Chesapeake Bay FieldScope Activity: Investigating Water Flow Patterns

OVERVIEW
Students explore diverse landscapes and water flow paths by zooming in on specific areas of the watershed using National Geographic FieldScope.

LEARNER GRADE(S) /AGE LEVEL(S)
Grades 6-8 (Ages 11-13)
Grades 9-12 (Ages 14-18)
Post-Secondary (Ages 18+)

GUIDING QUESTION
How does water flow through a region? What landscape features help define flow path?

CONNECTIONS TO NATIONAL GEOGRAPHY STANDARDS
Standard 1: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective

Standard 3: How to analyze the spatial organization of people, places, and environments on Earth's surface

Standard 8: The characteristics and spatial distribution of ecosystems on Earth's surface

LEARNING OBJECTIVES
Students will be able to:

- understand how the physical geography of a region affects water flow patterns
- compare water flow patterns in diverse landscapes across the Chesapeake Bay watershed

GEOGRAPHIC SKILLS
Asking Geographic Questions
Acquiring Geographic Information
Analyzing Geographic Information

PREPARATION

TIME (in minutes)
60 minutes (20 minute teacher demonstration; 40 minute student activity)

TECHNOLOGY REQUIRED
Computers/laptops with access to the Internet

MATERIALS REQUIRED
Student handouts

ONLINE RESOURCES USED IN ACTIVITY
National Geographic FieldScope

PRIOR KNOWLEDGE
See the vocabulary list for potentially unfamiliar terms.

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PROCEDURE/DIRECTIONS

DIRECTIONS

1. **Demonstrate how to use FieldScope by looking at two sample locations.**
   Start the activity by looking at two sample locations as a teacher demonstration for the whole class (Luray, Virginia, and Harpers Ferry, West Virginia). Then let students do the same investigation for their own study site. As you do the teacher demonstration, keep two goals in mind:
   1. Your demonstration should help students become more familiar with the use of FieldScope.
   2. During the demonstration, take time to talk about landscape features and physiographic regions, and how those can affect river and stream flow. Ask: *Predict how you think certain landscape features might affect water flow*. Have class discussions about those predictions. When students do their own work with their study site, they will need to make predictions about water flow patterns, and this discussion will prepare them for that task.

2. **Demonstrate how physical geography impacts water flow paths.**
   Direct students to Luray, Virginia, located at **38.67° N, 78.46° W**. Remember, students can search for Luray, Virginia, using the FieldScope search box, by searching for the latitude and longitude in the search box, or by using the dynamic latitude/longitude display box on the map. Once students have found Luray, Virginia, ask them to zoom in. Students should answer the following question:

   By what river is Luray, Virginia, located? **Answer:** Shenandoah River, or South Fork Shenandoah River

3. **Calculate the water flow path.**
   Direct students to select the Flow Path tool in the FieldScope toolbar and calculate the water flow path from Luray, Virginia, to the Bay. Students should notice that water will flow from the Susquehanna River to the Potomac River and finally to the Bay.

4. **Understand Physiographic Regions**
   Next, direct students to turn on the **Physiographic Regions** layer. Physiographic regions are defined by geology and terrain. Maps of physiographic regions can give you an overview of where mountains are versus where areas of flat terrain might be. Students should look at the water flow path to consider how it follows boundaries of the physiographic regions. Since water always wants to flow downhill, it often skirts around features in the terrain like mountains or ridges, searching for the path of least resistance. Ask students to read the layer description of the physiographic regions and use the Query tool to click on different physiographic regions and learn more about them. Students should answer the following questions:

   What physiographic region does the major river by Luray, Virginia, flow through? The physiography changes directly east of Luray. What physiographic region is east of Luray? How might the features in this region affect the flow of the river? **Answer:** Luray, Virginia, is located in the Great Valley physiographic region. Immediately east of Luray is the Blue Ridge physiographic region. Students should describe the mountains that make up the Blue Ridge and force the river northward.

5. **Compare Physiographic Regions.**
   Direct students to Harpers Ferry, West Virginia, at **39.32°N, 77.74°W**. Have students look at both the Terrain and Topographic base map layers. Direct their attention to the point where the Shenandoah and Potomac rivers come together. With the Physiographic Regions layer still turned on, students can see that the area immediately east of where these two rivers meet marks a boundary in the physiographic regions. Students should notice the Potomac River cutting through two ridges in the terrain before flowing into the Piedmont Upland physiographic region. Have students answer the following questions:

   Describe the changes in landscape from the point where the Shenandoah River meets the Potomac River and flows east and then southeast. What physiographic regions does the river encounter? What else can you

learn about the landscape by working with the different base map layers? **Answer:** After the Shenandoah River merges with the Potomac River, the Potomac flows east from the Blue Ridge physiographic region into the Piedmont Upland, back into the Blue Ridge, and then finally into the Piedmont Upland again. Using the Terrain layer and the Topographic map layer, you can see the river cut through two distinct ridges that are part of the Blue Ridge physiographic region.

Bonus question: *What physiographic region does the Potomac River flow into just before it passes by Washington, D.C., and Alexandria, Virginia?* **Answer:** the Coastal Plain physiographic region

6. **Investigate how land cover changes in your watershed.**
   Have students look at the land cover by Luray, Virginia, and along the tributary network connecting Luray to the Chesapeake Bay.

7. **Have students repeat the activity for their field location**
   Now that students have seen a good example of physical geography's impact on water flow, they should repeat the activity for their field study location (independently or in groups). Have students answer the questions on the student handout.

8. **Have students share their findings**
   As a group, discuss the physiographic provinces and the land cover might affect the water quality in your study area. Were there any nearby land cover types that they did not expect to see?

ADAPTATIONS

Classrooms outside of the watershed can also engage in the activity, picking a location in the watershed in place of home, school, or the field study location. Or, use the map layers and tools in your own watershed.

SUGGESTED STUDENT ASSESSMENT

Have students compare watershed flow paths at other locations in the watershed. Have students calculate the flow path from:
Charlottesville, Virginia (**38.04°N, 78.49°W**)
Scranton, Pennsylvania (**41.41°N, 75.66°W**)
Salisbury, Maryland (**38.37°N, 75.59°W**)
Ask students to give a spatial description of the water flow path, with an emphasis on the physiographic regions the water path encounters and any other physical geography features of interest.

EXTENDING THE ACTIVITY

Explain to students that topography lines can help us to see the landscape. Tell students that, by interpreting the lines, they can predict how water will flow across the landscape. Have students work with the topography maps in FieldScope to determine how water will flow across the landscape in an area of their choosing.

RELATED REFERENCE

VOCABULARY

flow path
map layers
physical geography
physiographic region
physiography
query tool

terrain
topography
watershed

BACKGROUND INFORMATION

The Chesapeake Bay watershed extends over a large area—from the Appalachian plateau in the west to the coastal plains in the east. Mountains, ridges, valleys, and gorges are some of the physical features found across this diverse landscape. The physical geography of the region defines how rivers and streams flow throughout the region. Students will work with map layers to discover the relationship between physical geography and patterns in river and stream networks.

RECOMMENDED RESOURCES

Additional resources for learning more about physiographic regions and the role of physiography in watershed dynamics include The Smithsonian Environmental Research Center, which provides an introduction to the coastal plain region of the Chesapeake Bay watershed: http://www.serc.si.edu/visiting/about/coastal_plain.jsp.

TIPS

Students will work with FieldScope to begin to understand their place in the watershed and their connection to the Chesapeake Bay. Students can use FieldScope tools and extract information from map layers to build a citizen watershed profile. You can make the profile an end product of the activity, or you can build upon it in following activities and modules.

Students should work from a predetermined location in the watershed, preferably the field study site where the class will conduct field work. Students can also use home or school as a starting point for the activity.

Classrooms outside of the Chesapeake Bay watershed can choose a location within the Bay watershed—a recognizable destination such as Washington, D.C., or Richmond, Virginia—and work through the activities using the selected location as their starting point.

Chesapeake Bay FieldScope Activity: Investigating Water Flow Patterns

How does water flow throughout a region? What defines water flow patterns? In this activity, you will use maps to investigate water flow patterns in the Chesapeake Bay region. Refine your skills as a geographer by using maps to look at features in the landscape that affect water flow —such as mountains, valleys, or drops in elevation. As a citizen scientist, you can use your skills to investigate how and why your local rivers and streams flow the way they do. An understanding of how water flows can provide clues to other issues, such as the upstream flow of pollution into your local waterways.

1. Physiographic Regions

Navigate to your study site location in FieldScope. Use the Flow Path tool to determine where water flows from your site to the Chesapeake Bay. Zoom out until you can see the entire path to the Bay.

Within what physiographic region is your study site located? (Hint: With the Physiographic Region layer turned on, use the Identify Feature tool and click on your location in the Bay to find the name of the region.)

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Follow your flow path to the Chesapeake Bay, and list the different physiographic regions you pass through.

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2. Landscape Features at Your Site

Describe the terrain around your study site (Is it hilly? Flat?) and list any physical features of interest at your study site that you can identify using different base map layers. (Hint: Experiment with using different map layers to explore different features. Turn on and off base maps like the Topographic map and the Terrain map. And use other layers such as Landcover or Wetlands. View the layer legends to learn more about the layers.)

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3. Landscape Features Along Your Flow Path

Describe the terrain and physical features the water flows through from your study site to the Bay. As the landscape changes, be sure to describe these changes. For example, describe if the river flows into another river and the name changes, or if the stream or river curves around a mountain or other feature.

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4. Land Cover Along Your Flow Path

How does land cover change from your location in the watershed and along your tributary path to the Chesapeake Bay? Use the land cover layer (Be sure to read the layer legend!) to explore the changes in land cover between your location and the Bay. In a few sentences, describe how the land cover changes. Note any interesting patterns you might see between land cover and landscape.

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