

A Tale of Two Rivers Lesson Plan

Students compare two streams and consider the implications of climate change and development.

Lesson Summary: Using data and technology including 15 years worth of flow data, students explore the differences between two notable streams – a creek that flows through Disney World, and the top of the Hillsborough River near the original source of Zephyrhills bottled water. Implications of development and climate change are considered.

Grade Level: 8 (adaptable 6-8)

Time Allotted: 1-4 days

Performance Objectives

References are to the Next Generation Sunshine State Standards (2007).

Science

- SC.8.N.1.1 Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types, such as systematic observations or experiments, identify variables, collect and organize data, interpret data in charts, tables, and graphics, analyze information, make predictions, and defend conclusions.
- SC.8.N.1.3 Use phrases such as "results support" or "fail to support" in science, understanding that science does not offer conclusive 'proof' of a knowledge claim.
- SC.8.N.1.6 Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence.
- SC.8.N.3.1 Select models useful in relating the results of their own investigations.
- SC.8.N.4.1 Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.
- SC.8.N.4.2 Explain how political, social, and economic concerns can affect science, and vice versa.

Math

- Big Idea 3: Analyze and summarize data sets.
- MA.8.S.3.1 Select, organize and construct appropriate data displays, including box and whisker plots, scatter plots, and lines of best fit to convey information and make conjectures about possible relationships.
- MA.8.S.3.2 Determine and describe how changes in data values impact measures of central tendency.

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- MA.8.A.6.4 Perform operations on real numbers (including integer exponents, radicals, percents, scientific notation, absolute value, rational numbers, and irrational numbers) using multi-step and real world problems.

Language Arts

- LA.8.1.5.1 The student will adjust reading rate based on purpose, text difficulty, form, and style.
- LA.8.1.6.1 The student will use new vocabulary that is introduced and taught directly.
- LA.8.1.6.2 The student will listen to, read, and discuss familiar and conceptually challenging text.
- LA.8.1.6.5 The student will relate new vocabulary to familiar words.
- LA.8.4.2.1 The student will write in a variety of informational/expository forms (e.g., summaries, procedures, instructions, experiments, rubrics, how-to manuals, assembly instructions).
- LA.8.4.2.2 The student will record information (e.g., observations, notes, lists, charts, legends) related to a topic, including visual aids to organize and record information, as appropriate, and attribute sources of information.

Social Studies

- SS.8.G.5.1 Describe human dependence on the physical environment and natural resources to satisfy basic needs in local environments in the United States.
- SS.8.G.5.2 Describe the impact of human modifications on the physical environment and ecosystems of the United States throughout history.

Prior Knowledge

Some familiarity with Central Florida.

Topic Overview

Using technology and data, students explore differences between two interesting bodies of water in Central Florida – a creek that flows through Disney World, and the upper Hillsborough River near Crystal Springs, the original source of Zephyrhills Spring water. Their knowledge about these streams grows in stages, beginning with exploration of the Water Atlas entries. They then examine 15 years of flow data (optionally cleaned and synchronized), and finally use an interactive mapping tool to get a closer look. Extensions include excursions, a controversy, and the potential effects of urban heating and climate change.

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Key Vocabulary

Blackwater river

A slow-moving stream or river that drains swampy areas high in tannins that stain the water a dark color. Blackwater rivers are typically relatively acidic and low in certain minerals.

Current

The speed at which water is flowing.

Flow

The volume of water moving past a point.

Spring fed

Referring to a stream or river that receives a majority of its flow from one or more springs, i.e., water emerging from an aquifer.

Spring run

A creek made up almost entirely of spring water; spring runs are typically clear and blue (e.g., Rock Springs Run).

Tannins

Naturally occurring organic acids; tannic acids leach from leaves and other organic material as it decomposes, giving water a tea or coffee color.

Urban heat island

A land area that captures and holds heat, its night-time temperatures elevated by consequences of urbanization such as dense coverage by buildings and pavement, and reduced vegetation coverage.

Materials

- Computers with internet connection
- Google Earth software (optional—free download)
- Spreadsheet, graphing and presentation software (Microsoft Excel and PowerPoint or equivalent)
- Science notebook.

Resources

The following documents may be found in the [Digital Library](#) of the Orange County Water Atlas:

[Climate Change and Land Use in Florida: Interdependencies and Opportunities](#)

Source: Collins Center for a Sustainable Florida. 2007.

[2008 Water Quality Report](#)

Source: Orange County Environmental Protection Division. 2008.

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[Urban Heat Island Basics](#)

Source: U.S. Environmental Protection Agency. 2008.

Other resources on the Orange County Water Atlas:

[Water Flow \(Learn More\)](#)

[Data Download and Graphing Tool](#)

Other resources:

Cook, John. [Skeptical Science: Getting Skeptical About Global Warming Skepticism](#). Website. Accessed June 2011.

Cool Neighborhoods (Florida Solar Energy Center)

<http://www.fsec.ucf.edu/en/publications/html/FSEC-PF-363-01/>

Disney Wilderness Preserve (optional excursion)

<http://www.nature.org/wherewework/northamerica/states/florida/preserves/art5523.html>

Disney World Map

<http://disneyworld.disney.go.com/maps/>

Orange County Regional History Center

<http://www.thehistorycenter.org/>

Florida Photographic Collection, State Library and Archives

<http://www.floridamemory.com/PhotographicCollection/>

Stanton, Elizabeth K., and Frank Ackerman. [Florida and Climate Change: The Cost of Inaction](#). 2007.

Tufts University Global Development and Environment Institute and Stockholm Environment Institute—US Center.

The Story of Bottled Water

<http://storyofstuff.org/bottledwater/>

Tampa Bay Water Atlas

<http://www.tampabay.wateratlas.usf.edu/>

Trout Creek Park

<http://www.swfwmd.state.fl.us/recreation/areas/lh-troutcreek.html>

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Procedure

Engage/Elicit

Tell the students you will be introducing them to two of central Florida's more interesting streams. One is near the source of water many of them have been drinking – another flows past a magic downtown. Although both of these streams cannot be explored completely in person because of private property, they will be using technology to learn about them. There are online data sets, maps and satellite views that can help tell their stories.

Explore 1: Exploring the atlas entries.

Give students links to the **Orange County Water Atlas** and the **Tampa Bay Water Atlas**, and tell them they will be comparing two streams. The first is Cypress Creek in Orange County, and the second is the upper part of the Hillsborough River, in Polk/Hillsborough counties. Ask them to come up with as many differences as they can between these two, and suggest reasons for those differences. Give them time to explore, then collect this information. This may be done individually or in groups, depending on computer availability.

Be sure to have them click the Learn More about Stream Flow link (**Water Flow** in Resources) to discover the difference between current and flow.

Explore 2: The flow data

If you have motivated students, they can download flow data from each stream using the Data Download and Graphing tools in the Orange County Water Atlas. Optionally, you may use a version of the data that has been compiled and “cleaned” by distributing one of the Cypress v Hills comparison files for them. The files contain flow data from 1995, and there is a lot of data to be explored – over 5500 entries each. The stations used are:

- Station 1: CYPRESS CREEK AT WORTHINGTON GARDENS FL
- Station 2: HILLSBOROUGH R BL CRYSTAL SPR NEAR ZEPHYRHILLS FL

The students can go to the **Orange County Water Atlas Data Download** to download the data as a spreadsheet and manipulate it themselves. Let them explore, ultimately finding the stations above and downloading the data in spreadsheet format. Or, they may use a “cleaned” data file in one of the following formats:

- Cypress v Hills.ods for the free OpenOffice Calc program, includes graph
- Cypress v Hills.xlsx for Microsoft Excel, includes graph
- Cypress v Hills.txt tab delimited text file, no graph

The first two include a graph of all of the data that shows dry spells and some huge flow increases. The third is just tab-delimited text data that can be loaded into any spreadsheet or graphing software to encourage the students to create their own graphs without seeing the overall one first.

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This is 15 years worth of data, and some interesting differences can be teased from it. Ask students to examine it, to prepare charts of all or parts of it, and to expand upon their thoughts about the differences between the two streams and possible reasons for them. (To download these data files, [click here.](#))

Explore 3: Eye in the sky

Have students try to find both bodies of water using the [Advanced Mapping Tool](#) on the Orange County Water Atlas and the Tampa Bay Water Atlas. Note that Cypress Creek is a common name, so they will need to find the one near Disney World. Once they have found them, have them prepare a brief report that includes location, nearby landmarks, surrounding ecosystems, land use, and drainage. Be sure they use the Map Layers tab to explore the various data sets included in the mapping tool.

For the optional Google Earth exploration, be sure to make them aware of the street view and photography layers, which can be clicked on for closer looks in some areas, notably the flood control structure on Cypress Creek above the bridge on Buena Vista Drive. Crystal Spring itself is visible at latitude/longitude 28.1826, -82.1852; the gate blocking access to it is visible from the nearby road. Remember that hitting the r key resets the view to straight down North up. If computers allow, have them prepare this report as a multimedia presentation.

Direct students to the Orange County **Water Quality Report** (see Resources). It has a picture of the actual gauge (nicely set in cypress trees), some graphs, and GPS coordinates they can use to verify the location in Google Earth. Be sure the units (Tools – Options – 3D View) are set properly, the Report uses the awkward Degrees – Minutes – Seconds format. Cypress Creek starts on page 381.

Note that it is also possible to find Cypress Creek on the official **Disney World Map** (available online in Resources) – although it is not labeled, students should still be able to recognize it by the shape and location (Clue – Disney Old Key West Resort). This is an interesting case of virtual worlds colliding.

Explain

Be sure students understand the difference between a blackwater river and a spring fed river, two of the three most common types in Florida (tidal rivers occur near the coast). The Hillsborough River becomes spring fed as it passes Crystal Springs, the original source of Zephyrhills Spring Water. This shows up in the data as a more steady flow at low levels. During droughts this source gradually tapers off but does not cease, while the flow in Cypress Creek regularly goes right down to zero.

Note that the larger and steeper the drainage, the more likely creek flow will increase dramatically during rains. Much of Florida now has flood control structures and systems to alleviate this – this is a good time to discuss the social and ecological consequences of controlling floods. Although the lower Hillsborough River has a huge area that is designed to absorb floods (Flatwoods), imagine Disney's resort area regularly flooding!

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Extension 1 – Development and Urban Heat Islands

As the history of these two rivers has shown, Florida's landscape has undergone extensive revisions during the past 100 years as the state's population has grown. Studies have shown that widespread landscape changes can affect Florida's climate. This is a two-way interaction, as climate changes may affect future land use in the state, especially as temperature fluctuations and coastal inundation change agricultural and urban development patterns. See ***Climate Change in Florida*** and ***Climate Change and Land Use in Florida*** for more details.

Have students investigate the "urban heat island" effect, starting by reading the EPA's ***Urban Heat Island Basics***. They can use thermometers to measure the temperature at areas around their school with various surfaces, such as a parking lot, dark-colored roof, light-colored roof, sunny/grassy field, wooded area, etc. Take these temperatures at different times during the day/night, compiling them into a time/temperature graph. Look for differences in temperature in different locations, as well as the rate at which the temperature changes throughout the day/night. Which locations have the highest/lowest temperature? Which locations hold heat longest? See ***Cool Neighborhoods*** for more information.

Extension 2 – Back in My Day...

Lead a class discussion about what it would have been like to live in Orange County in earlier times, when there were fewer roads and more open space. What were the main occupations of people? What events impacted their lives (Seminole Indian attacks, World War I and II, rise of agriculture, construction of theme parks, advent of the space program, etc.)?

Using the ***State Library and Archives*** and/or the ***Orange County Regional History Center***, provide each student with a photo of a particular place and time in Orange County's history. Then have them write a story written from the perspective of a person from that place and time, using the photo as inspiration. Post the photos and fictionalized stories on the Orange County Water Atlas Watershed Excursion.

Extension 3 – Excursions!

Excursion – although Cypress Creek has been surrounded by Disney resorts, The ***Disney Wilderness Preserve*** (see Resources for link) at Lake Russell, managed by the Nature Conservancy, has a hiking trail to one of the last remaining undeveloped lakes in Central Florida. For those interested in ecological restoration, the land here is actively being restored – teachers or parents should call the Nature Conservancy to arrange a visit.

Although Crystal Springs is privately owned, the Hillsborough River has a series of excellent county and state parks that highlight well-fields, flood control and littoral ecosystems. See Flatwoods, Morris Bridge or ***Trout Creek*** parks for more information.

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Extend 3: A Controversy

To help link Crystal Springs to the lives of the students, have them watch *The Story of Bottled Water*, an animated, unflattering description of the bottled water industry. Discuss, including bottled water sources and ways that associated companies can reduce their negative impacts.

Exchange/Evaluate

Collect their thoughts on the differences at various points throughout this lesson to see how they are progressing.

1. Initial (after exploring the Atlases)
2. After exploring and charting the flow data.
3. After using the interactive mapping tool and Google Earth to explore them from above.
4. You may also evaluate the computer presentations they create.

With some preparation, this lesson could be done using two different rivers – just be sure to check in advance that there is sufficient data available, in a format that is usable by your students.

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