NATIONAL GEOGRAPHIC

Helping Restore a Watershed

Chesapeake Bay States Land-Use Enrichment

GRADES

6 - 12, Higher Ed

SUBJECTS

Conservation, Geography, Physical Geography, Mathematics

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OVERVIEW

Chesapeake Bay States Land-Use Enrichment

For the complete activity with media resources, visit:

http://www.nationalgeographic.org/activity/helping-restore-watershed/

DIRECTIONS

The Chesapeake Bay is the largest estuary in the contiguous U.S. The watershed covers 165,759 square kilometers (64,000 square miles) and is fed by fifty major rivers and streams. Everything always flows downstream. Because of this downstream flow, all the results of human habitation run into the ocean. Human habitation includes farms and developed lands. As the land is farmed and developed more, there is less land to absorb and filter the water. Restoration efforts have made modest ecological gains, but they have been largely offset by rapid population growth. Agriculture and developed land are one of the land-use classifications that are used to study the health of the bay.

Scenario

The [Chesapeake Bay](#) Foundation is interested in correctly assigning funds and resources to the seven states that make up the Chesapeake Bay watershed. To do this, the foundation asked for both quantitative and qualitative information from its GIS department. The foundation wants to know what percentage of land use is in each designated state's watershed area and presented in a compelling way to present to the community.

Have students follow the directions below.

1. Open and save the map.

1. Sign into your [ArcGIS organizational account](#).
2. Open [Chesapeake Bay Landuse](#). The map opens showing the [Topographic](#) basemap and the outline of the Chesapeake Bay showing the section of each state that is in the bay.
3. On the ribbon click the Save button and choose Save As.
4. In the Save Map window, type Chesapeake Bay Landuse_yourinitials.
5. Tags: Remove the tags and add individualized tags
6. Write a brief description of the map's content.

2. Display the Bay area by state abbreviation.

1. Click Contents.
2. To open the Change Style pane click the Change Style icon, which opens the Change Style Pane.
3. The states are shown by location only. Choose STATE_ABBR in the Choose an attribute to show tab.
4. Click DONE. The states are now displayed by individual colors.

Write several spatial observations about the Chesapeake Bay watershed. Include in your observations a discussion of political vs natural boundaries. The observations that are written here will be used later in the exercise when you construct your story map.

3. Use the data enrichment tool.

The data enrichment tool helps you explore the character of areas. Detailed information is returned for the chosen area. For this area, you would like to know information about the percentage of land use or landcover in each of the states represented in the Chesapeake Bay.

1. Click the Perform Analysis icon.
2. Click Data Enrichment.
3. Click the Enrich Layer tool to activate the Enrich Layer menu.
4. The Bay Area by State is selected by the layer to enrich. Click SELECT VARIABLES to pick the land cover information that you want to retrieve.
5. In the Data Browser in the upper right corner be sure that the United States is selected.
6. Click the arrow to show the next page.
7. Click Landscape.
8. Click LANDCOVER.
9. Select all seven variables by selecting the Landscape Analyst Variables.
10. Click APPLY.
11. The Result layer name = Enriched Bay Area by State_your initials.
12. Uncheck Use current map extent.
13. Click RUN ANALYSIS. The Enriched Bay Area by State layer will be added to the Content Pane.
14. Click on the Show Table icon. When you open the table, you will see that each bay state has been populated with the percentage of land use.
15. When you examine the table you will see several fields that are not necessary for the analysis. Click Table Options in the right corner and click Show/Hide Columns. Uncheck the fields listed below: STATE_Name, ID, ENRICH-FID, sourceCountry, HasData, Aggregationmethod.
16. Close the table by clicking the X in the right corner.
17. Uncheck Bay Area by State in the Contents Pane.
18. Display Enriched Bay Area by State by STATE_ABBR.
19. Click DONE.

4. Configure attributes and show charts.

You can display the bay states by land use percentage, but the amount of information that you portray is neither compelling nor quantitative. A better way to present your data is to create a chart. A chart will graphically display the values of numeric attribute fields, in this

case, the percentage of land use. Before you chart your data, you need to configure your pop-ups.

1. Click the three small dots after Enriched Bay Area by State and go to Configure Pop-up.
2. Enter a title for your pop-up. Title = Enriched Bay Area by State.
3. Display: A list of field attributes.
4. Click Configure Attributes and uncheck the following: STATE_Name, ID, ENRICH-FID, sourceCountry, HasData, Aggregationmethod
5. Click within the attributes and change to the following. Ensure the following stay on: STATE_ABBR, percent Open Water, percent Barren Land, percent Developed, percent Forest, percent Herbaceous, percent Pasture/Crops, percent Wetlands.
6. Click OK.
7. Under Pop-up Media, click ADD and add a Pie Chart.
8. Configure Bar Chart as follows: Title= Chesapeake Bay Land Use; Caption = Percent of Land Use by State; Check the following Percent Open Water, Percent Barren Land, Percent Developed, Percent Forest, Percent Shrub/Scrub/Grassland/Herbaceous (NLCD), Percent Pasture/Hay/Cultivated Crops (NLCD), Percent Wetlands.
9. Click OK. Now when you click on each of the states it shows the percentages of land use in both a table and a pie chart.

5. Use the table.

Don't forget the interactive table is a quick way to analyze information and make decisions. Sorting by a specific attribute is always useful.

1. Show the table.
2. Click the field Percent Developed.
3. Choose Sort Descending. That puts the values in order from highest to lowest, and you can see that DC is by far the most developed state, followed by MD and VA. You can also sort the table to arrive at more quantitative data.
4. Close the table.
5. Click Save.

6. Create a web app.

The Chesapeake Bay Foundation asked you to show the percentage of land use area in the bay by each state in a compelling way to present to the community. You have decided to make a story map to fulfill this task. You have selected a story map that presents a series of maps and other content organized using tabs.

1. Click Save to be sure your work has been saved. You have decided that the individual state maps that you want to use in your story map will look better if the basemap is Imagery with Labels.
2. Change the basemap to Imagery with Labels.
3. Save the map as Answers: Chesapeake Bay Landuse 2.
4. Click Share and Share with Everyone. Answers: Chesapeake Bay Landuse 2 is the beginning map for your story map series. You will also need individual maps of each watershed.
5. Filter the map by STATE_ABBR and select NY.
6. Save the map as NY.
7. Share with everyone.
8. Repeat steps five through seven for all the states. You should have seven maps.
9. Choose Answers: Chesapeake Landuse.
10. Open Answers: Chesapeake Landuse2.
11. Click Share.
12. Click CREATE APP.
13. Click Build a Story Map.
14. Click Story Map Series.
15. Click CREATE WEB APP.
16. Specify a title, tags, and a summary for the new web app.
17. Click DONE.
18. Select Tabbed on the Welcome to Map Series Builder.
19. Type Chesapeake Bay Watershed as the title for your Tabbed Map Series.
20. Click the Arrow.
21. Add Land Use Analysis for the ADD TAB.
22. Select or create a map pull-down and pick Chesapeake Bay Landuse.
23. Click ADD.
24. At the Top Ribbon click SETTINGS.
25. Click Map options.
26. Uncheck Synchronize map locations.
27. Click APPLY.
28. Add some appropriate text about the Chesapeake Bay to the text box such as: The Chesapeake Bay is the largest estuary in the contiguous U.S. The watershed covers 165,759 square kilometers (64,000 square miles) and is fed by fifty major rivers and streams. Everything always flows downstream. Because of this downstream flow, all the results of human inhabitation run into the ocean. Human inhabitation includes farms and developed lands, and as the land is farmed and developed more, there is less land to absorb and filter the water. Restoration efforts have made modest ecological gains, but they have been

largely offset by rapid population growth. Agriculture and developed land are one of the land use classifications that are used to study the health of the bay.

29. Click ADD.
30. Select a map. Select NY.
31. Click ADD.
32. Click on the bay part of New York and copy the percentages and add to your text box.
33. Repeat steps 28-30 for the other six states.
34. Click SAVE in the upper right corner.
35. Click VIEW LIVE to review your story map.

This activity has been slightly adapted to fit the National Geographic Education format. Please find the original here.

OBJECTIVES

Subjects & Disciplines

- Conservation
  Geography
  - Physical Geography
- Mathematics

Learning Objectives

Students will:

- build the following mapping skills - opening a map, enriching a layer, configuring pop-ups, using pop-up media, calculating a percentage, publishing as a web app.

Teaching Approach

- Learning-for-use

Teaching Methods

- Hands-on learning

Skills Summary

This activity targets the following skills:

- Geographic Skills
  - Analyzing Geographic Information
- Science and Engineering Practices
  - Using mathematics and computational thinking

National Standards, Principles, and Practices

PREPARATION

What You'll Need

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per learner, 1 computer per pair

PHYSICAL SPACE

- Classroom
- Computer lab

OTHER NOTES

ArcGIS account required.

BACKGROUND & VOCABULARY

Background Information

Prior Knowledge

[]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
bay	noun	body of water partially surrounded by land, usually with a wide mouth to a larger body of water.
Chesapeake Bay	noun	large, shallow estuary of the Susquehanna and other rivers that flow through the U.S. states of Maryland, Virginia, West Virginia, Delaware, Pennsylvania, and New York and the capital of Washington, D.C., before emptying in the Atlantic Ocean.
classification	noun	grouping based on physical and genetic characteristics.
downstream	noun	in the direction of a flow, toward its end.
estuary	noun	mouth of a river where the river's current meets the sea's tide.
qualitative data	noun	descriptive information that does not use numbers.
quantitative data	noun	measured information using numbers.
restoration	noun	repair of damage to an ecosystem so that it can function as a normal self-regulating system.
river	noun	large stream of flowing fresh water.
topographic	adjective	having to do with maps based on natural and human-made features of the land, and marked by contour lines showing elevation.
watershed	noun	entire river system or an area drained by a river and its tributaries.

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