

One Hilltop, Three Major Watersheds!

Adapted from: An original Creek Connections activity.
Creek Connections, Box 10, Allegheny College, Meadville, Pennsylvania, 16335

Grade Level: Intermediate to Advanced

Duration: One class period or less

Setting: Classroom

Summary: Students use skills from other Topographic Map Module activities to pinpoint the one hilltop I Potter County from which runoff flows into three different major Pennsylvania watersheds.

Objectives: Students will be able to identify the six major watersheds of Pennsylvania. They will also be able to use their topographic map and watershed delineation skills to locate the single hilltop in Potter County from which runoff drains into three different major Pennsylvania watersheds. They will also be able to identify the strategies that were most effective in locating this hilltop. Finally, they will be able to identify the land use at the hilltop and the potential impacts of the land use on water quality.

Vocabulary: none

Related Module Resources:

- Activities: Watershed Delineation, Watershed Topography, Land Use in Watersheds
- Land Use Impacts on Water Quality Parameters (at the end of the Land Use in Watersheds activity)
- Book: 100 Topographic Maps

Materials (Included in Module):

- 6 laminated Potter County Maps
- Wet erase markers
- 2 Overhead Transparencies (Figures 1, 2, 3, 4, 5)
- 6 sets of Clue Cards in labeled envelope

Additional Materials (NOT Included in Module):

- Overhead projector

ACADEMIC STANDARDS:

ECOLOGY & ENVIRONMENT

7th Grade

- 4.1.7.B. Understand the role of the watershed.
 - Identify and explain what determines the boundaries of a watershed.
- 4.3.7.B. Describe how human actions affect the health of the environment.
 - Identify land use practices and their relation to environmental health.

10th Grade

- 4.1.10.B. Explain the relationship among landforms, vegetation and the amount and speed of water.
 - Delineate the boundaries of a watershed.
- 4.1.10.E. Identify and describe natural and human events on watersheds and wetlands.
 - Identify the effects of humans and human events on watersheds.
- 4.3.10.B. Explain how multiple variables determine the effects of pollution on environmental health, natural processes and human practices.
 - Explain how human practices affect the quality of the water and soil.

12th Grade

- 4.1.12.E. Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.
 - Evaluate the effects of human activities on watersheds and wetlands.

GEOGRAPHY

6th Grade

- 7.1.6.A. Describe geographic tools and their uses.
 - Geographical representations to display spatial information: topography
 - Basic spatial elements for depicting the patterns of physical and human features: point, line, area, location, distance, scale
- 7.2.6.A. Describe the physical characteristics of places and regions.
 - Components of Earth's physical systems (e.g., relief and elevation (topography))
 - Comparisons of the physical characteristics of different places and regions (e.g., topography)

9th Grade

- 7.4.9.B. Explain the impacts of people on physical systems
 - Forces by which people modify the physical environment (e.g., increasing population; new agricultural techniques; industrial processes and pollution)

12th Grade

- 7.2.12.A. Analyze the physical characteristics of places and regions including the interrelationships among the components of Earth's physical systems.
 - Watersheds and river basins

BACKGROUND:

As you have undoubtedly discovered while doing the activities in this module, the topography of Pennsylvania is diverse and interesting. One particular topographic feature that is unique and unusual is an unnamed, nondescript hilltop in Potter County. If you allowed your eyes to scan the Potter County topographic maps, they might first skip over this

particular hilltop. However, a closer examination would draw you back when you discovered that runoff from this single hilltop drains into three of Pennsylvania's six major watersheds: Genesee River (which flows into Lake Ontario), the Susquehanna River/Chesapeake Bay, and the Ohio River! We challenge your students to use their refined topographic maps skills to pinpoint the location of this very special topographic feature!

OVERVIEW:

Students use their knowledge of topography and watershed delineation to locate the single hilltop on the Potter County topographic map from which runoff drains into three major watersheds: Genesee River Basin, the Susquehanna River/Chesapeake Bay Basin, and the Ohio River Basin.

PROCEDURE:

Teacher Preparation:

1. Locate the 6 laminated Potter County Topographic Maps and wet erase markers. Lay out these maps and wet erase markers on flat surfaces at 6 stations around the classroom. You may want to secure the maps to the flat surfaces using tape.
2. Decide how you want to distribute clues to the students - either verbally or by handing them clue cards as they request them or by having them flip over numbered clue cards one at a time that you have placed at their station or by having them consult a photocopied list of the clues you provide them. Make the appropriate arrangements for the method you have chosen.
3. Procure and set up an overhead projector.

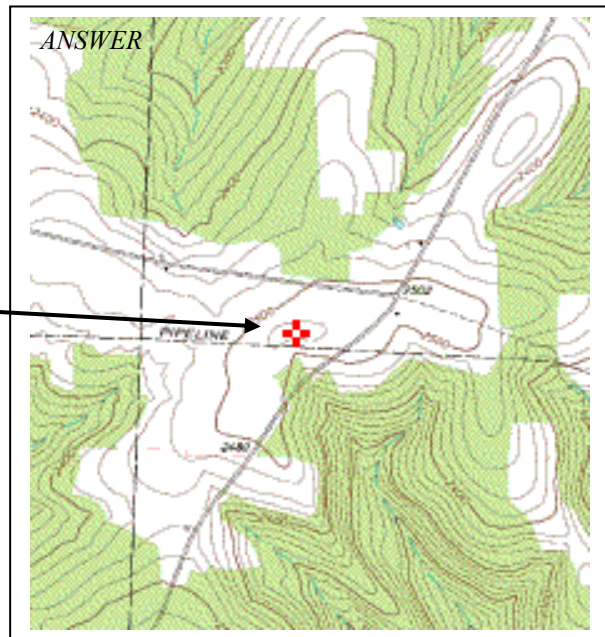
Student Activity:

1. Divide students into 6 groups and assign each group to a map station.
2. Tell students that they are trying to discover the location of a very unique topographical feature in Pennsylvania. When it rains in Potter County on one nondescript hilltop, the runoff from this hill flows to three very different places: 1) The Gulf of Mexico, 2) Chesapeake Bay, 3) St. Lawrence Seaway. Their task is to find this hill.
3. Ask students what a hill looks like on a topographic map. *Hills are represented by concentric (having the same center) contour lines, usually either circles or ovals.*
4. Ask students if the runoff is flowing to the three destinations listed above, what must that mean about the location of this hill? If no one knows the answer, offer them a hint by placing the overhead transparency (Fig. 1) that shows the six major watersheds of Pennsylvania: the Ohio River Basin, the Lake Erie Basin, the Genesee River Basin, the Susquehanna River/Chesapeake Bay Basin, the Potomac River Basin, and the Delaware River Basin. Have the students review where each of the major watersheds eventually flow to (Fig. 2). They should conclude that the Ohio

River Watershed flows eventually to the Gulf of Mexico (via the Mississippi River), the Susquehanna River eventually empties into the Chesapeake Bay, and the Genesee River, although a small watershed in Pennsylvania, flows into Lake Ontario and then into the St. Lawrence Seaway. Therefore if one hill is draining into these three destinations, that hill must be on the boundary between these three major watersheds. On the transparency, point out the spot where these three major watersheds converge.

- Now tell students that it is time to find this hill on the Potter County map. Indicate that they are to work together as a group to try to determine a strategy and implement that strategy to find this hill, using knowledge/skills from other topographic map activities they have completed. If they get stuck, you will provide them clues (either verbally or by handing them clue cards as they request them or by having them flip over numbered clue cards one at a time that you have placed at their station or by having them consult a photocopied list of the clues you provide them). Each clue will be more revealing and provide more detailed information or hints on how to find the hill. The students' goal should be to find the hill using as few clues as possible. You will find the clues and clue cards at the end of the activity.

- When groups feel that they have indeed located the precise hilltop, check their work. *The hilltop is in the western edge of Ulysses Township. It is southeast of the village Raymond, northwest of the village Brookland, and is bordered by two different roads. It is shown on the map to the right.*



- Once the entire class has found the hilltop, use the overhead transparency of the map and picture of the hilltop to reveal the answer and to facilitate further discussion questions. (Fig. 3, 4, 5).

- Use the discussion questions below to make students interpret their map further and review other topographic map reading skills.

DISCUSSION:

What were some of the strategies you used to locate the hilltop? Which seemed to be the most effective? *Answers will vary but it helps to figure out the major waterways and their tributaries for the Genesee, Ohio River, and Susquehanna Watersheds. Figure out which way these waterways flow. Find an area where the headwaters of these waterways converge, look for a hilltop that drains into these waterways. It would also be helpful to*

determine the direction of surface runoff/groundwater flow and to delineate the watershed boundaries around this area.

How would you be able to determine watershed boundaries? By locating hilltops and high points, determining the direction of runoff from various points using arrows, and then drawing a boundary that separated arrows pointing toward and those pointing away from the waterway of interest.

Which side of the hill is steeper – the north side or southern side? The southern side. This can be determined because the contour lines are closer together on the southern side, which means a rise in elevation over a short distance.

What is the contour interval on this map? 20 feet (6.1 m) between contour lines. This information is provided below the scale on the map.

What is the scale on the map? 1:50,000. How many miles does one inch on the map represent? 1 inch (0.0254 m) on the map = 50,000 inches (1,270 m) for the land depicted on the map. $50,000 \text{ inches (1,270 m)} \div 12 \text{ inches (0.305 m)} = 4,166.67 \text{ feet (1,270 m)}$. $4,166.67 \text{ feet (1,270 m)} \div 5,280 \text{ feet (1,609.3 m)} = 0.789 \text{ miles (1,269.8 m)}$.

The village of Brookland is 3 inches (7.62 cm) away from the hilltop on the map. How many miles away is Brookland from the hilltop? 1 inch (2.54 cm) = 0.789 mile (1.27 km). 3 inches (7.62 cm) x 0.789 miles (1.27 km) = 2.367 miles (3.81 km).

What is the latitude and longitude of the hilltop. Approximately 41° 51' 00" latitude, 77° 50' 00" longitude.

What is the stream order of the waterways into which the hilltop directly drains? All are first order streams.

What is the land use of this hilltop? This was given in a clue, but it is cleared land (white on topographic map). It may be agricultural land, but the map is not detailed enough to determine this (no barn symbols □ are shown on county topo maps).

Are the streams that this hilltop drains into protected by riparian forest buffers? Yes, all the streams into which runoff from this hilltop drains look to be well protected by riparian forest buffers.

Assuming the land use on the hilltop is agricultural land, how might this land use be affecting water quality, aquatic life, and humans downstream? In the absence of streamside forests, the cropland and/or pastureland might have negative effects on water quality, aquatic life, and humans downstream. These effects might include increased water temperatures resulting in less dissolved oxygen to support aquatic life, increased nitrates and phosphates from excess fertilization which could lead to eutrophication, decreased alkalinity due to the removal of vegetation which encourages surface runoff rather than infiltration, increased turbidity because of the increased susceptibility to soil

erosion, and increased TDS from the nutrients and salts washing off of the field. Pesticides used on the farmland might contaminate the stream and, if humans use it for drinking water, these pesticides could threaten the drinking water supply. The adverse water quality effects and impacts on aquatic life might reduce the fish populations and affect humans that use these fish as a source of food and/or recreation, etc. Soil erosion problems on the hilltop might decrease the fertility and productivity of the soil, reducing crop yields and the farmer's income. However, one very important factor about this hillside is that all the surrounding streams are buffered by a riparian forest zone, definitely reducing, may be even completely eliminating the negative impacts on the streams.

How does this activity illustrate that our actions have immediate local impacts but also affect things and people far away? *Runoff from this one hilltop drains into three different major watersheds thus poor (or good) land use at this site would negatively (or positively) affect water quality and aquatic life, as well as humans who use the different waterways for drinking water thousands of miles away! We do not live in a vacuum—what we do affects others!*

EVALUATION:

- Accurately located hilltop that drains into three major PA watersheds.
- Name the six major PA watersheds and sketch their boundaries on a PA map.
- Discussion questions above.
- Find a hilltop that drains into three (or more) smaller watersheds on the Potter County or other topographic map.

EXTENSIONS AND MODIFICATIONS:

- Using the Watersheds of PA map, find another location in Pennsylvania where water could potentially flow into three of the six major watersheds. This occurs only in one other place - in Somerset County, where a higher elevation drains into the Ohio River Watershed, Potomac River Watershed, and Susquehanna River Watershed.
- Although no other hilltops in PA other than the ones in Potter and Somerset counties described above drains into three of the six *major* watersheds, there are certainly countless hilltops that drain into three (or more) smaller different watersheds. Use a topographic map of your area to find such hilltops and then challenge students to do the same. Remember, every creek has a watershed.
- Determine where runoff from your school or nearby hill ultimately drains. How many watersheds does it drain into? *The list should include the small watershed that your school area drains into, and then include each of the watersheds for which your creek flows into...ultimately ending with the Ohio River Watershed, then Mississippi River Watershed (or Lake Erie, Lake Ontario, St. Lawrence Seaway Watershed depending on your location).*

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):



CLUES : ONE HILLTOP, THREE MAJOR WATERSHEDS

Use the following clues to find the unique hilltop, but try to use as few of the clues as possible. Each clue will be more revealing and provide more detailed information or hints on how to find the hill.

CLUE #1:

Try to figure out which of the larger waterways on the map are part of the Ohio River Watershed, the Susquehanna River Watershed, and the Genesee River Watershed.

CLUE#2

The Genesee River is located in the north central part of the map.

CLUE #3

Is the Allegheny River located on the southwestern corner of the map? Into what waterway does the Allegheny River eventually flow into?

CLUE #4

Find Pine Creek on the map. Pine Creek is a tributary to the Susquehanna River.

CLUE #5

If your map is laminated, use the wet-erase marker and trace the major waterways (specifically the Genesee River, Allegheny River, and Pine Creek) indicating the direction in which they flow. Also trace the tributaries for these waterways and indicate the direction in which they flow. Hopefully you know what a tributary is. You should, if not ask your teacher. If you are having trouble figuring out which direction a waterway flows, here is some help. Small waterways flow into larger waterways. Also, you could look at the contour lines along two different spots along a waterway and determine the elevations for those two spots. One elevation should be higher than the other. Water flows downhill, so that would indicate the direction of the waterway flow.

CLUE #6

Since you are looking for one hilltop that drains into three different watersheds, start looking for places on the map where the headwaters of the streams from different watersheds tend to be converging (coming together around).

CLUE #7

Keep in mind that you are looking for a hilltop that drains into three different watersheds, so you need to be able to distinguish how hilltops are depicted on the topographic map. Do you remember?

CLUE #8

You use contour lines to distinguish landform features like hilltops. Hilltops are depicted on topographic maps by concentric (having the same center) contour lines, usually in circle, oval, or lopsided, distorted oval patterns.

CLUE #9

Keep in mind that surface runoff and groundwater flows perpendicular to contour lines down a hillside.

CLUE #10

One of the small waterways that the hilltop drains into is Woodcock Creek, a tributary to the Allegheny River.

CLUE #11

Other small waterways that the hilltop drains into are unnamed streams that are tributaries to Pine Creek.

CLUE #12

Other small waterways that the hilltop drains into are unnamed streams that flow into the Middle Branch, a tributary to the Genesee River.

CLUE #13

The land on the hilltop is cleared land (white on the topographic map).

CLUE #14

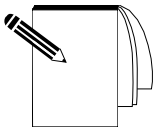
The elevation of the hilltop is 2520 feet (768.1 m).

CLUE #15

The hilltop is in the western edge of Ulysses Township. It is southeast of the village Raymond, northwest of the village Brookland, and is bordered by two different roads.

CLUE #16

Do you really need any more clues?



STUDENT NOTES: ONE HILLTOP, THREE MAJOR WATERSHEDS

Name _____

Date _____