtual field trip, we’ll first travel to the lush, rain-soaked splendor of the Olympic Peninsula and explore the urban watershed of Seattle. The abundant rainfall here provides plenty of water, but keeping it clean and safe can be a challenge. Next, we’ll head to Arizona’s dry, desert landscape and take a tour of the Verde River, one source of water that nourishes this parched land. Here, people and other living things must adapt to a limited water supply, yet sudden and violent storms can dump seven inches of rain in a single night! Join The Nature Conservancy’s water scientist Kari Vigerstol on this virtual field trip to find out how geography, people, and water interact in two of America’s “wildly” unique biomes.



Kari Vigerstol
Senior Hydrologist, Global
Freshwater Team

Standards:

Next Generation Science Standards Disciplinary Core Ideas

- ESS2.A Earth Materials and Systems
- ESS2.C The Roles of Water in Earth’s Surface
- ESS2.D Weather and Climate
- ESS2.E Biogeology
- ESS3.A Natural Resources
- ESS3.B Natural Hazards
- ESS3.C Human Impacts on Earth Systems
- LS1.C Organization for Matter and Energy Flow in Organisms
- LS2.A Interdependent Relationships in Ecosystems
- LS2.C Ecosystem Dynamics, Functioning, and Resilience
- LS4.C Adaptation
- LS4.D Biodiversity and Humans

National Geography Standards

- 8 - The characteristics and spatial distribution of ecosystems and biomes on Earth’s surface
- 12 - The processes, patterns, and functions of human settlement
- 14 - How human actions modify the physical environment
- 15 - How physical systems affect human systems



Discussion Questions: Use these questions for a follow-up discussion with your students after viewing the virtual field trip.

1. Where can you find a temperate rainforest in the United States?

Answer: Temperate rainforests can be found from California all the way up to Alaska on the Pacific Coast. The Olympic Peninsula in Washington State is a great example.

2. What are some differences between the temperate rainforest and desert biomes?

Answer: Temperate rainforests are a type of woodland with a mild climate and heavy rainfall. For example, parts of the Olympic Peninsula can receive from 140 to 167 inches of rainfall a year. Deserts have a dry climate and have sparse rainfall. However, sometimes deserts can receive a lot of rain at one time and flash flooding becomes a problem.

3. What types of organisms can you find in the temperate rainforest of Washington State?

Answer: Trees like Douglas fir, hemlock, cedar, and spruce. The Olympic Marmot is a type of mammal that is found only on the Olympic Peninsula.

4. Why does Western Washington receive so much rainfall compared to Eastern Washington?

Answer: The rain shadow effect is responsible for this phenomenon. When water from the Pacific Ocean evaporates, the resulting moist air is carried by the wind across the landscape and toward the Cascade Mountains (windward side). When an air mass moves from a low to high elevation (such as it does over a mountain range), it expands, because there is less pressure, and it cools. Cool air cannot hold moisture as well as warmer air and cool air tends to form clouds, which produce rain and snow as they move up a mountain. As the air mass moves down the eastern slope of the mountains, the elevation drops, the air warms, and the clouds dissipate, producing less rainfall. That's why it's often cloudy and rainy in Seattle, but on the east or leeward side of the Cascade Mountains it's often more dry and sunny! [This satellite image from NASA shows the result of the rain shadow effect in Oregon State](#) and [this satellite image depicts Washington State](#).

5. What does a hydrologist do?

Answer: Hydrologists measure the properties of a body of water like stream flow and volume. They collect water samples and test for certain properties like turbidity, pollutants, and pH. They also analyze data on the environmental impacts of things like drought and pollution.

6. Where does our water come from?

Answer: Students may have a variety of answers, but your class can look up where their water comes from on [The Nature Conservancy's website](#).

7. What is a watershed?

Answer: A watershed is an area of land where the water all drains to the same place. For example, if it rains on a mountainside, the water will flow downhill and eventually end up in a river or lake or even the ocean. Hills, mountains, canyons and other land features will affect where water will drain into a [watershed](#). This [map by USGS](#) depicts all of the watersheds in the U.S. derived from major rivers.

8. Why is a watershed important?

Answer: Watersheds supply our drinking water, water for agriculture and manufacturing, as well as opportunities for recreation like boating and swimming. Watersheds also provide habitat for plants and animals. Clean, healthy watersheds sustain our lives!

9. What does impervious mean?

Answer: It means that a fluid cannot pass through. An example is concrete or some solid surface that water cannot penetrate or go into.

10. How does water move differently in an urban watershed compared to a more natural watershed?

Answer: Because urban watersheds contain a lot of impervious surfaces like parking lots, rooftops, and other paved areas like roads – water in urban watersheds flows quickly over these surfaces, which can contribute to flooding. Water also picks up trash and pollutants in urban watersheds and eventually, these items are carried into rivers, lakes, and even the ocean, which can be bad for the environment. In a natural watershed, the natural surfaces like sand and soil allow the water to seep in more slowly and it gets filtered along the way. Pollutants like oil get filtered by the soil before they can get into our water supplies and our rivers, lakes, and oceans.

11. Why are forests, grasslands, and wetlands important?

Answer: These areas are nature’s filters. They keep erosion and pollution from flowing into our water and they slow rainwater down, which helps to prevent flooding and also allows water to seep into the ground and replenish underground water supplies.

12. What is a biome?

Answer: A biome is a large community of plants and animals that occupies a distinct region. Biomes on the land are defined by their climate and dominant vegetation. The two biomes in the virtual field trip are desert and temperate rainforest but other biomes include grasslands, tropical rainforest, tundra, taiga, and deciduous or coniferous forests.

13. Describe the Sonoran Desert biome.

Answer: The Sonoran Desert biome is found in southern Arizona and is one of our country’s hottest deserts. It’s fairly warm there all year because it is at a lower elevation than the Great Basin Desert of Northern Arizona, which is cooler and can even get snow. The Sonoran Desert has two rainy seasons every year, so while it has a dry climate, it still gets some precipitation.

14. What adaptations do desert plants have that help them to survive in dry conditions?

Answer: Cacti are an example of a desert plant with adaptations to dry conditions. They have spines, which are modified leaves. By having a spine instead of a leaf, the cacti are able to cut back on the amount of water that would normally be lost through the surface area of a leaf. The spines double as a protective measure because they keep thirsty desert animals from eating the cacti! The saguaro cactus is a classic Sonoran Desert species. When it rains, the saguaro can expand as it takes up rainwater through its roots. This way, the saguaro can store water for long periods of time.

15. How is the Verde River Watershed different than a watershed in the Pacific Northwest temperate rainforest?

Answer: In the Verde River watershed where there isn’t much rain, the river is fed mainly by groundwater. Groundwater is found deep underground and this water moves up to the surface and then along through the river itself. In Western Washington State, where there is more rain, the watershed gets more of its water from surface water that comes from rain or melting snow.

16. Explain why flash floods can occur in dry, desert areas.

Answer: Desert areas have very dry soil that can’t soak up water very well. When there’s a downpour in a desert, the water moves very quickly across these hard, dry surfaces. A flash flood can occur when a lot of rain comes down in the desert in a very short period of time. Creeks and streams that were once dry can fill up with water very quickly. In desert areas, these washes or arroyos can be very dangerous when they suddenly fill with rapidly moving flood waters.

17. Why is water important?

Answer: The human body is more than 60% water. We rely on clean water to stay hydrated and to keep us healthy. The plants and animals around us also rely on clean water for their survival.

18. What are ways that you can cut down on your water use?

Answer: You can turn off the water while you are brushing your teeth and take shorter showers or shower less frequently. Your parents could cut down on washing their cars or watering their lawns or plant native vegetation that doesn't require as much water to grow – especially if you live in a desert area. Learn more about your water footprint here: <http://www.nature.org/ourinitiatives/habitats/riverslakes/explore/water-footprint-of-an-american.xml>

Related Resources: The following lesson plans and videos can be used to supplement the virtual field trip.



How Natural Areas Filter Water

Grade Levels: 6-8

Nature works to filter and release water over time, reducing the amount of treatment needed to filter water and helping to prevent flooding. In this lesson, students learn about the importance of water quality, examine their water consumption, and brainstorm threats to the water supply. **Includes directions for recreating the filtration demonstration that Kari conducted during the VFT where she compared natural surfaces to impervious areas.**



Garden Activity Guide: Water

Grade Levels: All

By filtering rainwater and slowing the movement of water to rivers, lakes and oceans, a garden works as a mini-watershed. In this lesson, students calculate the permeable surface area of their garden and periodically measure rainfall amounts. Using the collected data, students determine how much water their garden filters and explore the relationship between their garden and water quality in the surrounding watershed.



Managing Salmon to Support Healthy Forests

Grade Levels: 6-8

In this lesson plan, students address the impact of unsustainable fishing practices. Salmon runs are an important factor in nutrient cycling. Students explore the connection between the size of salmon population and forest health. First, they test a population model to estimate a sustainable salmon harvest. Second, they simulate variation in nutrient input by comparing growth of plants given inputs of different concentrations of fish-based fertilizer with a control.

Relevant Standards for Wild Biomes: From America's Rainforest to America's Desert

National Geography Standards

- 8 [The characteristics and spatial distribution of ecosystems and biomes on Earth's surface](#)
- 12 [The processes, patterns, and functions of human settlement](#)
- 14 [How human actions modify the physical environment](#)
- 15 [How physical systems affect human systems](#)

Next Generation Science Standards

Grade	Topic	Disciplinary Core Idea	Performance Expectation
K	Life Science	LS1.C Organization for Matter and Energy Flow in Organisms - All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow.	K-LS1-1 Use observations to describe patters of what plants and animals (including humans) need to survive.
K	Earth Systems	ESS2.D Weather and Climate - Weather is the combination of sunlight, wind, snow, or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.	K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time.
K	Earth Systems	ESS2.E Biogeology - Plants and animals can change their environment.	K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
K	Earth Systems	ESS3.C Human Impacts on Earth Systems - things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

K	Earth Systems	ESS3.C Human Impacts on Earth Systems - things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things.	K-ESS3-3 Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. Also ETS1.B Developing Possible Solutions - designs can be conveyed through sketches, drawing, physical models. These representations are useful in communicating ideas for a problem's solution to other people.
K	Earth Systems	ESS3.A Natural Resources - Living things need water, air, and resources from the land and they live in places that have the things they need. Humans use natural resources for everything they do.	K-ESS3-1 Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.
2nd grade	Life Science	LS2.A Interdependent Relationships in Ecosystems - Plants depend on water and light to grow.	2-LS2-1 Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2nd grade	Life Science	LS4.D Biodiversity and Humans - There are many different kinds of living things in any area, and they exist in different places on land and in water.	2-LS4-1 Make observations of plants and animals to compare the diversity of life in different habitats.
2nd grade	Earth Systems	ESS2.A Earth Materials and Systems - wind and water can change the shape of the land.	2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
2nd grade	Earth Systems	ESS2.C The Roles of Water in Earth's Surface - Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.	2-ESS2-3 Obtain information to identify where water is found on Earth and that it can be solid or liquid.
3rd grade	Life Science	LS4.D Biodiversity and Humans - Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

3rd grade	Life Science	LS4.C Adaptation - for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
3rd grade	Life Science	LS2.C Ecosystem Dynamics, Functioning, and Resilience - when the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.	3-LS4-4 Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
3rd grade	Earth Systems	ESS2.D Weather and Climate - Climate describes a range of an area's typical weather conditions to the extent to which those conditions vary over years.	3-ESS2-2 Obtain and combine information to describe climates in different regions of the world.
3rd grade	Earth Systems	ESS3.B Natural Hazards - A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.	3-ESS3-1 Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard (flooding).
4th grade	Earth Systems	ESS2.A Earth Materials and Systems - Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.	4-ESS2-1 Make Observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4th grade	Earth Systems	ESS2.E Biogeology - Living things affect the physical characteristics of their regions.	4-ESS2-1 Make Observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4th grade	Earth Systems	ESS3.A Natural Resources - Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.	4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4th grade	Earth Systems	ESS3.B Natural Hazards - A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.	4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
5th grade	Life Science	LS1.C Organization for Matter and Energy Flow in Organisms - plants acquire their material for growth chiefly from air and water.	5-LS1-1 Support an argument that plants get the materials they need for growth chiefly from air and water.
5th grade	Earth Systems	ESS2.A Earth Materials and Systems - Earth's major systems are the geosphere, the hydrosphere, the atmosphere, and the biosphere. These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate...	5-ESS2-1 Develop a model using an example to describe the ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
5th grade	Earth Systems	ESS2.C The Roles of Water in Earth's Surface Processes - nearly all of Earth's available water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	5-ESS2-2 Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
5th grade	Earth Systems	ESS3.C Human Impacts on Earth Systems - human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.	5-ESS3-1 Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
Middle School	Life Science	LS2.A Interdependent Relationships in Ecosystems - Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.	MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

Middle School	Life Science	LS2.C Ecosystem Dynamics, Functioning, and Resilience - Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
Middle School	Life Science	LS2.C Ecosystem Dynamics, Functioning, and Resilience - Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.	MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
Middle School	Life Science	LS4.D Biodiversity and Humans - Changes in biodiversity can influence humans' resources such as food, energy, and medicines, as well as ecosystem services that humans rely on - for example, water purification and recycling.	MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
Middle School	Earth Systems	ESS2.C The Roles of Water in Earth's Surface Processes - Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, crystallization, and precipitation, as well as downhill flows on land.	MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
Middle School	Earth Systems	ESS2.D Weather and Climate -Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.	MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
Middle School	Earth Systems	ESS3.C Human Impacts on Earth Systems - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.	MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Middle School	Earth Systems	ESS3.C Human Impacts on Earth Systems - Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.	MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
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