Go with the flow

Grades 6 to 9

Olympic National Park, Washington

During heavy rains or snowmelt excess water may flow over the surface of the land as surface runoff. If the ground is saturated or impermeable to water then the surface runoff will flow on top of the ground and eventually collect in channels, lakes, reservoirs or other bodies of water.
The land where the surface water drains is called a watershed or drainage basin.

From an aerial view, drainage patterns in watersheds resemble a network similar to the branching pattern of a tree. Just as smaller twigs meet up with a larger branch, smaller stream channels and tributaries merge together to form a wider channel. Eventually water accumulates in a wide river and then empties into a larger body of water, such as a lake or ocean.

Watersheds are either open or closed systems. Most watersheds are open systems, where water that collects in smaller watersheds overflows into outlet rivers and eventually empties into the sea or ocean.

The many tributaries, steam channels and rivers that flow into the Chesapeake Bay eventually leave the bay and empty into the ocean. This makes the Bay an excellent example of an open watershed system.

In closed watershed systems, water collects at a low point that lacks an outlet and never makes it to the sea. Crater Lake, of Crater Lake National Park in Oregon, is an example of a closed system. The only way water naturally leaves a closed watershed system is through evaporation or seeping into the ground.

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, where the slope of the land decreases and the area is flatter, the water flows more slowly.

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Objective
Students will be able to visualize, understand, and apply watershed knowledge by learning key watershed concepts and building a watershed model.

Time
50 minutes

Key terms
- » Watershed or drainage basin
- » Surface runoff
- » Branching pattern
- » Outlet river
- » Open and closed watershed systems
- » Ridge lines or divides
- » Contour or topographic map
- » Contour lines
- » Gradient

Materials
- » Rocks of various sizes
- » Spray bottles
- » Blue food coloring
- » Pencil or pen
- » Plastic wrap
- » White paper
- » Black, blue, and yellow overhead markers
- » Shallow baking pan
- » Transparency paper
- » Contour maps of a local watershed

For the complete lesson visit:

nature.nps.gov/views

Engage
Draw a typical branching pattern on the board. Give the students a minute to think about what was drawn and then ask for students to volunteer their ideas. Don't tell them what you drew!

Pre-activity
1. Give each student a topographic map of your local area or a national park. Ask the students to observe the map and look for any patterns similar to the one on the board.

2. Give the students a piece of transparency paper to place over a section of the map and then tape into place. They will now trace the rivers and streams from the map onto their transparency paper using the blue marker.

3. Draw an example of a simple contour or topographic map. Instruct the students to trace the index contour lines from their contour map on to the transparency paper.

4. Help the students to find areas of high and low elevation on their maps and have them label areas of high elevation on their contour map with the letter "H" and low areas with a letter "L".

5. Ask the students to think about areas on their map where water would flow quickly based on the gradient (topo line closer together), and areas where water would flow slower based on the gradient (topo line farther apart). Have the students draw arrows indicating where the water would flow and collect.

6. Have the students identify any ridge lines or divides by drawing a line to connect the high elevations "H's" on their map.

Procedure
The students will now make a model replica of their watershed. Divide the class into small groups and give each group a small baking pan, rocks, white paper, and a spray bottle filled with blue water.

1. Wrap the white paper around the rocks and arrange them in the pan in a way that mimics the contour map you traced in the pre-activity. The instructor can help groups to cover the rocks snugly with plastic wrap, making sure that the edges of the plastic wrap are inside of the pan.

2. Simulate a thunderstorm by spraying the watershed models continuously for 3 minutes. Each student in the group should take turns spraying.

3. As the water falls onto the watershed observe the flow patterns and draw arrows on the contour maps you traced in the pre-activity indicating where the water flowed.

4. When everyone has drawn the flow pattern arrows, complete these discussion questions:

a. Did you accurately predict the flow patterns of the watershed?
b. Were you able to identify areas where water flowed the fastest? The slowest? Were there any outlet rivers?

Evaluate
Write a story from the perspective of a rain drop that has fallen on an area of high elevation in an area on your map. Where does the rain drop go? What path does it take and what does it encounter?

Challenge yourself to include all of the following terms in your story: watershed or drainage basin, surface runoff, outlet river, stream channel or river, ridgeline or divide, open or closed watershed system.