

## Festival Activity: Watershed Detective

**Subject:** Science

**Concepts:** Watersheds and water quality

**Key Vocabulary**

- Watershed

**Skills**

- Observation
- Analyzing
- Predicting

**Materials**

- All materials will be supplied by activity leader.

Solve the mystery of what's happening in your **watershed** (the land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water) and the salmon's habitat. Using scientific tools, students become detectives and uncover clues about the temperature and amount of oxygen in the stream that affects its health.



### Grade Level Expectations (GLEs) or Evidence of Learning

#### Science

1.2.4 Understand that Earth's system includes a mostly solid interior, landforms, bodies of water, and an atmosphere.

1.3.3 Understand that a substance remains the same substance when changing state. Understand that two or more substances can react to become new substances.

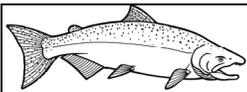
1.3.6 Understand weather indicators and understand how water cycles through the atmosphere.

#### **Objectives**

Students will: 1) test stream water for temperature and dissolved oxygen, and 2) explain effects of land-use activities on a watershed using the "Enviroscape" land-use model.

#### **Suggested Procedure**

Utilizing a 3-dimensional watershed model, students will observe how various land uses can affect water quality.



## Pre-Work: Branching Out!

**Subject:** Science

**Concept:** Watersheds

**Key Vocabulary:**

- Watershed
- Divides
- Runoff
- Tributary

**Skills**

- Organizing
- Analyzing
- Applying
- Evaluating

**Materials**

- Teacher Reference, "Branching Patterns"
- Blue-colored water
- Spray bottle or sprinkling can
- White trash bag
- Newspaper
- Colored markers

Is it possible to cross the Columbia River in one step? The pattern water makes as it flows through a watershed is familiar to students who have drawn pictures of trees or studied the nervous system. By investigating drainage patterns, students consider how watersheds distinguish different land areas.



Chalk Art by Candice Dillhoff

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#### **Objectives**

Students will: 1) predict where water will flow in watersheds, and 2) describe drainage patterns in watersheds.

#### **Background**

When the ground is saturated or impermeable to water during heavy rains or snowmelt, excess water flows over the surface of land as **runoff**. Eventually, this water collects in channels such as streams. The land area that drains water into the channels is called the **watershed** or drainage basin.

Watersheds are separated from each other by areas of higher elevation called ridge lines or **divides**. Near the divide of a watershed, water channels are narrow and can contain fast-moving water. At lower elevations, the slope of the land decreases, causing water to flow more slowly. As smaller streams merge together, the width of the channel increases. Eventually, water collects in a wide river that empties into a body of water, such as a lake or ocean.

From an aerial view, drainage patterns in watersheds resemble a network similar to the branching pattern of a tree. **Tributaries**, similar to twigs and small branches, flow into streams, the main branches of the tree. Streams eventually empty into a large river, comparable to the trunk. Like other branching patterns (e.g., road maps, veins in a leaf, the human nervous system), the drainage pattern consists of smaller channels merging into larger ones. This is diagramed in Teacher Reference, “Branching Patterns.”

Watersheds are either closed or open systems. In closed systems, such as Crater lake in southwest Oregon or the Great Salt Lake in Utah, water collects at a low point that lacks an outlet. The only way water naturally leaves the system is through evaporating or seeping into the ground. Most watersheds are open: water that collects in smaller drainage basins overflows into outlet rivers and eventually empties into the sea.

### **Vocabulary Words**

**Watershed** - the land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water.

**Divides** - points of higher ground that separate two adjacent streams or watersheds.

**Runoff** - precipitation that flows overland to surface streams, rivers, and lakes.

**Tributary** - a stream that contributes its water to another stream or body of water.

### **Suggested Procedure**

1. Make a transparency of Teacher Reference, “Branching Patterns” (the outlines of a watershed’s drainage pattern, a tree in winter, the human nervous system, and a road map). Show the students the transparency and ask them what all the pictures have in common. Optional: Using a branch from a tree is a great way to show your students this pattern.
2. Discuss how all the networks involve smaller channels merging together and becoming larger.
3. Now, you and your students will construct a watershed model. Find a flat surface outside to place your model or place the model on a large tarp in the classroom.
4. Crumple newspaper and place in a large, white garbage bag. Form the paper to simulate ridges and valleys. Explain to your students that this is an exaggerated model of the land within a watershed.
5. Tell students that the model will soon experience a rainstorm. Where do they think water will flow and collect in the model?

6. Spray blue-colored water over the model and note where it flows. Water may need to be sprayed for several minutes to cause a continual flow. As droplets accumulate on the garbage bag, they will begin to trickle down one side or the other and will form small pools along the bottom.

7. Assist students in identifying branching patterns as water from smaller channels merges into larger streams.

8. Have students use a colored marker to draw the actual branching patterns of water on the garbage bag. Ask them to confirm the locations of watersheds by noting where water has collected in the model.

9. Have students determine if smaller watersheds overflow into larger ones. Does all the water in the model eventually drain into one collection site (open watershed system)? Does the model contain several closed watershed systems (collection sites that lack an outlet)?

10. Compare the branching patterns they drew on their watershed with the branching patterns presented in step 1. Discuss how all the networks involve smaller channels merging together and becoming larger.

11. Provide groups of students with a copy of a local map. Have students locate streams and rivers and note where smaller rivers flow together or merge into larger ones. Ask them to encircle land areas they think drain into the rivers.

12. Have students pick one river on the map and follow its path in two directions. If all of the river is pictured, one direction should lead to the headwaters or source (where the line tapers off). In the opposite direction, the river will merge with another river or empty into a body of water.

13. Have students write a story or draw a picture about a local river. Have them describe how water moves to the river from surrounding land areas or tributaries and then flows to a larger body of water.

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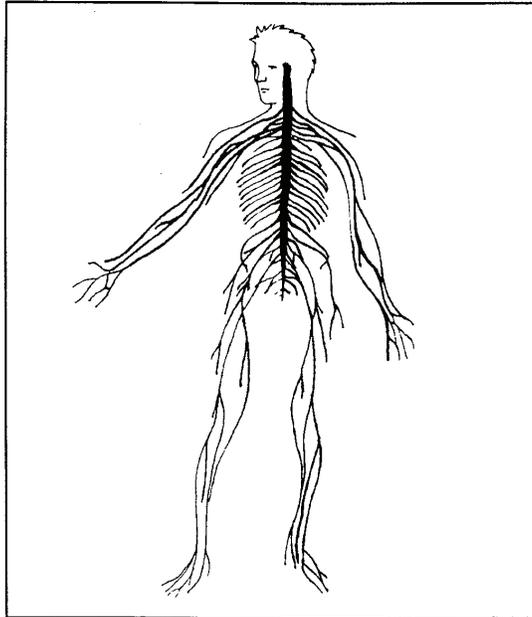
Continue to learn about “Watersheds” by visiting the following websites:

<http://www.epa.gov/owow/nps/kids/>

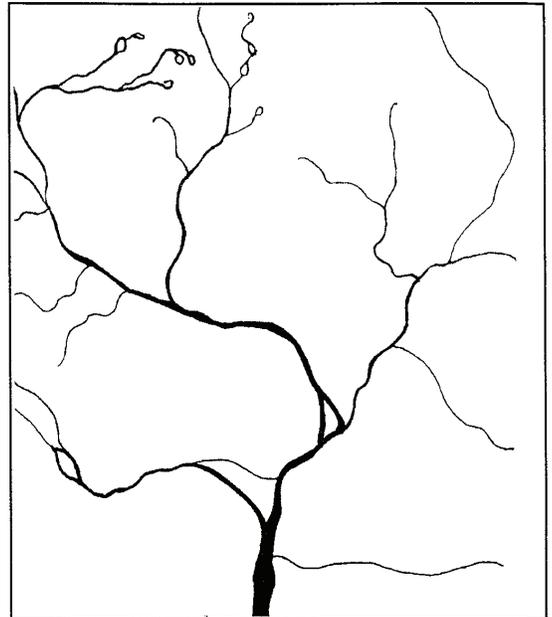
<http://www.bellmuseum.org/distancelearning/watershed/watershed2.html>

Each year, in affiliation with The Library of Congress Center for the Book, “River of Words” there is a free international poetry and art contest for youth on the theme of **WATERSHEDS**. The contest is designed to help youth explore the natural and cultural history of the place they live and to express, through poetry and art, what they discover. The contest is open to any child in the world from 5-19 years of age. To learn more visit the website: <http://www.riverofwords.org/contest/index.html>

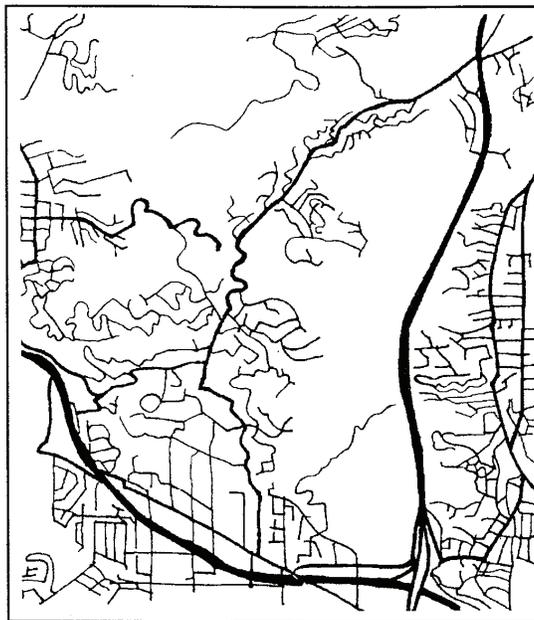
## Teacher Reference: Branching Patterns



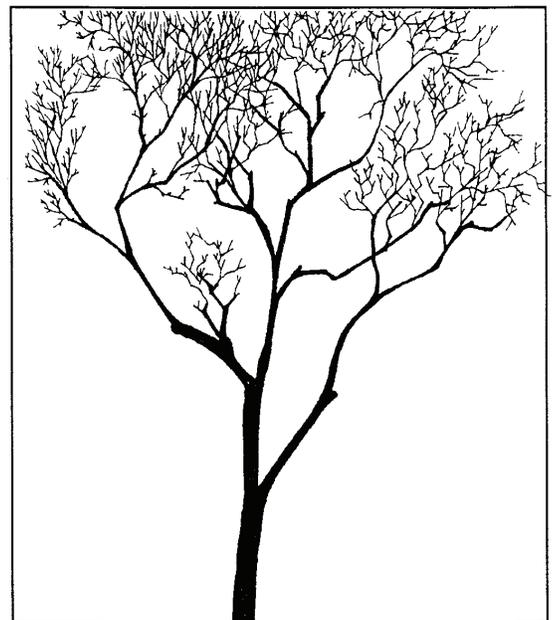
Human nervous system



Watershed drainage pattern

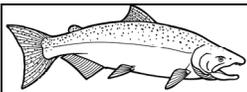


Road system



Tree in winter

Branching Patterns is part of the “Branching Out!” activity. It is used with permission from the Watercourse/Montana State University and the Council for Environmental Education (CEE) from the Project WET Curriculum and Activity Guide.



## Post-Work: Rainy-Day Hike

**Subject:** Science and Geography

**Concepts:** Watersheds and water quality

### Key Vocabulary

- Watershed
- Non-point source  
Pollutants
- Point-source  
pollution

### Skills

- Gathering information
- Organizing
- Analyzing
- Interpreting
- Mapping

### Materials

- Maps of the local community showing streams, lakes, and topography
- Drawing paper
- Two sets of copies of Student Worksheet, “Legend”
- Waterproof outerwear
- Clipboards or sturdy cardboard with rubber band to secure paper (heavier pieces of cardboard can be used to form a book; students can close map inside to keep it dry)
- Plastic wrap
- Pencils

What do a puddle on your playground and a nearby lake or stream have in common? Students are introduced to the concept of watersheds by collecting data about water flowing over school grounds.

### Science

1.2.4 Understand that Earth’s system includes a mostly solid interior, landforms, bodies of water, and an atmosphere.

1.3.6 Understand weather indicators and understand how water cycles through the atmosphere.

### Objectives

Students will: 1) identify the watershed in which their school is located, and 2) explain the role the schoolyard plays in the watershed.

### Making Connections

Students may be familiar with the idea of a **watershed** (the land area from which surface runoff drains into a stream channel, lake, reservoir, or other body of water), but unaware that they live and attend school within one. Observing water flowing through and collecting on their school grounds provides students with direct experience in their watershed.

### Background

Puddles, streams, and lakes all have something in common. They collect water that has drained from watersheds. Watersheds are like funnels; they are drainage basins where surface water runs off and drains into a common collection site. Watersheds are separate from each other by land forms (ridge lines or mountain divides). Water falling on each side of the divide drains into different watersheds and collection sites.

Surface runoff flows over a school’s grounds on its way to the collection site (e.g., a river); therefore, schoolyards are a part of a watershed. (Puddles are the collection sites of mini-watersheds: land surrounding puddles are the mini-drainage basins that empty into the puddle.) When the puddles overflow the soil becomes saturated, water is released.

Often, materials carried by water to the school grounds (e.g., litter, twigs, leaves, oil) are left behind. Surface

water leaving the school grounds may carry materials to the collection site of the watershed. These materials include soil, leaves, and twigs; litter; oil and gasoline from parking lots; and fertilizer from lawns.

As water flows from the school grounds, it combines with runoff from other land areas within the drainage basin. Materials from these other places are added to the water. While some substances decompose, settle out, or are filtered by soil, other matter continues to travel long distances downstream. Organic materials carried by the water nourish aquatic life. Some substances are toxic, however, and can endanger organisms consuming or living in the water.

Contaminants whose entry point into watershed is difficult to locate are classified as **non-point source pollutants**. Along with residential areas, agricultural fields, and paved parking lots, school grounds can contribute non-point source pollutants. The schoolyard contributes **point-source pollution** when the source of the pollutant can be traced back to a specific location on the school grounds (e.g., sewer, ditch, pipe).

### **Suggested Procedure (Before the hike)**

Show students a map of the community and identify local rivers or lakes. Ask the class if they think a connection exists between their schoolyard and these bodies of water. Tell the class they will take a fair-weather and a rainy-day hike, to study what happens to the water that falls on and flows over their school property.

Although plans for a rainy-day hike will generate student excitement, the wait for a wet day may prove discouraging. The lack of rain offers the opportunity to discuss with students the idea that people do not control the rain or other aspects of the weather. Remind students that even if people cannot “control” the weather, they can often predict it.

Have students listen to, watch, or read weather reports. When is rain predicted? Students can mark the calendar with the date and continue “preparations” for the hike.

### **Suggested Procedure (Part I)**

1. In planning for the rainy day, have students create a map of the school grounds. Divide the grounds into sections and assign groups to map each area. Orient students to which direction is north so all maps face the same direction.
2. Remind groups to include the following: school buildings, parking lots, designated playgrounds, natural areas (trees, grass, flower gardens), with emphasis on water features like streams, temporary and permanent ponds, and constructed water features like bird baths and fountains.
3. After students have completed their initial mapping, if there is a school building in their area, have them consider the following questions. Can they determine where the water that falls on the roofs goes? Does it flow off the roof into gutters that lead to waterspouts or does it fall directly onto the ground? Have students place an “X” on the buildings to indicate the location of waterspouts.
4. Make two copies of student maps, one for the fair-weather hike where students make predictions of water flow and one for the rainy-day hike when students check their predictions.

5. For the fair-weather hike, give each group a copy of their mapped section. Make a transparency of Teacher Reference, “Legend” to show the direction of water flowing down the hillside and location of puddles. Have each group predict the direction water will flow through their section. Where do students think water will be stored? Are there ponds or low spots?

6. Have students survey the ground area of their section for possible sources of point and non-point contamination (oil stains on parking lots, trash, tainted soil near the school dumpster). What materials could be on the roof of the school building that could be washed off during a rain (bird and rodent droppings, insects, dirt, roofing materials, leaves, twigs, etc.)?

7. Assemble the map sections from the groups and post in the classroom. Have them summarize their predictions. How do the predictions of individual groups relate to each other? Where do students think water flows onto the school grounds? Where will it flow off the school grounds?

### **Suggested Procedure (Part I)**

1. On a rainy day, have students dress properly; take them outside and begin a simple tour of the school grounds. Have students identify patterns of water flow. Discuss what influences the direction water moves. Have students:

- note slopes, depressions, cracks in the sidewalk, erosion trails, rocks, buildings, gardens, trees, etc.
- compare how fast or slow water flows in different places.
- identify ways water affects the surface of the school grounds (e.g., watering plants, eroding soil, piling up litter, washing away litter).
- note water flowing from the roofs of buildings and waterspouts.

2. Divide the class into their original groups and give each group a copy of their unmarked map section. Show the transparency, “Legend” and have students indicate the following on their maps: direction and of flowing water and areas of standing water. Remind students to use pencils—ink runs. They can cover their note pads with plastic wrap or cardboard when they are not writing.

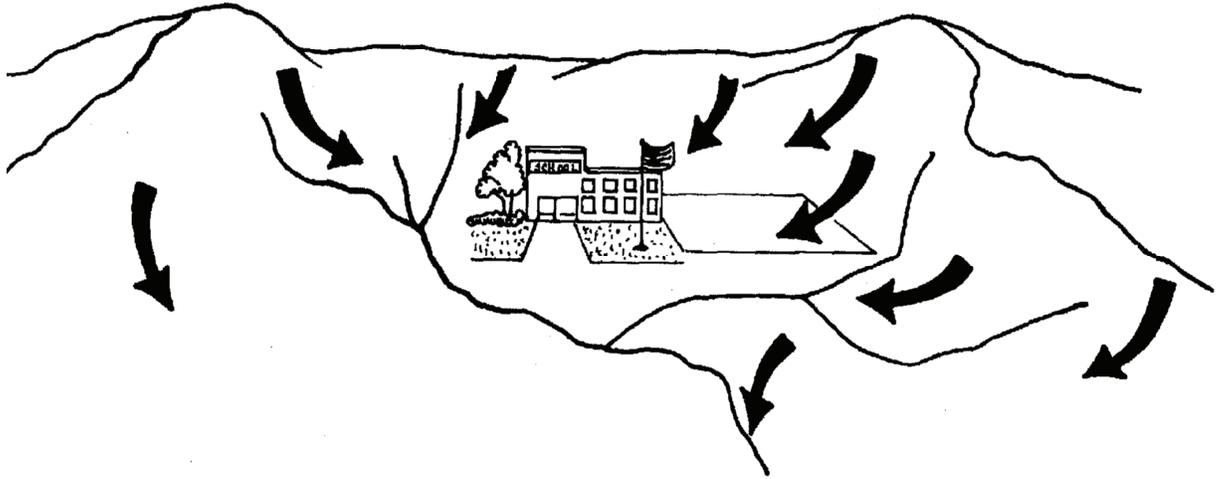
3. When students have completed their investigations, assemble the map sections and post in the classroom. Arrows of adjacent map sections should line up. If they don't, discuss reasons for discrepancies.

### **Wrap Up and Action**

Have students summarize the general pattern of surface water as it flows across the school property. They should identify areas where the flow of water is slowed by landforms and vegetation, collects in depressions, and flows off school property.

Have them compare the completed map on the rainy-day hike to the map indicating their predictions. How accurate were their predictions?

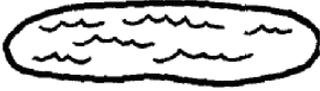
**Teacher Reference: Legend**



**Legend**



arrows indicate direction of water flowing onto and away from study area



a puddle shows where water collects in the study area