How Do Wildfires Affect Our Water?

Objective:
Students will learn how wildfires impact watersheds and water quality and think critically about how people and communities can adapt to these changes. This activity aligns with **Next Generation Science Standards** for high school science education.

Next Generation Science Standards (NGSS) Standards:

- DCIs: ESS2.C: the roles of Water in Earth's Surface Processes, ESS3.A: Natural resources, ESS3.C: Human Impacts on Earth Systems, ESS3.D Global Climate Change

- CCCs: Cause and effect, stability and change, systems and systems models, energy and matter

- SEPs: Developing and using models, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence.

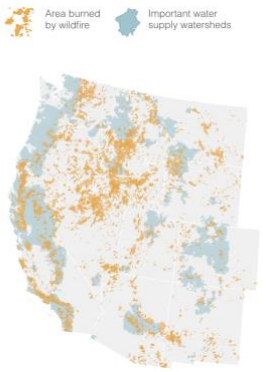
Key Terms:

- **Watershed** - A watershed is an area of land that drains all the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel.
- **Aquifer -** layer of underground rock and soil that holds groundwater.
- **Debris flow -** rapid mass movement where a mixture of loose soil, rock, organic matter, air, and water mobilizes as a slurry that flows downwards.
- **Turbidity -** measure of the level of particles such as sediment or organic matter, in a body of water
- **Sedimentation -** the process where eroded sediment (soil, rock fragments, etc.) is deposited by water, wind, ice, or gravity
- **Eutrophication -** the process where a water body becomes enriched with plant nutrients, most commonly phosphorus and nitrogen. This enrichment leads to excessive algal growth

Think - Individually

Think about the last time you saw news about a wildfire. What effects do you think wildfires have on the environment, specifically on our water sources. How might this impact water supplies throughout the United States?

Using the following data visualization page from USGS VizLab to complete the activity.
https://labs.waterdata.usgs.gov/visualizations/fire-hydro/index.html#/



Review - Pair or Group Discussion
After reading the passage on the page, ask students to define or discuss the following in pairs or groups.

1. What is a watershed?

2. What role do forests play in keeping our water clean?

3. How do wildfires change the way water moves through a watershed?

Analyze and Reflect - Answer individually or in small groups

Comprehension

1. Why are wildfires becoming more dangerous in the western U.S.?

2. What happens to the soil after a wildfire?

3. How do these soil changes affect rainfall and flooding?

4. What kinds of things might get into the water after a fire

Data Interpretation - On the visualization, look at the data from 1984 to 2020.

1. On the map of the western U.S., what do the orange areas represent? What do the blue areas represent?

2. What is the bar graph below the map showing?

3. What trend do you notice about the number of acres burned by wildfire over time? How does this trend relate to the areas being burned near watersheds?

4. How might this trend impact the water supply for people in the western U.S.?

Challenge - Design a Water Safety Plan

Imagine your town is downstream of a forest that just had a big wildfire. You are part of the water management team. Come up with three actions you would recommend to help protect your town's drinking water from pollution and sediment after the fire. Use ideas from the reading!

U.S. Department of Interior
U.S. Geological Survey

Applied Exploration

Fire vs. Forest - A Water Flow Experiment

Objective: Model how wildfires affect soil and water movement in a watershed by comparing water absorption in a healthy forest vs. burned land.

Materials (per group of 3–4 students):

- 2 aluminum baking pans or plastic trays
- Soil (enough to fill each pan with a 1–2 inch layer)
- Sponges or moss (to simulate leaf litter and vegetation)
- Aluminum foil or wax paper (to simulate burned, hardened soil surface)
- Spray bottle or cup with water
- Container to collect runoff

Procedure:

1. Set Up the "Healthy Forest" Pan
    a. Fill one pan with soil.
    b. Place sponges or moss on top of the soil to represent vegetation and leaf litter. This is your "Healthy Forest" model.

2. Set Up the "Burned Forest" Pan
    a. Fill the second pan with soil.
    b. Press down and cover parts of the soil with aluminum foil or wax paper to simulate hardened, hydrophobic soil. Add some soil over the top of the aluminum foil. This is your "Burned Forest" model.

3. Simulate Rainfall
    a. Place a Container at the bottom of each pan to catch runoff.
    b. Use a spray bottle or slowly pour equal amounts of water over both pans
    c. Observe what happens in each pan.
        i. Does the water soak in or run off?
        ii. How fast does the water move?
        iii. Is there erosion or sediment movement?

Discussion Questions:

1. Which pan soaked up more water? Why?

2. Which pan had more runoff or sediment?

3. How does this experiment show what might happen in a real watershed after a wildfire?

4. What might this mean for cities and towns that rely on this water?

Helpful Links:

https://labs.waterdata.usgs.gov/visualizations/fire-hydro/index.html#/

https://www.usgs.gov/mission-areas/water-resources/science/water-quality-after-wildfire?qt-science_center_objects=0#qt-science_center_objects

https://www.usgs.gov/special-topics/wildland-fire-science

For further exploration: https://www.cns-eoc.colostate.edu/from-forests-to-faucets-stem-kit/