Delaware Bay FieldScope Activity: Take a Trip Down Your Tributary

OVERVIEW

In this activity, students work with National Geographic FieldScope to begin to build their identity as citizens of a vast and ecologically important watershed. Students will trace the tributary network path that connects their location to the Delaware Bay, adding key information to a watershed profile along the way.

LEARNER GRADE(S) /AGE LEVEL(S)

Grades 6-8 (Ages 11-13)
Grades 9-12 (Ages 14-18)
Post-Secondary (Ages 18+)

GUIDING QUESTION

Where are you located in the Delaware Bay watershed? How are you connected to the Bay?

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

INSTRUCTIONAL PURPOSE

Engage/Motivate OR Develop/Construct Knowledge

LEARNING OBJECTIVES

Students will be able to:

- locate themselves in the watershed using the FieldScope tool
- consider their absolute location in the watershed (i.e., latitude and longitude) in relation to other features
- trace the path that water takes from a point upstream to the Bay
- identify physical and cultural features along their tributary path

GEOGRAPHIC SKILLS

Asking Geographic Questions
Acquiring Geographic Information
Organizing Geographic Information
Answering Geographic Questions
Analyzing Geographic Information

PREPARATION

TIME (in minutes)

60 minutes

TECHNOLOGY REQUIRED

Computers/laptops with access to the Internet

MATERIALS REQUIRED

Student handouts

ONLINE RESOURCES USED IN ACTIVITY

National Geographic FieldScope

STUDENT HANDOUTS/BLACKLINE MASTERS

Student Watershed Profile handouts

PRIOR KNOWLEDGE

Students should have knowledge of geographic coordinate systems, specifically latitude and longitude. If they do not, additional instruction may be needed (see Recommended Resources). See the vocabulary list for other potentially unfamiliar terms.

PROCEDURE/DIRECTIONS

DIRECTIONS

1. **Activate students' prior knowledge about the Delaware Bay.**
   Have a whole-class discussion about the Delaware Bay watershed. Ask: *Where do you live in relation to the Delaware Bay? Are you close to its shores? Do you visit the Bay often? Or do you live farther from it?*Ask students to share their personal experiences such as what they do there, what they have noticed over time. Note that students may not have been to or experienced the Delaware Bay, but there's a good chance they have visited one of the many of streams and rivers—small and large—that eventually flow into the Delaware Bay.

2. **Build background about the Delaware Bay Watershed.**
   Tell students that the Delaware Bay is a large estuary. An estuary is a dynamic system where salt water from the Atlantic Ocean meets fresh water draining from a large area around it. That large area of land is called a watershed. People that live within the reach of this watershed have a special connection to the Bay. Their actions and the actions of their communities have a direct impact on the health of the Bay and the many streams and rivers that drain into it.

3. **Have students find their absolute location in the watershed.**
   Explain to students that they will explore their connection to the Delaware Bay using the FieldScope tool. Tell students they will create their own Delaware Bay watershed profile to start to build their identities as citizens of the Delaware Bay watershed. Knowing their watershed locations and developing their watershed profiles are key steps in the process of becoming informed watershed citizens. Distribute the Watershed Profile worksheet. Instruct students to use FieldScope to find their location in the watershed and record the latitude and longitude. Students can do this in one of three ways:

   - If a Global Positioning System (GPS) unit is available, students can use the unit to record the class location. Students can then use the geographic coordinates, or latitude and longitude, to manually navigate to the location using the navigation tools in FieldScope. A worksheet on latitude/longitude is included in the student handouts.

   - If a GPS unit is not available, students can search for the location address in the FieldScope search box or use the map tools to navigate to the site manually, using their own knowledge of local geography. Once students have located the site, they can record the latitude and longitude from the dynamic latitude/longitude display on the upper right side of the FieldScope map interface.

   - If no GPS unit is available and students will use the FieldScope application to record the coordinates, students can use the layer of satellite imagery and other base map layers to find their precise location. Once located, students can zoom in as close as possible and move the mouse over the site to record the latitude and longitude of that exact location.

Encourage students to notice how the latitude and longitude numbers change as they scroll the mouse around the map. Explain to them that this is a dynamic display of latitude and longitude. Once students have identified the latitude and longitude, have them record the geographic coordinates of the location on the student Watershed Profile handout.

4. **Have students measure the shortest distance from their location to the Delaware Bay**
   Direct students to the Measure Distance tool in the map toolbar. Have students select the tool and draw a straight line from their location to the shoreline of the Bay. Point out to students the difference between the actual Delaware Bay and its tributaries—students should draw the line to the Bay itself. Once the line is in place, students can record the distance in their student Watershed Profile handout.

5. **Have students measure the tributary water flow path to the Delaware Bay**
   Tell students that they will learn about the flow of water in the watershed by looking at the real route water travels from a specific location to the Bay. First, have students select the Flow Path tool. Have students click on their school or field study site. A time clock will appear, indicating that the tool is processing the information. After a few seconds, a flow line will appear that traces the path that water will take to get to the Bay. Students should use the Measure Distance tool to measure the distance of the flow path line from their location to the Delaware Bay. Explain to students that they should stop their measurement when the river they are measuring empties into the Delaware Bay. The flow path line may extend beyond this point.

   Explain to students that this tool uses an elevation dataset to model the path of water flow. Tell students that this means the elevation dataset is only a representation of the Earth's surface, and the tool will not compute the flow path with 100% accuracy. If possible, compute a flow path and, as a class, zoom in to trace the path. Discuss where the path lines up with the network of rivers and streams on the map and where it does not. Students should record the distance from their location to the Bay via the tributary network.

6. **Have students find the principle tributary and explore the tributary**
   Have students zoom in to their location and start to navigate down the tributary network in the direction of the Bay. In this part, students will pick out specific features along the way, such as major towns, cities, parks, or military bases. Encourage students to toggle between the different base map layers, each of which may show a variety of place names, features, and other information. As students navigate downstream, have them pick out at least five features of interest and any identifiable stream names. Make sure students identify the name of the main tributary that connects them to the Delaware Bay. Remind them that the main tributary is the final river or stream in their watershed that feeds directly into the Bay. For example, the Schuykill and Cooper rivers are possible main tributaries.

7. **Have students share their findings**
   Have a large class discussion about what students noticed. Ask: *What is your connection to the Delaware Bay? If you dropped an orange in the stream behind our school (or study location, or nearby location), what path would it take to reach the Delaware Bay? How might what we do at our location effect the Delaware Bay?*

EXTENDING THE ACTIVITY

Instead of having students locate their school or field study site location, ask students to locate their homes. Students can then compare results to see what different tributaries might be part of their tributary networks.

Have students present to the class on a feature of interest they found during their trip down the tributary. Encourage students to conduct additional research if they don't have sufficient knowledge about a feature (e.g., if a feature looks like a power plant, what power plant is it? If a feature is a park, what can you tell us about the park?) Emphasize the richness of a tributary network and the features along it that make it unique. Encourage students to explore the different map layers to interact with different features.

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RELATED REFERENCE

VOCABULARY

absolute location
aerial imagery
base layer
estuary
flow path
geographic coordinates
Geographic Information System (GIS)
Global Positioning System (GPS)
hydrologic features
latitude and longitude
relative location
satellite imagery
topographic map
tributary
tributary network

BACKGROUND INFORMATION

Understanding your place in a geographic area can be a powerful tool for building a connection to that place and gaining a deeper understanding of your place in relation to the world around you. National Geographic FieldScope brings maps and other geographic resources to the classroom that allow students to connect to their place in the Delaware Bay watershed.

Classrooms in the Delaware Bay watershed region come from a diverse range of settings—from the flat, agricultural areas of the shore, to the changing topography that makes up the mountains and valleys in the northwestern watershed, to the cities and towns along the Delaware and its tributaries.

Before starting the activity, emphasize to students the importance of recognizing their place in a larger system, such as the Delaware Bay watershed ecosystem. Reiterate this concept throughout the activity.

Absolute versus Relative Location

Your absolute location marks your exact location on Earth. This is different from a relative location, which is a place or region in relation to other places or regions. For example, the National Geographic Society is located just north of the White House in Washington, D.C., and a few miles northeast of the Potomac River. That is the relative location of the National Geographic Society.

To mark the absolute location of the National Geographic Society, we must use a system of coordinates, called latitude and longitude, to record the exact location in Washington, D.C., and the world! Every building, house, tree, and rock will have a unique set of coordinates that we can record to mark the feature on a map. The geographic coordinates of the National Geographic Society are:

Latitude: 38.9053°N
Longitude: 77.0380°W

Latitude and longitude are important values for scientists and researchers to record. Imagine finding an important fossil in the deep forest, or spotting an endangered animal darting through a patch of thick brush. Recording the location of events can give us information that we can share with others who will later visit the site, or it can be useful for other reasons, like plotting the field study site on a map.

GPS

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The Global Positioning System (GPS) is a network of satellites orbiting the Earth that we use to obtain location information—latitude and longitude—on the ground. GPS units are handheld devices that receive signals from the satellites and calculate your latitude and longitude by measuring the relative positions of the network of GPS satellites above.

RECOMMENDED RESOURCES

The Smithsonian—A National Geographic partner in the Thinkfinity consortium—offers a set of introductory materials on the Global Positioning System, or GPS: http://www.nasm.si.edu/exhibitions/gps/index.htm.

The NOAA National Estuarine Research Reserve System (NERRS) offers great educational resources that you can use to extend your study of estuaries and supplement the exploration of estuary tributary systems with additional materials. **Estuaries.gov** is the home site for the NERRS *Estuaries 101* curriculum. See the Earth Science module for exercises you can use to extend this activity.

EDUCATOR/STUDENT TIPS

Depending on your students' comfort with technology, you may want to demonstrate the lesson first with a sample location, and then let students complete the activity on their own for their study site. Student groups who are comfortable with technology may be able to complete the activity without teacher modeling.

Students will work with FieldScope to begin to understand their place in the watershed and their connection to the Delaware 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 Delaware Bay watershed can choose a location within the Bay watershed—a recognizable destination such as Philadelphia, Wilmington, Trenton or Cape May and work through the activities using the selected location as their starting point.

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Watershed Profile

1. Absolute Location
In FieldScope, use the "Find a location" search box and zoom in/out tools to navigate to your field study site. Record the latitude and longitude, listed in the upper right corner of the screen.

Latitude: _____ Longitude: _____

2. Shortest Distance to the Delaware Bay
Use the Measure Distance tool to measure the shortest straight-line distance from your location to the Delaware Bay. Select the tool and then draw a straight line from your location to the nearest point on the shore of the Bay. If you're unsure which place on the Bay is closest, keep checking until you find it. Be sure to include units.

Distance to the Bay (shortest straight-line): _____

3. Water Flow Path to the Delaware Bay
Select the FieldScope Flow Path tool and use it to calculate the path that water will take from your location to the Bay. Make sure you zoom in to your location so that you can place the tool on the precise spot. Then click on your location and wait as the tool computes your flow path. When the computation is complete, your flow path line will appear. Use the Measure Distance tool to trace the path of the line from your point to the Delaware Bay. (Hint: The Delaware Bay starts where the river, or tributary, empties into it. Measure the distance only from your point to where a river connects with the Bay.)

Distance to the Bay (tributary flow path): _____

4. A Trip Down Your Tributary
From your location in the watershed, follow your flow path line to the Delaware Bay. Zoom in close enough so that you can see features like parks, or buildings on the ground. There are different map layers you can use to explore different features. Use different base map layers to see how each map layer can be used to explore your tributary network.

Try using each of the following layers during your trip down your tributary: ***Satellite Imagery, Street Map, Topographic Map,*** *and* ***Boundaries and Places.***

List the names of ALL the streams and rivers that connect your location to the Delaware Bay. Zoom in and travel along your flow path to make sure you include all connected streams and rivers. (Hint: The topographic map layer labels hydrologic feature names.)

_____
_____
_____

5. Principal Tributary

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The Delaware Bay has several rivers that drain directly into it. These rivers are the principal tributaries of the Bay. What is the name of the principal tributary downstream from you that flows into the Delaware Bay?

_____

6. *Identify five features of interest between your study site and the Bay. Include 1-2 sentences that describe why you found those features interesting. Think about how those features connect to the stream or river that they are near.*

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