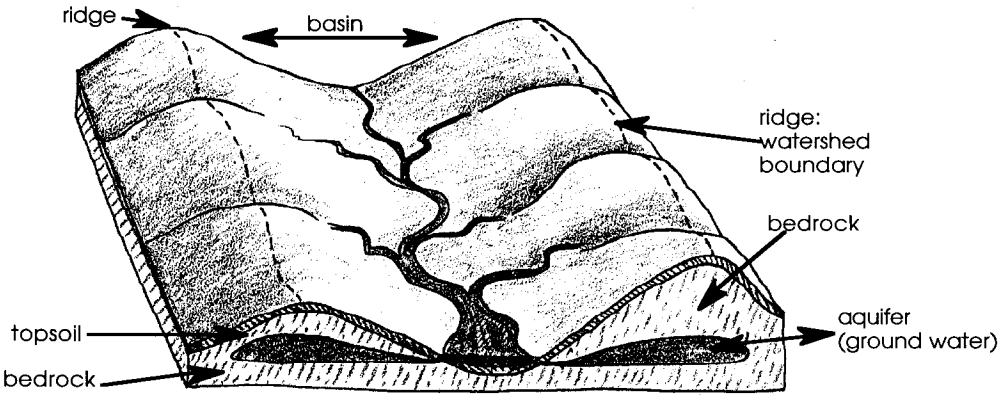
Do I Live In a Watershed?

Key Concepts

1. Everyone lives on some part of a watershed.
2. Watersheds are divided by ridges or high elevation points and drain into basins that may contain streams and rivers.
3. Water is stored in a watershed or drains into a particular creek, river, stream, or other body of water.
4. Elevations within our watershed determine how water flows.
5. The quality of our water depends upon how we treat our watersheds.
6. Wetlands result from storage of water within the watershed.

Background

Watersheds are areas that receive, transport and store water. How water moves through the watershed is directly related to its topography. Watersheds are composed of bedrock and the aquifers (pockets of ground water) beneath the ground, and the soil and plants above ground. Watersheds are divided by ridges. The area within the ridges drains into the watershed basin. The elevations of land within our watersheds determine how water flows. The changes that we make to the area's landscapes also directly affect the flow of water. The sketch below shows a generalized watershed.



Materials

For class of 32:

- topographic map of your area
- butcher paper
- marking pens
- masking tape
- ruler
- overhead or opaque projector
- carbon paper
- rubber cement

For each group of 4 students:

- 1-2 mat knives or heavy duty scissors capable of cutting cardboard
- large cardboard sheet(s) - roughly the size of the finished model you desire. (see Hints for needed number)
- colored pencils
- white glue
- papier mâché
- paint
- paint brushes

Teaching Hints

In the activity "Do I Live in a Watershed?" your students will make a model of your local watershed. This activity can seem intimidating but is an excellent way for students to really conceptualize that **all** the land upon which we live is a series of watersheds.

This activity requires some advance planning. First, you will need to obtain a topographic map of your area. The best ones are U.S. Geological Survey (USGS) maps. Next, decide if your area, particularly the area of the school grounds, is on a watershed that can be shown in a three dimensional model of reasonable size. Your local water department can provide you with help in determining the general watershed boundaries in your area. If your area does not lend itself well to a model, choose an area that is familiar to your students that has more relief.

The area you are modeling is likely to represent only a small portion of the map. As such, you will need to enlarge that portion of the map. If you have an opaque projector, you will be able to enlarge your map directly onto a piece of paper taped to your wall to make your model map. If you use an overhead projector you will need to make a transparency from your map so that you can project the map onto your butcher paper to make your model map. While some photocopiers can make transparencies, you can also lay a blank transparency over the map and follow the lines with a marker.

USGS maps have a contour interval of 20 feet. Plan for 1 large cardboard sheet for each interval. You can decrease the number if you see that the higher elevations have smaller areas to cut out. Encourage students to use cardboard scraps where possible but caution them to label the pieces to be saved. Some teachers have chosen to use foam insulation board instead of cardboard.

This is a labor intensive project up to the point of letting students cut. Some teachers may be able to have students trace the map but large classes make management of this difficult. After the cutting is done and the model is constructed you will see that it is really a valuable exercise.

Procedure

The process involves enlarging the map, tracing individual contours onto separate sheets of cardboard, cutting out the contours, stacking them in order, gluing them together, filling in with papier mâché, and then adding details (painting, etc.).

1. Use an opaque projector or overhead projector to enlarge your map. (You must enlarge your area map or the contour lines will be too close together.)

   opaque projector: Use the map directly or make a photocopy of the area to be enlarged.

   overhead projector: Use a transparency of the map. (A hand-drawn transparency will work but a machine-made transparency is much easier to work with!)

2. Set up your machine in a place that will give you a good projection on a wall or board. Tape the butcher paper on the wall or board making sure it is secure and flat against the surface. This map will get a great deal of use so don't use lightweight paper or newsprint.

3. After your students and/or you decide the area size of your model, it is time to trace the contour lines. Due to the time involved in the contour tracing and the necessity of keeping the projector in the same position throughout

the tracing, you may decide to do all the tracing on the enlargement yourself. This is time consuming but may be more practical especially if you have a large class, limited space, and limited class time slots. With either approach, trace adjacent contours in different colors to make them easier to distinguish later when they are traced onto cardboard. If your area is very steep you might not want to trace every contour. Be aware of land projections that may cause problems during cutting.

4. Since the contours will be layered, it is very important to have guide marks on the model map so that the layers can be glued together correctly later. The easiest way is to make a mark on each corner of the map.

5. The next step is to transfer the individual contours onto separate cardboard sheets. With rubber cement, glue the carbon paper to the back of the map with the carbon side facing out. Trim excess carbon paper.

6. Place map on a cardboard sheet. Trace the lowest elevation contour line. If it is a contour that extends to any side of the model, trace the guide marks. Some contours may not extend to any of the sides. Be sure to write the contour interval somewhere on the sheet.

7. Trace each successive contour line on to a separate cardboard sheet. To decrease the confusion regarding which lines have been traced, use different colored pencils. Label each contour area.

8. After all the contours are traced, the sheets are ready to be cut out. Students may cut them out in class. If you provide mat knives, you will need to stress and model safety. Make sure that you provide extra cardboard to protect the desk or counter surfaces as the pieces are cut.

9. After each layer is cut, put the layers in order and see if the model resembles the actual area. Make adjustments BEFORE gluing. When you and your class feel that the model is a good representation, begin gluing from the bottom up. Put glue on the underside of the loose piece rather than on the surface of the base piece to which the loose piece is being added. It will take about a day to dry.

10. At this point, the model will look like the elevations occur in steps. Use papier mâché to smooth out the model and to make it look more realistic. Be careful not to fill in low lying areas.

11. Wait two or three days for the model to dry completely. As a group, decide how you will paint your model. Paint streams with a thin brush. Seasonal streams can be shown as dotted lines. Buildings can be shown with tacks

or push pins or signs. Roads can also be detailed. You might want to distinguish between developed and undeveloped areas. If your model includes parts of other watersheds make sure that you outline your particular watershed by drawing a continuous line along the ridges which define the watershed.

12. Students will devise a scale for the model by completing the answers on the next page. After they agree on the scale, they should make a card that shows both horizontal and vertical scale and attach it to their model.

13. Display your model at an open house or in the library when it is finished!

Key Words

contour interval - the difference in elevation between two succeeding contour lines

contour line - line on a topographic map indicating a specific elevation along its entire length.

elevation - distance above sea level

map - representation of part of the earth shown on a flat surface

model - a small object, usually built to scale, that represents some existing object

sea level - level of the surface of the sea, used as the starting point for measuring elevation above as well as depth below the surface.

scale - the proportion used in determining the relationship of a representation to that which it represents; also the calibrated line, as on a map, used to indicate such a proportion

topographic map - a map showing the shape of the land, or elevation

watershed - the region draining into a river, river system, or body of water

Extension

1. Have a speaker come from your local water district or a city planner to talk about issues related to development and the effects on watersheds.

Answer Key

1. The scale on the map was 1/8" = 20'.

2. Answer depends on the thickness of the cardboard used.

3. The horizontal scale is 1' = 1 mile.

4.,5. Answers depend upon the model constructed.

6. Watersheds are divided on ridges because water flows downhill and the ridges, as the highest points of elevation, divide the flow of water between drainage basins.

7. a. Some of the rain that falls on a watershed runs off, some percolates (soaks in) into the soil, and some evaporates.

   b. The rain can go into streams or other bodies of water, be intercepted or taken up by vegetation, percolate into ground water, etc.

8. Many built things alter the flow of water through a watershed including: landscaping, logging, dams, pavement, farming practices, and buildings.

9. People can add oil wastes, pesticides, cleaners and other chemicals directly to water or, indirectly, through the soil. People can also increase silt and trash in flowing water. Runoff from streets can carry asbestos from brake linings, oily wastes, antifreeze and the like. Just about anything we do can affect the watershed.

10. Answers will vary since this calls for an opinion. Most students will tell the person that oil dumped on the ground can find its way into streams and other bodies of water via runoff; and, into groundwater by percolation through the soil.

11. Answers will vary depending upon the area modeled.

Adapted with permission from
California Salmon and Steelhead: Our Valuable Natural Heritage by D. Higgins.

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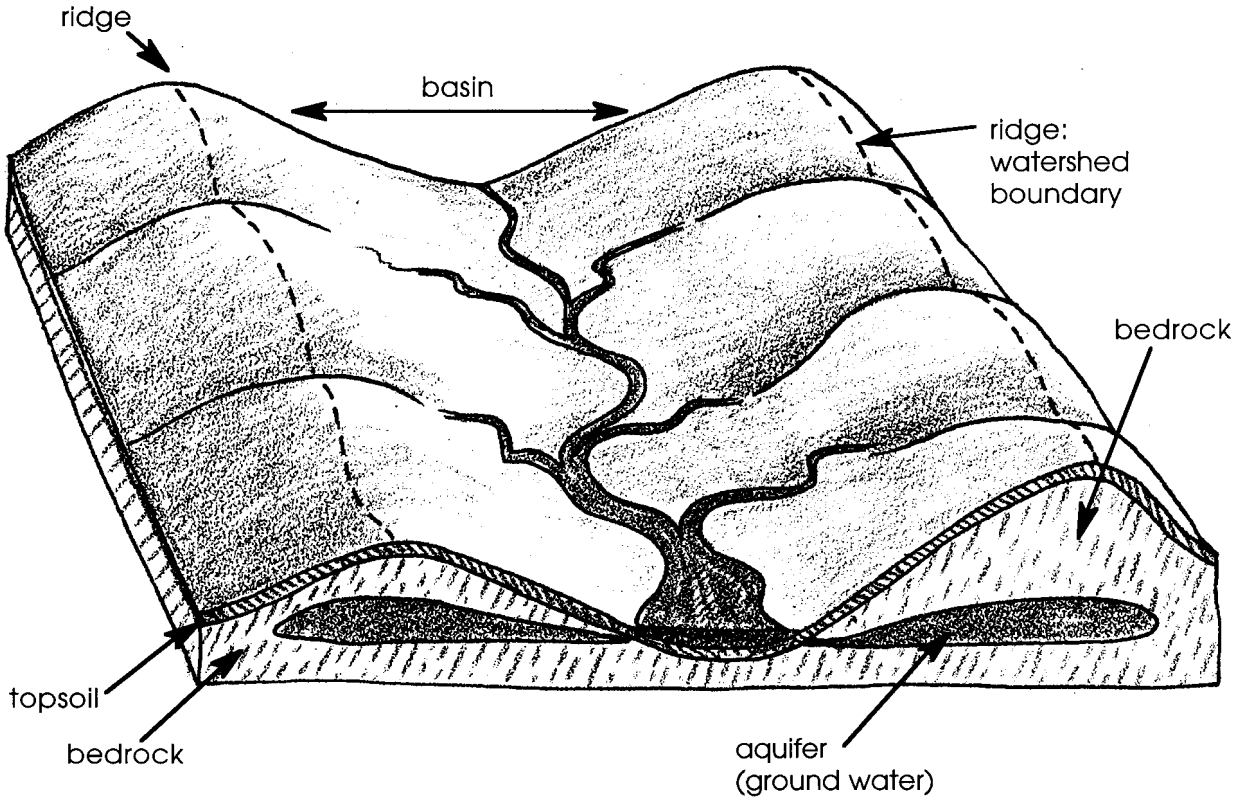

After constructing (and admiring) your watershed model, answer the following questions.

Every model must have a scale that relates the size of the model to the real world. You have to decide on a vertical scale (up and down) and a horizontal scale (side to side). Scale measurements are always given in the form: **model measurement = actual measurement.** For example, a map might have a scale of 1" = 1 mile. On such a map, a 5" long road would represent a road 5 miles long in real life.

1. A class constructed a model using cardboard that was 1/8 inch thick. Using this model measurement and the 20' contour interval from the USGS map, the students were able to devise the vertical scale. What was their scale?

_____ inch = _____ feet
model actual

2. What is the thickness of the cardboard that you used? _____

   What is the actual contour interval from your map?_____

   What is the vertical scale for your model?

   _____ = _____
   model actual

Use the USGS map to help you figure out the horizontal scale. Notice that the USGS map is overlaid by a grid of numbered squares. Each numbered square represents a section of land. A section measures a mile on each side. By measuring the distance that one section occupies on your model, you can determine the horizontal scale.

3. If a class found that the section measured 1 foot on their model, what would their horizontal scale be?

   _____ = _____
   model actual

4. What is the distance that one section (or part of a section) measures on your model?_____

5. What is the horizontal scale for your model?

   _____ = _____
   model actual

6. Why are watersheds divided on ridges?

7. a. What happens to the rain that falls on the watershed?

   b. What are the possible places that it can go?

8. What are some of the things that have been built which change the way that water moves through our watershed?

9. What are some of the things that people do that can pollute the water in our watershed?

10. What would you say to someone who says "I can dump my car oil out behind my garage and bury it and not worry about it affecting the water in my watershed because I don't live by a stream."

11. a. You will be studying about areas of land that store water called wetlands. Wetlands can be found near streams, rivers, oceans, ponds, or just low areas. You might be able to see water in them all year or just part of the year. Locate places on your watershed model that you know contain wetlands.

    b. Where do you think other wetlands might be found?