Watersheds: Where We Live

Watershed Divide

Watershed Divide

controlled runoff

controlled runoff

LYSTROM RECYCLING CENTER

UNDEVELOPED WATERSHED

PLANNED WATERSHED

UNPLANNED WATERSHED

Developed Flood Plain

Developed Flood Plain

Small Watershed

Wetlands

Limited Flood Plain Development

Nathan's FIELD

MURPHY'S RANCH

ADAM'S SNOWBOARDS

FLOOD PLAIN

FLOOD PLAIN

FLOOD PLAIN

FLOOD PLAIN

FLOOD PLAIN

FLOOD PLAIN

Water Table

Water Table

Water Table

AQUIFER

GRADE SCHOOL

UNITED STATES GEOLOGICAL SURVEY

U.S. DEPARTMENT OF THE INTERIOR

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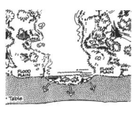
We all live in a watershed. Animals and plants all live there with us. Everyone affects what happens in a watershed by how we treat the natural resources. So what is a watershed? It is the land area that drains water to a stream, river, lake, or ocean. Water travels over the Earth's surface across forest land, farm fields, pastures, suburban lawns, and city streets, or it seeps into the soil and makes its way to a stream as local ground water. Watersheds come in many different shapes and sizes. Some contain mountains and hills, and others are nearly flat. A watershed can be affected by many different activities and events. Construction of cities and towns, farming, logging, and the application and disposal of many garden and household chemicals can affect the quantity and quality of water flowing from a watershed.

Floods are one of the major events in a watershed. Floods occur when the volume of water exceeds the ability of a water body (stream, river, or lake) to contain the water within its normal banks. Any stream, river, or lake can flood. The size or magnitude of a flood is described by a term called a recurrence interval. By studying a long period of flow records for a stream, it is possible to estimate the size of a flood that would, for example, have a 100-year recurrence interval (a 100-year flood). On the average, a 100-year flood would occur every 100 years. However, there is a 1-percent chance that a 100-year flood could happen any year. The severity of a flood is usually measured in terms of loss to human life or property, which is directly proportional to the amount of development in the flood plain surrounding the stream or river. A flood plain is a strip of relatively flat land bordering a stream, river, or lake that conveys the overflow of flood waters. Flood plains are Nature's way of carrying away flood waters. Because they are flat areas, flood plains are desirable locations for development.

This poster depicts many small watersheds within the three large watersheds, which are labeled in red on the poster. The large watersheds are separated by the two ridges that run from the top to the bottom of the poster. The large watershed labeled as undeveloped shows a watershed that has no development, the planned watershed has planned development, and the unplanned watershed has development that is unplanned. On the poster, a flood is shown in the planned watershed. The flood plains associated with the streams in each watershed are identified on the poster. One of the small watersheds is shown with a heavy dashed line within the larger unplanned watershed. The poster is folded into 8.5" x 11" panels; front and back panels can easily be photocopied.

Small Watershed

Watersheds come in many shapes and sizes. Larger watersheds are composed of many smaller watersheds. This watershed is a subwatershed of a larger watershed that has unplanned development. A watershed is determined by connecting the highest topographic points on a map between two adjacent areas. These points form a watershed boundary, similar to the edge of a bowl.



Flood Plain

Flood plains are relatively flat lands that border streams and rivers. Flood plains normally are dry but are covered with water during floods. Flood plains are created by floods and are indicators of the size of a flood produced by the upstream watershed. They are classified according to the flood events that created them. As with floods, the most common flood-plain delineations are 10, 50, 100, and 500 years.

WATERSHED MANAGEMENT

The quantity and quality of water draining from a watershed are dependent upon the climate, vegetation, soils, geology, and development within that watershed. Activities that change the vegetation and surface characteristics of some watersheds will affect the quantity and quality of water contributed to a stream. For example, a greater volume of water, perhaps of poorer quality, will flow from a parking lot than from a forest or pasture, which may result in increased flooding in a watershed because the greater volume exceeds the natural ability of the stream to transport the water.

Undeveloped Watershed

Undeveloped watersheds are drainage basins that have no development affecting the quality or quantity of water in that watershed. These watersheds are primarily on public-owned lands in national forests, national parks, and wilderness areas. Undeveloped watersheds provide scientists with areas to study the natural processes of a watershed and the movement of water within a watershed.

Planned Watershed

Planning the development within a watershed requires consideration of the entire drainage basin. Planned actions that consider the effect on the natural resources of the watershed will help preserve the quality and quantity of water flowing from a watershed. Actions such as controlling surface runoff from streets, providing recycling centers, farming along the contours, and logging practices that include controlling runoff and protecting stream channels help preserve the quality and quantity of water flowing from a watershed. Limiting the number and type of structures on a flood plain is one method of preventing loss of property from floods. Placing parks, golf courses, or farmland on a flood plain can reduce property loss caused by floods.

Unplanned Watershed

Unplanned development within a watershed has the potential for degradation of water quality and increased loss of property from flooding. Runoff from city streets, improper farming and logging techniques, and poor residential and industrial chemical-disposal practices all can affect water quality. Locating homes and businesses on flood plains greatly increases the chance of damage from flooding. In some places, flood-control structures such as dams and levees are required to protect development already located on the flood plain.

ACTIVITY
Watersheds, Floods, and Flood Plains

INTRODUCTION

A watershed is an area of land that drains water to a stream, river, lake, or ocean. It is a land surface feature that can be identified by connecting the highest elevations between two areas. For example, the pitched roof of a house or building is usually divided by a ridge. The back part of the roof is a separate watershed from the front part of the roof. During rainstorms, some water runs off both parts of the roof but meets in the street. Rain water from other houses in the neighborhood also flow to the street. Water from the street flows to a drain, ditch, or stream. Thus, the street is a larger watershed consisting of several smaller watersheds.

Floods occur when the level of a stream, river, or lake exceeds its normal height. Any stream or river can flood. During floods, water flows over the banks of a stream and into the surrounding low-lying areas called flood plains. During flooding, the threat to life and property damage most often occurs in the flood plain. Limiting the development within the flood plain is the best way to reduce damage associated with flooding.

The following activity is designed to demonstrate a watershed and the connection between small watersheds and larger watersheds. The activity also demonstrates property damage control during flooding through the placement of buildings in a flood plain.

OBJECTIVES—STUDENTS WILL:

1. Identify a watershed.
2. Observe how water flows from higher elevations to lower elevations in a watershed.
3. Observe the interconnection between watersheds.
4. Observe the importance of locating buildings within a watershed.
5. Experience a flood in a model watershed.

MATERIALS—EACH GROUP WILL NEED:

1. One container at least 22 cm wide, 33 cm long, and 6 cm deep. One possible container is a metal baking pan.
2. Two sheets of newspaper.
3. One sheet of thin (0.5 mils) plastic at least 30 cm larger in all dimensions than the container.
4. One waterproof marker.
5. One spray bottle.
6. Colored water to fill a spray bottle.
7. One book.
8. Two Styrofoam packing peanuts.

PROCEDURE

1. Divide the class into groups of three. Provide each group with a container, two sheets of newspaper, one sheet of plastic, one waterproof marker, one book, and one spray bottle filled with blue water.

2. Have one student in each group crumple both sheets of newspaper separately and place them next to each other at one end of the container. Drape the sheet of plastic over the crumpled newspaper, causing it to form hills over the high places and valleys in the low places. Put a book under one end of the container to allow water to flow down the valleys and pool at the front of the container. Place the sides of the plastic sheet down into the container to prevent water from overflowing the container.

3. Explain that the plastic sheet represents the ground surface covering the hills and valleys. Using the markers, have the students draw where they believe the main rivers will flow in their models. Have each student spray several pumps of water, using the spray bottle, on the model. Point out to students how water runs down one side or the other of the ridges and forms rivers in the valleys. The ridges divide individual watersheds. All the area from which water flows into a river is that river's watershed. Have the students count the number of small watersheds that drain into the main river they drew with the marker. All the watersheds should drain into a lake at the lower end of the container.

4. Discuss with the students that each small stream is formed by its own watershed. As streams join together, their combined watersheds and streamflow form larger watersheds and rivers.

5. Have each student place two of the Styrofoam peanuts (representing houses) on a flat location in the watershed. Have each student rapidly spray nine pumps of water on the upper portion of the watershed. Explain that rapidly spraying more water creates a flood in the watershed. Observe the houses during the rainstorm. Did the flood cause different amounts of damage (cause some to move) to the houses based on their location in the watershed?

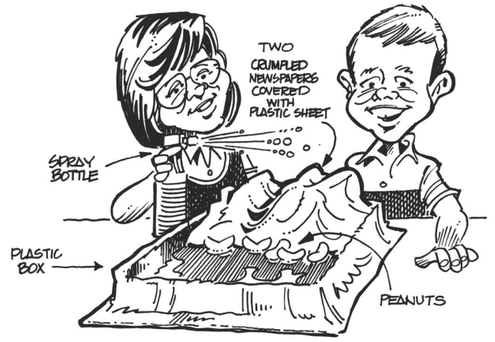
TEACHER PREPARATION

1. This activity is designed for students to work in groups of three.

2. Display a copy of the poster titled "Watersheds: Where We Live" on the classroom wall several days prior to conducting this activity.

3. Fill the spray bottles full of water and add several drops of blue food coloring so that the water can be easily identified.

4. Assemble one of the models as an example for the students.



INTERPRETIVE QUESTIONS

Have students examine other groups' models. How are they alike and how are they different?

1. How many watersheds are above the lake that forms at the bottom of model?
   Answer: The answer will vary from model to model, but students should be able to identify at least four. Have students look carefully because some of the watersheds may be hard to see.
2. What happens to the size of the stream as the watersheds get larger?
   Answer: The streams get larger.
3. What happens to the houses that the students placed on the level locations of the watershed? Were any houses washed away by the flood?
   Answer: The houses that were the closest to the river were the ones that were washed away by the flood.

EXTENSION

1. Have students write a short essay discussing what they learned about watersheds and floods. As part of the essay, have them draw a picture of a watershed including the stream and associated flood plains. Also have students discuss where the best place to build homes within their watershed would be in order to avoid flooding.

DEFINITIONS

Aquifer—An underground body of porous sand, gravel, or fractured rock filled with water and capable of supplying useful quantities of water to a well or a spring.

Drainage basin—Land area drained by a river.

Flood—Any relatively high flow of water that overflows natural or artificial banks of a stream, river, lake, or body of water.

Flood plain—A strip of relatively flat land bordering a stream, river, or lake that conveys the overflow of flood waters.

Ground water—Water found in pores or cracks in sand, gravel, and rock beneath the land surface.

Precipitation—Rain, snow, hail, or sleet.

Recurrence interval—The average interval of time within which the magnitude of a given event, such as a flood, will be equaled or exceeded one time.

Runoff—That part of precipitation that appears in surface-water bodies.

Watershed—The land area that drains water to a stream, river, lake, or ocean.

Poster Series

This poster is part of a series of water-resources education posters developed through the Water Resources Education Initiative. The Water Resources Education Initiative is a cooperative effort between public and private education interests. Partners in the program include the U.S. Geological Survey, U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior, the U.S. Environmental Protection Agency, the U.S. Army Corps of Engineers, the Nebraska Groundwater Foundation, and the National Science Teachers Association.

The other completed posters in the series are entitled "Water: The Resource That Gets Used & Used & Used for Everything!", "How Do We Treat Our Wastewater?", "Wetlands: Water, Wildlife, Plants, & People!", "Ground Water: The Hidden Resource!", "Water Quality: Potential Sources of Pollution", "Navigation: Traveling the Water Highways!", and "Hazardous Waste: Cleanup and Prevention." The posters in the series are designed to be joined to create a wall mural. A schematic of the wall mural including the topics for the completed and planned posters is displayed on this panel. The light-shaded spaces indicate the completed posters. The dark-shaded space represents this poster.

OCEANS	WATERSHEDS	HAZARDOUS WASTE
WETLANDS	WATER USE	WASTEWATER TREATMENT
NAVIGATION	GROUND WATER	WATER QUALITY

Water-resources topics of the completed posters are drawn in a cartoon format by the same artist. Posters are available in color or black-and-white. The reverse sides of the color posters contain educational activities: one version for children in grades 3–5 and the other with activities for children in grades 6–8. The black-and-white posters are intended for coloring by children in grades K–2.

ORDERING INFORMATION

Copies of the completed posters in the series (see Poster Series panel) and the Watersheds poster (color for grades 3–5 and 6–8 or black-and-white) can be obtained at no cost from the U.S. Geological Survey. Write to the address below and specify the poster title(s) and grade level(s) desired. A limited number of color and black-and-white posters entitled "Water: The Resource That Gets Used & Used & Used for Everything" also are available in Spanish by writing to the address below.

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The following individuals contributed to the development of this poster:

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U.S. GEOLOGICAL SURVEY

As the Nation's largest earth-science information and research agency, the U.S. Geological Survey (USGS) maintains a long tradition of providing "Earth Science in the Public Service." As a Nation, we face serious questions concerning our global environment. Providing the scientific information necessary to answer these questions is the primary mission of the U.S. Geological Survey. Such information is essential for the public and its officials to make informed decisions concerning the wise use of our natural resources and the management of our global environment.

U.S. DEPARTMENT OF THE INTERIOR

As the Nation's principal conservation agency, the U.S. Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This responsibility includes fostering the wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing enjoyment through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The Department also has a major responsibility for Native American reservation communities and for people who live in island territories under United States administration.

Grade School