

# 6-8 What are Watersheds? Activity

## Overview

### Focus Question

What is a watershed?

### Activity Synopsis

Students will use a physical map of South Carolina to trace the major watersheds of South Carolina to show where they are located and demonstrate an understanding of the terms watersheds, drainage basins and drainage divides.

### Time Frame

1 class period

### Objectives

The learner will be able to:

- Explain what a watershed is
- Explain what a drainage divide and a drainage basin are
- Given a physical map of South Carolina, delineate the four major watersheds of the major rivers of South Carolina

### Student Key Terms

- drainage basin
- drainage divide
- watershed

### Teacher Key Terms

- dendritic pattern
- groundwater
- headwaters
- surface runoff
- tributary

## Standards

### *South Carolina College- and Career-Ready Science Standards 2021*

**6<sup>th</sup> Grade: 6-ESS2-4**

**7<sup>th</sup> Grade: 7-LS2-1, 7-LS2-2, 7-LS2-4**

**8<sup>th</sup> Grade:**

**\*Bold standards are the main standards addressed in this activity**

### 6<sup>th</sup> Grade Performance Expectations

**6-ESS2-4.** Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

### 7<sup>th</sup> Grade Performance Expectations

7-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

7-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

7-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

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## Cross Curricular Standards

### *South Carolina Social Studies Standards*

6.5.CX, 7.5.1.PR, 7.5.2.ER

### *South Carolina College and Career Standards for ELA*

Reading Info (RI) – 6-7.1, 7-7.1, 8-7.1

Writing (W) – 6-1.1, 6-2.1, 6-4.1, 6-5.2, 6-6.1, 7-1.1, 7-2.1, 7-4.1, 7-5.2, 7-6.1, 8-1.1, 8-2.1, 8-4.1, 8-5.2, 8-6.1

Communication (C) – 6-1.1, 6-1.2, 6-1.3, 6-1.4, 6-1.5, 6-2.1, 6-2.4, 7-1.1, 7-1.2, 7-1.3, 7-1.4, 7-1.5, 7-2.1, 7-2.4, 8-1.1, 8-1.2, 8-1.3, 8-1.4, 8-1.5, 8-2.1, 8-2.4

### *Common Core Math Standards*

6.G.4, 7.G.6

### *Common Core ELA Standards*

Writing – 6.1, 6.2, 7.1, 7.2, 8.1, 8.2

Speaking/Listening – 6.1, 6.2, 6.3, 6.4, 7.1, 7.2, 7.3, 7.4, 8.1, 8.2, 8.3, 8.4

Language – 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 8.1, 8.2, 8.3, 8.4, 8.5, 8.6

## Background

### Key Points

*Key Points will give you the main information you should know to teach the activity.*

- **Watersheds**, also known as **drainage basins**, are areas of land where all of the water that collects in the area from precipitation will eventually drain into the same river, lake, wetland or other body of water.
- **Drainage divides** are the boundaries between watersheds. They are areas of higher elevation, such as ridges, hills or mountains, in which all of the precipitation on one side of the ridge will flow into one watershed and all of the precipitation on the other side of the ridge, will flow into a different watershed.
- South Carolina has four major watershed systems:
  - The Santee River Watershed is the largest watershed in South Carolina and extends from the Blue Ridge Mountains of South and North Carolina to the ocean in South Carolina.
  - The Pee Dee River Watershed also extends to the Blue Ridge Mountains in North Carolina and covers the northeast corner of South Carolina.
  - The Savannah River Watershed extends to the Blue Ridge Mountains, but is found primarily in Georgia.
  - The Coastal Plain Watershed is the only watershed completely contained in South Carolina. This watershed is made up of many smaller watersheds, including the watersheds of rivers such as the Ashley River, the Edisto River and the Combahee River.

### Detailed Information

*Detailed Information gives more in-depth background to increase your own knowledge, in case you want to expand upon the activity or you are asked detailed questions by students.*

People are so used to having water easily available to them that most probably do not give any thought to where the water comes from. Every glass of water has its origin in the natural world, and the water molecules in the glass have been traveling around the planet through most of Earth's history. At different times these molecules may have been rain, water vapor, water in rivers or oceans, frozen in glaciers or inside a living organism. To become a glass of drinking water, these water molecules came to a local area, were collected in local wells or reservoirs, and were pumped to a local faucet by a water utility company. The way this water traveled from rainwater along the ground to a reservoir is through a watershed.

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A **watershed** is a delineated area of land where all of the precipitation water drains into a particular stream, river, lake or wetland. Watersheds can be as small as a few acres or as large as a subcontinent. For example, the watershed of the Ashley River is contained entirely in the Lowcountry of South Carolina, while the Santee River watershed extends all the way from the Atlantic Ocean to the Blue Ridge Mountains. Water flowing into the Atlantic Ocean from the Santee River may have come from Columbia, Rock Hill, Greenville, Laurens and even towns in western North Carolina, as the Santee River watershed extends to all of these areas. The Mississippi River watershed, the largest watershed in the United States, extends from the Gulf of Mexico to Southern Canada and from the Rocky Mountains to the Appalachian Mountains.

The area a watershed drains can also be termed a **drainage basin**. To make it confusing, the tributary of a river will have its own watershed or drainage basin that is also part of the larger watershed of the river. **Tributaries** are the smaller streams and rivers that join a river and bring water into it. For example, the Saluda River has a drainage basin that is separate from the drainage basin of the Broad River. Both these rivers' drainage basins, though, are part of the Congaree River drainage basin, as both of these rivers flow in to the Congaree River. All of these river watersheds are part of the Santee River watershed, as all of them bring water into the Santee River and eventually the Atlantic Ocean.

The boundaries of a watershed are named **drainage divides**. Drainage divides are areas of relatively higher topography in which water on one side of the divide will drain into one basin and the water on the other side will drain into a different basin. The Continental Divide in the Rocky Mountains is an example of a drainage divide, where water on the west side flows to the Pacific Ocean and water on the east side flows to the Gulf of Mexico.

Watersheds contain both **surface runoff** and **groundwater**. During rains, some water will flow across the surface, moving down the land as elevation drops until it joins local streams or rivers. This water is termed surface runoff. In South Carolina, the surface water continues moving southeastward in streams and rivers until it reaches the ocean.

Rainwater that infiltrates into the ground is known as groundwater. Water is pulled downwards by gravity until it reaches an impermeable surface. It then moves in a lateral downwards direction, following the topography of the watershed towards the ocean. Groundwater moves very slowly, sometimes being measured in centimeters per year. Though not visible to us, groundwater comprises over 95% of the liquid freshwater on earth.

Watersheds are determined by the shape of the land and are affected by elevation. As gravity pulls water downward, the water moves from higher to lower elevations. Areas of relatively high topography surround watersheds, and these areas become the drainage divides. In a flat area such as the Lowcountry, slight changes in elevation can define drainage divides. The water in the watershed will follow the sloping of the land downward to the sea.

Watersheds are also affected by the underlying soil and rocks. If the underlying soil and rock is resistant to erosion, then the water will flow along the top and will not be able to erode enough material to create much of a channel in the rock. If the underlying rock is highly susceptible to erosion, then deep streambeds and wide river valleys will be created. Each river will have many stream tributaries and the drainage pattern of the watershed will resemble a tree with many branches. This pattern of drainage is known as a **dendritic pattern**. The dendritic pattern can be found in all the watersheds of South Carolina.

South Carolina is drained by three major watersheds: the Pee Dee River drainage basin, the Santee River drainage basin and the Savannah River drainage basin, as well as a handful of smaller watersheds in the Coastal Plain. These follow the slope of the state from the high elevation of the northwest mountains to the low elevation of the southeast sea. The **headwaters**, streams at the beginning of watersheds, of these three major watersheds in South Carolina form on the slopes of the Blue Ridge Mountains in North Carolina, east of the Appalachian Divide. Smaller watersheds of rivers and streams, such as the Ashley, Combahee and Edisto River drainage basins, are situated entirely within the Coastal Plain of the state.

Of South Carolina's three major river watersheds, the largest is the Santee. The Santee and its tributaries in the Blue Ridge Mountains and Piedmont drain nearly 40 percent of the state's total area. The Pee Dee River winds 197 miles (317 km) from the North Carolina line to the Atlantic Ocean, and its watershed drains the northeastern corner of our state (about 25% of South Carolina). The Savannah River drains about 20 percent of South Carolina's total area. Though the Savannah River extends 260 miles (418 km) along South

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Carolina's border, its watershed only extends 15 to 60 miles (24 to 97 km) into the state. The majority of its watershed is in Georgia. The number of smaller watersheds, such as those of the Ashley, Edisto and Combahee Rivers, form a fourth drainage system south of the Santee watershed. Lying totally within South Carolina and originating in the Coastal Plain, these rivers together drain about 15 percent of the state's total area. The major watersheds, because they drain a much larger area than the coastal river watersheds, carry a much larger volume of water and transport more sediment than these smaller watersheds. Here is a chart showing each watershed's drainage percentage:

**Watershed Percentage** of SC land drained by each watershed

- Santee River Watershed 40%
- Pee Dee River Watershed 25%
- Savannah River Watershed 20%
- Coastal Plain Watershed 15%

Watersheds are increasingly a concern for many people because of issues of water quality and contamination. Contamination in rivers and streams not only affects human water supplies, but it has a major effect on the wildlife that depend on these watersheds for water and who do not have access to filters or water treatment plants. Because a river's watershed may extend across an entire state, or even more than one state, if there is a contamination problem in that watershed, it is necessary to look at the entire watershed to determine where the contamination might be coming from. For example, if the Pee Dee River near Georgetown were experiencing water quality problems, it would be necessary to look at the entire Pee Dee Watershed to determine what might be causing this, both in South and North Carolina, since this entire area could be picking up contaminants and bringing it to the Pee Dee River. Students need to be aware of watersheds to realize that people miles upstream from them can affect the local water quality, and also that the students themselves have the ability to affect the water quality of people and wildlife miles downstream from them.

## **Procedure**

### **Materials**

- Laminated physical maps of South Carolina (1 per student group)
- South Carolina Watersheds Map ([Color Map](#); [Black and White Map](#))
- South Carolina Regions Map ([Color Map](#); [Black and White Map](#))
- 4 different color Non-permanent markers (visa vis markers work best) or other writing utensils
- [SC Rivers Map](#) (8.5x11)
- [SC Rivers Map](#) (11x17)
- Baby wipes (for cleaning off maps if needed)

### **Procedure**

Preparation: The teacher should contact the local water utility company to determine what source (river, groundwater, reservoir,...) local water is drawn from. The teacher should use this information to determine what watershed the local area is in and then become familiar with the size and shape of this watershed, as well as any other pertinent information about it.

1. Begin the class by giving a student a glass and asking him or her to fill it up with water from a nearby faucet or water fountain. Once this is done, hold up the glass of water and ask the students where the water came from? Students should brainstorm ideas, until one of them comes up with a local water source (stream, river or lake).
2. Show a laminated physical map of South Carolina or the SC Rivers Map and have students find the nearest local river or lake. Ask the students "Where does the water in this river or lake come from?"
3. Then ask the students which way they think the water in the rivers is flowing. (Hint: the mountains are in the northwest, the ocean

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is in the southeast and water flows from high to low elevation). Next, ask one of the students to follow the river upstream with a non-permanent marker. Then have the student start tracing all tributaries of that river (the streams and rivers that branch off of it on the map).

4. Once the river and all its tributaries are traced, remark that this outlined area is the watershed for the local river. Define the terms watershed (or drainage basin) and drainage divide and identify them on the map.

5. Ask the students if the local watershed drains directly into the ocean or if it drains into another river or lake. If it does not drain directly into the ocean, then it must be a part of a much larger watershed. Have a student follow the local river downstream with a non-permanent marker until it reaches the ocean at its outlet.

6. Have two different students come to the map and look at the outlet of the watershed into the ocean. Using markers, have them trace along both sides of the river, one student per side, enclosing all tributaries, until their pens meet or they reach the state border. *Note: Coastal rivers, such as the Ashley, Edisto and Combahee, will have their watersheds entirely within the state. Major rivers such as the Savannah, Santee and Pee Dee have watersheds that extend out of the state and students will stop drawing at the state boundaries for these.*

7. Show them the drainage divide for the watershed they just traced and talk about the elevation changes along the different sections of the watershed.

8. Show the students the South Carolina Watershed map. Point out each watershed and give background information on each (information found in Background for this activity).

9. Show them the South Carolina Regions map. Quickly review the regions of South Carolina and then ask them how a watershed map differs from a region map.

10. This next part can be done a couple different ways depending on what maps you have available to you.

- With a large map of South Carolina, use these directions:
  - Break the students up into groups of 4 students.
  - Give each group a laminated physical map of South Carolina and 4 non-permanent markers (4 colors work best so each student will have their own color).
  - Have the groups assign each student to a river (see list below). Ask the students to put an X on the map where their river/s meet/s the ocean, and then use these X's as starting points to trace the rivers and their tributaries.
    - Student 1 – Savannah River
    - Student 2 – Edisto, Ashley and Combahee River
    - Student 3 – Santee River
    - Student 4 – Pee Dee River
  - When the students are finished, ask the students to look at the watersheds they have outlined and consider the size.
- With the small (8.5x11 or 11x17) map of SC Rivers, use these directions:
  - Give each student a SC River Map and 4 different color writing utensils
  - Have each student trace the rivers using a different color for each symbol on the map
  - When the students are finished, ask the students to look at the watersheds they have outlined and consider the size.

11. Pose these questions:

- How would you describe our local watershed?
- About how large is the watershed (drainage basin)?

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- Where are the drainage divides?
- Why do you think the drainage divides are where they are?
- When considering how to improve water quality in our town, can we only look at the rivers and streams in town?
- Can the local water quality be affected by the actions of towns and people upstream from us?
- Can our town's actions affect the water quality of those downstream of us?
- Can pollutants in Spartanburg affect the water quality of the Santee River on the coast?
- Are there places in South Carolina where one would have to look at other states to determine all the factors that might be affecting water quality?

12. Students should write down their answers, thoughts and ideas.

## At-home Learning and Virtual Modifications

At-home and Virtual Learning: Use the following nearpod information to choose how to complete this activity. You could choose to have them do it independently (lesson is narrated to help them along) or with you leading. This interactive activity will cover watersheds and drainage divides as well as focus on South Carolina's watersheds.

[Nearpod Watershed Lesson \(without student interaction\)](#)

Nearpod Watershed Lesson (with student interaction) - directions

1. Create a free nearpod account (<https://nearpod.com/>)
2. Ask Aquarium to send you the What at Watersheds? nearpod link (email [education@scaquarium.org](mailto:education@scaquarium.org))
3. After you receive Aquarium link, add lesson to your nearpod activities by clicking "Add to My Library"
4. Send to students using Live Participation
5. You'll be able to see their answers and interactions

## Follow-up questions

- Which do you think would have a higher volume of water flowing, the Edisto River or the Santee River? Why?
- Which do you think would be transporting more sediment, the Edisto River or the Santee River? Why?

## Assessment

Give each student a physical map of South Carolina. Have students delineate the four major watersheds of South Carolina. Tell them to put a star where the school is located on their map to delineate which watershed is their 'local' watershed. At the bottom of their map, have them describe their local watershed in a way that demonstrates their understanding of the terms watershed (drainage basin) and drainage divide.

*Scoring rubric out of 100 points*

For each South Carolina watershed correctly delineated:	<b>20 points (total 80 points)</b>
Demonstrates understanding of the term watershed (drainage basin):	<b>10 points</b>
Demonstrates understanding of the term drainage divide:	<b>10 points</b>

## Cross Curricular Extensions

### STEM Extension

Ask students to re-design their town/community in such a way that the town/community does more to protect the existing watershed. They would need to think about areas within their town/community that have the greatest negative impacts on their watershed, research various ways/technologies that protect watersheds (gravel parking lots, more parks, recycling bins, rain barrels,

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transit system,...), construct a model or drawing of their town/community with the implemented changes and estimate the costs of these changes. They could then present their proposed changes to the town/school administrators/class. After getting feedback, have them make improvements to their plan.

## **Social Studies Extension**

Have students find an old map of South Carolina such as the Carte Des Deux Carolines et De La Georgie. They can use the map to compare and contrast it with the map they have used to delineate the watersheds. They will determine where development has occurred and how watersheds have changed in the last 100 or 200 years in South Carolina.

## **Math Extension**

Using the scale of a South Carolina map and transparent grids, have students approximate the area of the major watersheds of South Carolina.

## **Language Arts Extension**

Have students read an assessment of local water quality by the EPA, DHEC, USGS or SCDNR. They can take this information to write a mock newspaper article about the water quality in their area.

[Sixth Grade Social Studies Extension](#) by South Carolina Aquarium Master teacher, JoLynn Prochaska

[Sixth Grade Math Extension](#) by South Carolina Aquarium Master teacher, Laura Kent

## **Resources**

### **Teacher Reference Books**

Cvancara, Alan M. A Field Manual For The Amateur Geologist: Tools and Activities for Exploring Our Planet, John Wiley & Sons, Inc., New York, 1995.

*This field guide contains information on the physical environment.*

Kovacik, Charles F. and John J. Winberry. South Carolina: the Making of a Landscape, University of South Carolina Press, Columbia, 1989.

*This wonderful reference book provides information on the abiotic factors that determine the habitats of South Carolina.*

Murphy, Carolyn Hanna. Carolina Rocks!: The Geology of South Carolina, Sandlapper Publishing Co., Inc., Orangeburg, 1995.

*Information on the geology, topography and formation of all of the regions in South Carolina.*

Plummer, Charles C. and David McGeary. Physical Geology, Wm. C. Brown Publishers, Iowa, 1991.

*This college textbook is an excellent resource for anyone wanting to know more about geology.*

### **Teacher Reference Websites**

Chesapeake Bay Foundation Environmental Education

[www.cbf.org/](http://www.cbf.org/)

The Chesapeake Bay Foundation has put together an exemplary watershed protection program that encompasses many states. This site includes information on what they have done in this program as well as curricula and other education related items.

EPA'S Environmental Education Center

[www.epa.gov/teachers/](http://www.epa.gov/teachers/)

Provides information on water and watersheds and links to other sites.

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EPA Office of Water: Office of Wetlands, Oceans and Watersheds

[www.epa.gov/owow/](http://www.epa.gov/owow/)

Provides information on watersheds, wetlands, water quality plus much more.

South Carolina Department of Health and Environmental Control (DHEC): Bureau of Water

[www.scdhec.net/water](http://www.scdhec.net/water)

This site offers information on drinking water, water pollution control, watersheds plus much more.

Southern Appalachian Watershed Conservation Clearinghouse

<http://sunsite.utk.edu/samab/proj/watershed.html>

This site offers links to a number of websites related to watershed conservation in the Southeastern United States.

Surf Your Watershed: A Service to Help You Locate, Use, and Share Environmental Information about your Place

[www.epa.gov/surf](http://www.epa.gov/surf)

This site allows you to learn specific information related to the watershed your town is located in.

## Student Reference Books

Cone, Molly. *Come Back, Salmon*, Sierra Club Books for Children, San Francisco, 1992.

*Learn how the students of Jackson Elementary School in Everett, Washington, cleaned a nearby stream, stocked it with salmon and protected it from pollution.*

Haslam, Andrew. *Make It Work! Rivers*, World Book Inc./ Two-Can, Hong Kong, 1996.

*Readers will explore the rivers of the world and determine how they affect Earth.*

Levete, Sarah. *Closer Look At: Rivers and Lakes*, Copper Beech Books, Connecticut, 1999.

*This book uses photographs, illustrations and text to teach the reader about rivers and lakes.*

## Student Fiction Books

Cherry, Lynne. *A River Ran Wild*, Gulliver Books/HBJ, San Diego, California, 1992.

*Follow the environmental history of the Nashua River, from its discovery to present day. Learn how it was polluted during the Industrial Revolution but has since been cleaned.*

## Curricula

Aquatic Project WILD

Aquatic Project WILD is an interdisciplinary curriculum for K-12 teachers on aquatic wildlife and ecosystems. The activities cover a broad range of environmental and conservation topics.

For more information click on: <http://www.projectwild.org/ProjectWILDK-12AquaticcurriculumandActivityGuide.htm>

JASON Science: Education through Exploration

The JASON Science is an interdisciplinary curriculum for K-12 teachers focusing on the geology, climate, biology and biodiversity of specific regions in the world. The activities cover a broad range of topics.

For more information click on: <http://www.jason.org/public/whatis/start.aspx>

Project WILD

Project WILD is an interdisciplinary curriculum for K-12 teachers on a broad range of environmental and conservation topics.

For more information click on: <http://www.projectwild.org/>



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## Project WET

Project WET is an interdisciplinary curriculum for K-12 teachers on water. The activities cover a wide range of water-related topics. For more information visit the website at <http://www.projectwet.org/>

## SC MAPS

SC MAPS is a standards-based interdisciplinary curriculum for middle school teachers that focus on the geology of the regions of South Carolina using aerial photographs, images and topographic maps. Great source for good maps!

For more information visit the website at <http://www.cas.sc.edu/cege/resources/scmaps/scmaps.html>