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

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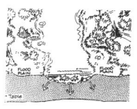
We all live in a watershed. Animals and plants all live there with us. Everyone affects what happens in a watershed by how we treat the natural resources. So what is a watershed? It is the land area that drains water to a stream, river, lake, or ocean. Water travels over the Earth's surface across forest 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
What is a Watershed?

INTRODUCTION

A watershed is the land area that drains water to a stream, river, or lake. It is a land surface feature that can be identified by tracing a line along the highest elevations between two areas on a map. Everyone lives within a watershed that drains to a local stream or river. Large watersheds, such as that of the Mississippi River, contain thousands of smaller watersheds. Changes in small watersheds can affect the river systems downstream. The following activity is designed to demonstrate a watershed and the connection between small watersheds and larger watersheds.

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.

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.

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.

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.

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 lower end of model?
   Answer: The answer will vary from model to model but will be at least four.
2. What happens to the size of the stream as the watersheds get larger?
   Answer: The streams get larger.

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.

ACTIVITY
Size and Occurrence of Floods

INTRODUCTION

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 during any year. Many people have heard of the 10-year, 50-year, or 100-year flood. These year descriptors are the recurrence intervals for the floods.

The following activity is designed to demonstrate the occurrence of a particular flood event and to show that floods do not necessarily occur every 10, 50, or 100 years.

OBJECTIVES—STUDENTS WILL:

1. Determine the occurrence of an event based on the random selection of different colored items.
2. Relate the occurrence of events to 5-, 10-, 50-, and 100-year floods.

MATERIALS—EACH GROUP WILL NEED:

1. One hundred items the same size and shape, but of five different colors. Suggestions for items include marbles, dried beans, or multicolored macaroni. The items need to be organized according to color and number as follows:
   - One item its own color. This item represents a 100-year flood event, 100-year recurrence interval.
   - Two items their own color. These items represent a 50-year flood event, 50-year recurrence interval.
   - Ten items their own color. These Items represent a 10-year flood event, a 10-year recurrence interval.
   - Twenty items their own color. These items represent a 5-year flood event, a 5-year recurrence interval.
   - Sixty-seven items their own color. These items represent no flooding.
2. A small paper bag or large coffee can to contain the items. The opening at the top of the container must be large enough for the students to place their hand in for selection of an item.
3. Paper and pencil.

TEACHER PREPARATION

1. Display a copy of the poster titled "Watersheds: Where We Live" on the classroom wall several days prior to conducting this activity.
2. Organize the items according to the numbers and colors as described under the section, Materials.
3. Place each set of 100 items in a paper sack or other opaque container.

PROCEDURE

If sufficient materials are available, divide the class into small groups. Provide each group with a container of 100 items. Explain to the students that each item in the container represents a flood event. The single item represents the 100-year flood event, the two items of the same color represent the 50-year flood event, the 10 items of the same color represent the 10-year flood event, the 20 items of the same color represent the 5-year flood event, and the 67 items of the same color represent no flood. Students will be selecting 100 different items from the container, simulating 100 years of streamflow.

Identify one student in the group as the note keeper. The note keeper is to make a table with column headings of 100, 50, 10, 5, and 1. This individual needs to keep track of each item that is selected from the container. There will be a total of 100 items selected from the container.

Designate one student to hold the container above the heads of the other students in the group while they take turns selecting one item at a time from the container. After the note keeper has tallied the selection, the student should return the item back to the container prior to selection of the next item. Students will make a total of 100 selections from the container. After the 100th selection, the note keeper is to total all the selections by individual flood events and make a grand total of all selections.

When all the groups have finished, make a master list of each groups' results on the chalkboard so all the students can share the results.

INTERPRETIVE QUESTIONS

1. How many times did the 100-year flood occur during the 100 selections? How many times did the 50-year, 10-year, or 5-year floods occur?
2. If the 100-year flood happened last year, what are the chances of it happening again this year?
   Answer: The same chance each year, one chance in 100.
3. What are several ways to protect individuals and property from floods?
   Possible Answers: Develop flood-warning systems to alert citizens when water in streams and rivers reaches a certain height. Limit development and land use in flood plains. (Possible flood plain uses that are not severely impacted by flooding because of lack of structures include farming, parks, and golf courses.) Construction of flood control structures such as dams and levees.

Poster Series

This poster is part of a series of water-resources education posters developed through the U.S. Geological Survey's Water Resources Education Initiative, a cooperative effort between public and private education interests. Partners in the program include the U.S. Geological Survey, Bureau of Reclamation, and the U.S. Fish and Wildlife Service of the U.S. Department of the Interior; the National Oceanic and Atmospheric Administration; 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 posters in the series are entitled "Oceans--Coastal Hazards: Hurricanes, Tsunamis, Coastal Erosion", "Hazardous Waste: Cleanup and Prevention", "Wetlands: Water, Wildlife, Plants, & People!", "Water: The Resource That Gets Used & Used & Used for Everything!", "How Do We Treat Our Wastewater?", "Navigation: Traveling the Water Highways!", "Ground Water: The Hidden Resource!", and "Water Quality...Potential Sources of Pollution". The posters in the series are designed to be joined to create a large wall mural. A schematic of the wall mural is displayed on this panel. The gray shaded spaces represent the posters listed above. The black shaded space represents this poster.

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

Water-resources topics of the posters are drawn in a cartoon format by the same artist. All poster are available in color. The reverse sides of the color posters contain educational activities: one version for children in grades 3-5 and the other for children in grades 6-8.

ORDERING INFORMATION

Copies of all the posters in the series (see Poster Series Panel) can be obtained at no cost from the U.S. Geological Survey. Write to the address below and specify the poster title(s) listed on the Poster Series panel, and grade level(s) desired. The poster "Water: The Resource That Gets Used & Used & Used for Everything!" is also available in black-and-white, intended for coloring by children in grades K-2. In addition, the poster "Water: The Resource That Gets Used & Used & Used for Everything!" with activities intended for grades 3-5 is available in Spanish. There is a minimum shipping charge of $20.00 or actual cost if greater and $3.50 handling charge (total $23.50 in U.S. dollars) applying to ALL orders shipped to locations that are not a U.S. State or Territory.

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U.S. GEOLOGICAL SURVEY

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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.

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MIDDLE SCHOOL