

## What is a Watershed?

**Essential Question:** What is a watershed?

**Objective:** Students will be able to explain the components of a watershed and its effects on the environment through analysis of a model.

**Next Generation Sunshine State Standard(s):**

SC.6.E.6.1 Describe and give examples of ways in which the Earth’s surface is built up and torn down by physical and chemical weathering, erosion and deposition.

SC.6.E.7.2 Investigate and apply how the cycling of water between the atmosphere and hydrosphere has an effect on weather patterns and climate.

**Next Generation Science Standard(s):**

MS-ESS2-1. Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process.

MS-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.

**Materials:**

- Copies of **Landforms in Peninsular Florida and The Florida Water Cycle and the Watershed**
- Small disposable aluminum pan (approx. 9" x 12")
- Water based markers (blue, brown, red)
- White copier paper
- Spray bottle (best version is one with adjustable fan)
- Water access
- Optional: Lab sheet for **Watershed Model**

**Set up and prep:** 10/15 minutes - Place all of the materials in the pans prior to the students arrival in class

**Lesson Duration:** Two-three class periods

**Procedure A**

1. Begin the simulation by explaining to your students that they will be creating a watershed model with a simple piece of paper. They will be able to see the ridges, slopes and drainage patterns that make up a 3D watershed.
2. Start with each team seated with a set of the above materials on a flat surface, have a student in each group crumple the paper into a ball. Then, gently un-crumple the paper so that it sits in the pan but will retain the folds and creases that will represent ridges and valleys. Students should then label each side with a direction letter (N-North, S-South, E-East, W-West). North should be the edge farthest from them, South should be the edge closest to them.
3. Direct students to use a **black permanent** marker to outline the tops of the ridges that separate one valley from another.
4. Direct students to use a **blue water-based** marker to mark streams in the valleys on their papers.
5. Have them use the blue markers again to go over the permanent black ridges. (This will make the sheet flow down the sides of the slopes easier to see)
6. Students will then use a **brown water-based** marker, to draw some areas of exposed soil on the sides of the ridges. These will represent area of construction, farming or lumbering.
7. Direct students to use a **red** water-based marker, to make some dots on the paper to represent pollutants

- that may be found in their watershed, such as soap from washing cars, pesticides from lawns, and animal waste from farms.
8. Discuss with them about internally and externally draining watersheds. Have them look for these possible locations on their paper.
  9. Now ask them to predict what will happen in their watersheds when it “rains”.
  10. Have them use the spray bottle to gently spray the tops of the ridges.
  11. Instruct them to keep spraying until the colors begin to flow.
  12. Have them observe (indicate on the model) how water flows across the landscape, how it flows through the valleys and where it collects.
  13. Ask and answer: A watershed is the area of land where all of the water that is under it or drains off of it goes into the same place. Refer to the model. How is the model representative of a watershed? Allow students to explain their responses.

*Probing questions to build definitions and allow students to begin thinking about watershed concerns:*

*What do you predict will happen when you spray water on the watershed model?*

*What do you think the paper and spray represent?*

*Did the water flow as you anticipated?*

*What would you call the water that runs down in the creases?*

*How is erosion illustrated on your model? Where would deposition occur?*

*What would you call the water that collects in “pools”?*

*Describe what happened at the lowest point of the watershed. Did different colors mix together?*

*What water quality problems do you see if the red ink represents pollutants and the brown ink soil?*

*Where in the watershed would the most pollutants collect?*

*Were there places where water drained into a confined lake with no outlet? What water quality problems would this cause?*

### **Procedure B**

1. Ask and answer: Are you familiar with rivers and their watersheds found on Florida’s west coast? If not, think about a river that you have seen. How does it affect the land it runs through?
2. Purpose for reading:
  - a. As you read this selection, write down some questions about this topic.
  - b. Discuss these questions, and possible answers, with your team (or in a whole class discussion).  
\*Do not continue to the five follow up questions.\*
  - c. Allow whole group discussion of student generated questions and answers.
  - d. Follow up with modeling, guided, and independent answering of questions 1-5.
  - e. Review whole class.
3. Final activity questions:
  - a. According to the text, how has the Hillsborough River changed over time?
  - b. How have the major physical characteristics, natural resources and climate influenced the watershed on Florida’s west coast? What information from the text and model supports your response?

### **Procedure C**

1. Ask and answer: Have you studied weather? If not, think about when we have wet weather in Florida and when we have dry weather.
2. Purpose for reading:
  - a. As you read this selection, write down some questions about this topic.
  - b. Discuss these questions, and possible answers, with your team (or in a whole class discussion).  
\*Do not continue to the two follow up questions.\*
  - c. Allow whole group discussion of student generated questions and answers.

- d. Follow up with independent answering of questions 1-2. Groups can collaborate on responses after individual responses.
  - e. Review whole class.
3. Final activity questions:
- a. According to the text, how does the cycling of water between the atmosphere and the hydrosphere effect weather patterns and climate?
  - b. Using the model, demonstrate and explain how summer convectonal rain pattern works on Florida's west coast.

**Assessment**

Using the watershed model as a visual, students will create mini posters explaining the components of a watershed and its effects on the environment.



## Landforms in Peninsular Florida

## Bell Work



### Questions and Notes

Florida's land is divided into four main regions; the Gulf Coast/Atlantic Coastal Plain, the Uplands (*hilly area*) of the north, central and northwest, the swampy Everglades of the far south, and the Florida Keys.

### Peninsular Florida

Most of the land area of Florida lies on the Florida peninsula. This landform was created when layers of marine limestone and sand were gently uplifted by forces within the earth. During the Pleistocene **Ice Age** the peninsula was subject to extensive **deposition** and **erosion** as sea level change many times. As the glaciers grew, sea level retreated. Erosion and deposition were primarily caused by freshwater systems. As the glaciers melted, the sea level rose. Erosion and deposition were primarily caused by saltwater systems. During the last rise in sea level that began about 10 million years ago, rainfall increased and most of the major watersheds on the peninsula were formed.



Found within these watersheds are a variety of landforms and ecosystems. High, dry **xeric** uplands are found on the Central Florida ridge and may be found on the higher elevations around the edges of individual watersheds. These are located on the top of old marine terraces and ancient coastal sand dunes. At slightly lower elevations, **mesic** uplands, dominated the flatter landscapes. These occupy land that was once on the bottom of shallow seas. In the lowest areas, along the edges of current lakes, streams and rivers are freshwater **wetlands**. Along the current coast are **barrier islands** with coastal uplands, such as beach dune and coastal berms. In the lower areas are coastal wetlands. Both of these areas are influenced by marine erosion, deposition, salt spray, and storms.

### l Plain

4. Water drains off of the central uplands of the peninsula and moves west both on the surface and underground. It moves through layers of porous limestone called the **aquifer**. During its journey, water creates a variety of creeks, rivers and bays through erosion and system deposition. This type of water is called the **surface water system** and it creates a variety of landforms on the surface of the land. **Groundwater** moves below the surface of the land. It too creates a series of landforms primarily by erosion. Ground water creates sinks where water enters the aquifer, pipes where water moves through the aquifer and springs where water comes out of the aquifer.

### West Coast Watersheds

5. The interaction of the water cycle with the geology of Florida's west coast creates landforms known as **watersheds**. During the winter dry season, the rains are brought by the impact of cold fronts moving across the state from west to east. When this moving band of arctic air hits the relatively warmer, moist air flowing across the Florida Peninsula from the south, rain happens. During the summer wet season, a convectional interaction between the land and the water surrounding the peninsula occurs. This brings 60-80% of Florida's annual rain as violent thunderstorms. This water collects in **basins** rimmed by uplands and flows downhill to bays and inlets eventually reaching the Gulf of Mexico.

### Questions and Notes

**Bell Work** 

**Directions:** Answer these questions about your reading.

Underline, or highlight, the areas in the text which support your answers.

1. Based on your reading, what forces shaped the present day watersheds of peninsular Florida?
  - A. Heavy wind and ice
  - B. Sea level change and rainfall
  - C. Glaciers and fire
  - D. Sand dunes and freshwater wetlands
  
2. Which type of water system found in the reading would be most likely to carve a river valley?  
\_\_\_\_\_
  
3. Based on your reading, during what season would a river on Florida's west coast be most like to flood? \_\_\_\_\_
  
4. Which word in bold text in the reading is most likely a synonym for watershed?
  - A. mesic
  - B. erosion
  - C. deposition
  - D. basin
  
5. According to the text, which is not a landform created by ground water?
  - A. creek
  - B. sink
  - C. spring
  - D. pipe

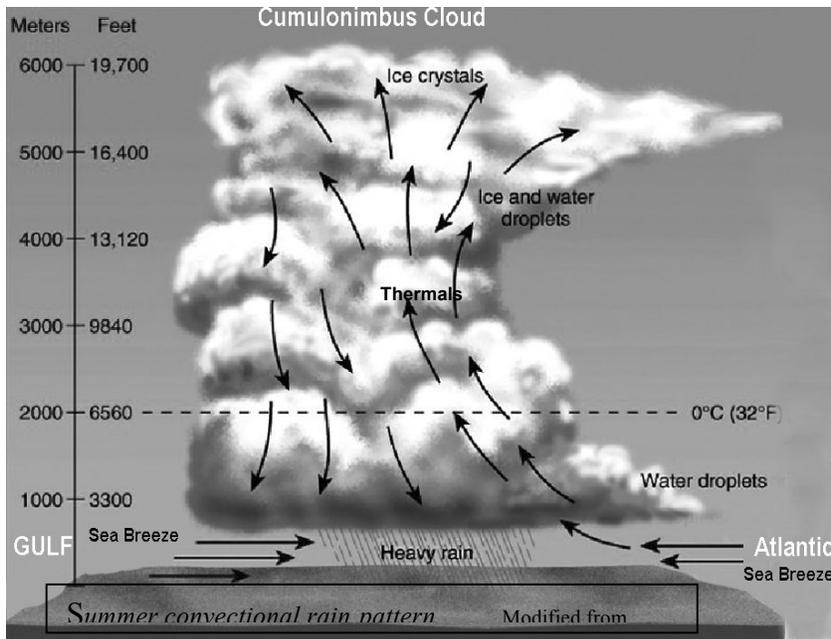
## The Florida Water Cycle and the Watershed

## Bell Work



## Questions and Notes

1. The Hillsborough River and its watershed are the products of the interaction of the **water cycle** with the **geology** of the area. **Climate** is the sum of the **meteorological** conditions in a given region over long periods of time. **Weather** is the present condition of these same elements and their variations over shorter time periods. Central Florida, where the Hillsborough River watershed is located has a **humid subtropical climate**. The summers are warm and wet and the winters are mild and much drier. This climate is created by three weather patterns. The most important of these from the standpoint of the water cycle, is the **summer convective rain pattern**. This is created by differential heating of the land and the water during the summer months. As a solid, the land mass heats up faster than the surrounding water. The water surfaces of the Gulf and Atlantic heat up at a much slower rate than the land in the center of the state. This heat is transferred to the air above the land causing it to rise. It also increases **evaporation** and **transpiration**. As the air above the peninsula rises rapidly upward, an area of low pressure is created at the surface. Cooler, moister air from above the Gulf and the Atlantic rush in to fill this area of low pressure. This creates a wind called the **sea breeze**. The masses of rising warm air are called **thermals**. The thermals transport vapor upwards. The upper atmosphere becomes filled with moisture as the thermals get higher.
- 2.



3. As the heated air continues to rise, it begins to cool. Eventually the water vapor in the air **condenses** back to liquid water creating clouds known as **cumulus**. As the heating continues into the early afternoon, the cumulus clouds grow taller evolving in to giant flat-topped **cumulonimbus** clouds in the uppermost parts of the cloud the water freezes forming ice crystals. During this process huge amounts of electrical energy are moved from the surface into the atmosphere. Also, negatively charged electrons are stripped from the surface of the land and carried up into the clouds.
4. As ice and water develop in clouds there is an electrical buildup. The electrical buildup on each ice and water drop is very small but the huge number of ice crystals and water drops creates a large electrical difference between different portions of the cloud. **Lightning** occurs to balance the electrical build in the clouds or between the clouds and the ground. When lightning moves through the air it increases the temperature of the air dramatically in a very short period of time. Heated air expands. The rapid expansion of air creates a sonic shock wave. This wave produces the sound of thunder. When the amount of water in the air exceeds the ability of the up-rushing wind to keep it aloft, a heavy cold rain is released from the cloud. This type of rainstorm is called a **thunderstorm**.

### Questions and Notes

**Bell Work**

**Directions:** Use the reading to help you answer the questions below.

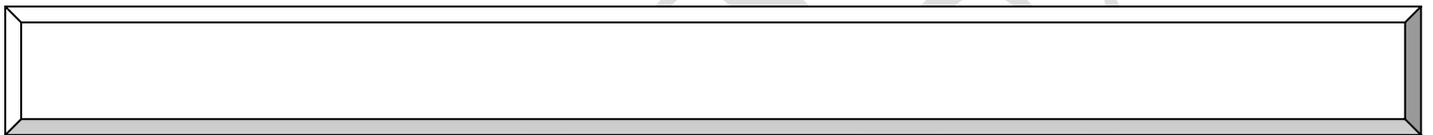
1. Meg and Wanda are going to spend the some time paddling on the Hillsborough River. The morning weather forecast predicted a 40% chance of rain on this bright, sunny, summer day. What type of weather conditions will they most likely encounter if they wait until the afternoon to go on the river?
  - A. Clear skies
  - B. Heavy rain
  - C. Thick Fog
  - D. Sunny skies

2. Using support from the text, why is the west central coast of Florida called the “summer lightening capital of the United States”?

---

---

---



Team \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

**Using the watershed model as a visual, create a mini poster explaining the components of a watershed and its effects on the environment.**

## Investigating a Watershed – Simulation Lab

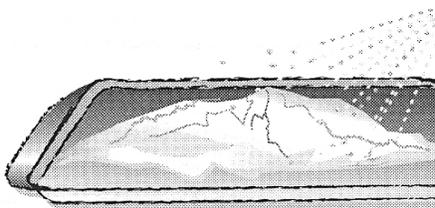
Team \_\_\_\_\_ Date \_\_\_\_\_ Period \_\_\_\_\_

### PURPOSE

The purpose of the lesson is to help you use a model to understand the way water moves in watersheds and to see how human activities affect water quality.

**MATERIALS:** per team (check off)

- 🍏 paper
- 🍏 small disposable aluminum pan (approx. 9" x 12")
- 🍏 water based markers (blue, brown, red)
- 🍏 one black permanent marker
- 🍏 spray bottle



### PROCEDURE

1. Crumple the sheet of paper into a ball then partially smooth it out, leaving some wrinkles that resemble hills and valleys. Place the paper in your pan.
2. Label each side with a direction letter (N-North, S-South, E-East, W-West). North should be the edge farthest from you, South should be the edge closest to you.
3. Using a **black** permanent marker, outline the tops of ridges that separate one stream or river from another.
4. Use a **blue** water-based marker to mark the valleys, the top of the ridges (on top of the black marks) and where you think the water will collect as it runs downhill. (This could represent a lake.).
5. Using **brown** water-based markers, draw some exposed soil on the sides of the ridges.
6. Using **red** water-based markers, make some dots on the paper to represent some pollutants that may be found in your watershed, such as soap from washing cars, pesticides from lawns, and animal waste from a nearby farm.