



Water Matters!

Saving Your Water through Science

Southwest Florida
Water Management District



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Welcome to the “Water Matters!” curriculum developed by the Southwest Florida Water Management District (SWFWMD). The SWFWMD manages the water resources for west-central Florida as directed by state law. It was established in 1961 as a flood protection agency. Since then, its responsibilities have grown to include managing the water supply, protecting water quality and preserving natural systems that serve important water-related functions.

The “Water Matters!” student publication provides information to help you become a good steward of Florida’s precious water resources. When reading this publication, pay attention to vocabulary words in the text that appear both *italicized* and in **bold**.

Check out WaterMatters.org/Education for additional water-related resources.

Email WaterEducation@WaterMatters.org with questions or comments.

Introduction



In Florida, we receive about 53 inches of rainfall annually. Because of all this rain, you may assume it’s not important for Floridians to conserve water. That’s not the case!

Water is vitally important to every aspect of our lives and also vitally important to the environment. It is wild to think the water utilized by the world’s population of seven billion people is found in only 1 percent of the Earth’s water. We have a limited supply of fresh water, and even here in Florida, we need to be concerned with the amount of fresh water available and the quality of our water.

The hydrologic cycle affects the amount of fresh water available. Florida’s weather and climate also affect our water supply. Additionally, the actions of people affect the quality of available fresh water, both above and below the Earth’s surface. Protecting water resources is not only the job of the SWFWMD, it’s the responsibility of everyone who lives in our state.

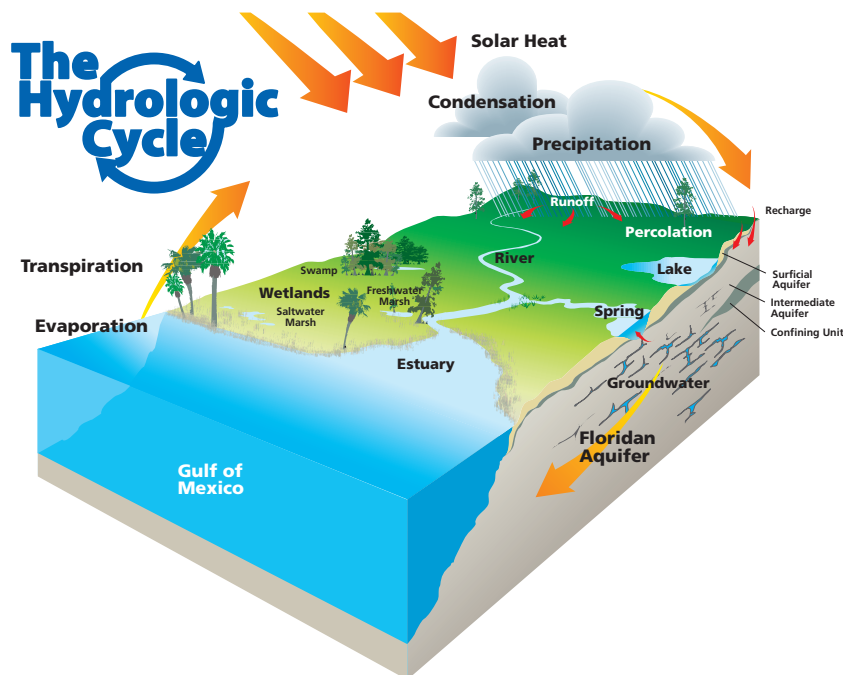
Section One:

Review of Freshwater Concepts from Grades 6 and 7

The Hydrologic Cycle

All of the water in our environment recycles itself over and over again with no beginning and no end. This process is called the **hydrologic cycle** or water cycle. The amount of water that travels through the water cycle is constant. It always stays the same. The sun is the energy source that causes water to move continuously within the hydrologic cycle.

- **Evaporation** — vapor created when the sun heats water in lakes, streams, rivers, oceans, puddles and other bodies of water
- **Transpiration** — vapor created when plants and trees give off moisture through their leaves
- **Condensation** — tiny droplets of water formed when the water vapor rises into the air and cools, forming clouds
- **Precipitation** — moisture released from clouds in the form of rain, snow, sleet or hail
- **Percolation** — downward movement of water through the ground



Water is continually moving and changing from one state of matter to another — solid, liquid and gas. It also continually interacts with the atmosphere, hydrosphere, cryosphere (ice sheets), biosphere (living organisms) and geosphere (soils, sediments and rocks). The interaction of water among all the different spheres is important. Just think about where weather and climate take place in the atmosphere.

Weather and Climate

Weather is what it's like outside on any day at any moment, and the hydrologic cycle plays an important role in weather. As the sun heats the Earth's surface, water evaporates into the atmosphere where it condenses to form clouds. Eventually, precipitation is created, which then returns to Earth. Nearly all weather develops within the troposphere, an eight-mile atmospheric layer surrounding the Earth.

Weather depends on air temperature, air pressure, fog, humidity, cloud cover, precipitation, wind speed and direction. When air masses of different temperatures and densities meet, they do not mix well. Thus a weather front is formed that may bring precipitation in the form of rain, snow or hail — usually rain in Florida. Weather patterns affect how much and how frequently water returns to Earth. Therefore, weather affects how much water is available for the needs of people and the environment.

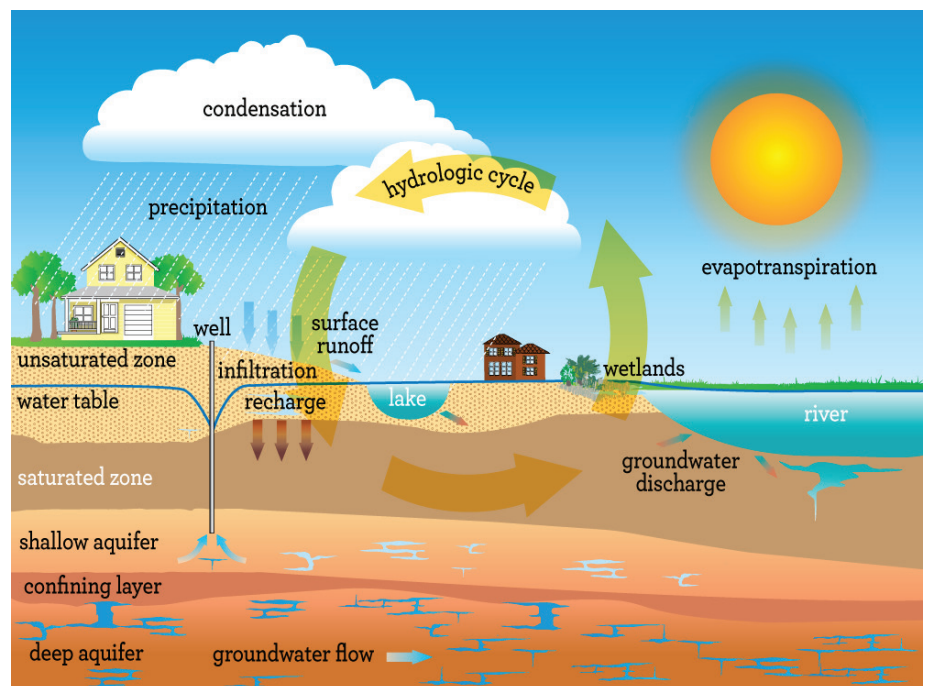
Florida has its share of extreme weather conditions, like droughts, hurricanes, tornadoes and thunderstorms. To monitor weather patterns and extreme weather conditions, meteorologists use basic instruments, such as thermometers, hydrographs, weather vanes, anemometers, barometers and rain gauges, as well as high-powered computer systems. Advanced tools, such as satellites and Doppler radar systems, also are used along with weather balloons, ocean buoys and more.

Although almost anything can happen with the weather, **climate** is more predictable. Climate refers to the weather patterns that take place in an area over a long period of time. Florida has two types of climate: humid subtropical in the northern and central parts of the state, and tropical savanna in the southern part of Florida and in the Keys.

Florida's Water Above and Below the Surface

Watersheds

A **watershed** is an area of land that water flows across as it moves toward a common body of water, such as a stream, river, lake or coast. Watersheds can be very large, draining thousands of square miles to a major body of water, or very small, draining a few acres to a small pond. Healthy watersheds offer many benefits. They provide water for drinking, irrigation, agriculture, industry, boating, fishing and swimming as well as food and shelter for wildlife. Watersheds are important for a strong environment and economy.



Surface Water

As rain travels across a watershed, some of it evaporates while some of it percolates into the ground. Yet other water runs off into water bodies. This water seen on the Earth's surface is called **surface water**, and it exists in many shapes and forms. Surface water in Florida includes rivers, lakes, streams, creeks, ponds, sloughs, wetlands and salt water in oceans.

Groundwater

Much of Florida has a **karst terrain**, the land surface produced when bedrock dissolves slowly over time as acidic rainwater passes through it. Karst terrain is often characterized by the existence of springs, sinkholes and caverns, and it makes up Florida's aquifer system. **Aquifers** are sponge-like layers of underground rocks and limestone that hold and release water. Florida's aquifers are where you'll find groundwater. Rain that has seeped into the ground and is held in soil and rock is called **groundwater**. Most of Florida's population depends on groundwater. In fact, approximately 80 percent of the water supply in west-central Florida comes from groundwater. Most of the remaining 20 percent comes from bodies of fresh surface water.

Water Pollution

Because we have a limited supply of fresh water, it's important to protect it. Although there are natural processes in water that alter its quality, water pollution does as well. There are many pollutants that affect both surface water and groundwater. These are usually grouped according to categories such as micro-organisms, suspended solids, inorganic compounds, synthetic organic compounds and radioactive materials. The commonly known pollutants include trash, chemicals, fertilizers, pesticides, oil, sewage/wastewater and soil particles.

Water pollution is often classified as **point-source pollution** or **nonpoint-source pollution**. The first can be traced to a single point or location. The source of point-source pollution is often easier to identify, because you can see the cause of the pollution and do something about it. Nonpoint-source pollution cannot be traced to a single point or location. It is much harder to identify but more likely to occur. It comes from a wide variety of sources including: pesticides, fertilizers, automobile fluids, leaky sewers and septic tanks, sediment from soil erosion, metals found in some paints and air pollution.

Stormwater runoff is a type of nonpoint-source pollution. It occurs when rain water picks up pollution as it washes over roads, parking lots, driveways, roof tops and other hard surfaces and washes the pollution into ditches, storm drains and water bodies. Untreated stormwater runoff is the state's leading source of water pollution. Therefore, it's important we realize how our actions on land can negatively impact water resources.





Section Two: Sustainability

What is Sustainability?

Have you ever heard people talk about **sustainability**? What do you think it means? Sustain comes from the Latin word *sustinere*, which means to hold up or support. Webster’s Dictionary defines sustainability as having the characteristic of being able “to keep up, to carry or withstand.” Essentially, sustainability is using a resource in such a way that the resource is not depleted or permanently damaged.

To understand the concept of sustaining natural resources, let’s reference something you probably know very well — your home refrigerator! Let’s consider it a closed environment. If the contents of the refrigerator are never replenished, sooner or later there will be nothing left. The refrigerator would not be able to “sustain” the pressure of having food frequently removed from it. Oh no! You would grow hungry. For the contents of the refrigerator to be sustained, the amount of food put in the refrigerator must be at least as much as the amount of food taken out over a given period of time. Compare this to Florida’s water supply.

In 1970, the Florida Legislature officially named Florida the “Sunshine State.” Millions of people flock to Florida each year whether for the sunshine, miles of sandy beaches, amusement parks, numerous campgrounds, or the hundreds of golf courses and shopping malls. Aside from tourists, an average of 1,000 people move to the state each day.

With each new Floridian, the need for sustainable water supplies increases. And, it’s not just people who need ample fresh water, but the environment too. Making sure there is adequate fresh water for people and the environment, both now and in the future, is not only the job of the state’s five water management districts — it’s the job of all Floridians!

Sustaining Florida’s Water Supply

Water management districts, local governments and regional water supply authorities are continuously preparing for increased demands on Florida’s water supply in the future. They are investigating, developing and implementing a wide range of alternative water sources. Have you heard of **alternative water supplies**? These include any source of water other than groundwater. Let’s learn more about them.

Reclaimed water — Reclaimed water is “reused” water. It’s highly treated wastewater that can be used for irrigation, industrial processes and other uses. It reduces the demand on groundwater and relieves stress on the environment by saving fresh water for drinking and other daily needs.

Reservoirs — Reservoirs are natural or constructed areas where surface water is collected and stored for future use. For example, during the rainy season, water can be skimmed from the high flows of rivers and stored in reservoirs for later treatment and use.

Desalination — Desalination is the process of converting salt water into fresh, drinking-quality water. In west Florida, desalination allows us to benefit from the vast quantities of salt water available in the Gulf of Mexico. When operating, the Tampa Bay Seawater Desalination Plant can provide up to 25 million gallons per day of drinking water. That may sound like a lot, but it's only 10 percent of the region's water needs.

Aquifer Storage and Recovery (ASR) — Through this process, water can be treated and injected into the aquifer for storage, then recovered and retreated for use when needed. A benefit of ASR is that these systems store water for longer than above-ground reservoirs where water can evaporate.

Land Acquisition and Management — As you can see, a combination of alternative water supplies is needed to sustain Florida's water supply. Another key effort to a sustainable water supply is land acquisition and management. The SWFWMD, other government agencies, organizations and private citizens all contribute to managing and protecting natural lands, which in turn protects our water resources.

The SWFWMD obtains conservation lands around lakes, rivers, wetlands and estuaries. These lands serve as a natural buffer that filters out pollution from runoff before it reaches the nearest body of water. The SWFWMD also buys lands to preserve and restore native Florida ecosystems that provide water resources benefits and water storage during hurricanes and other major storm events.

Conservation — Water conservation includes everyone from individuals to businesses and entire industries being more efficient and less wasteful with water resources. Conservation is simply the practice of using less water. It is a key link to balancing current and future water needs. It's also the easiest and most cost-effective way to reduce demands on groundwater. However, conservation alone will not be enough to restore impacts to natural resources and ensure sufficient water to meet current and future needs.



Four Tips to Help Conserve Water Indoors

- Turn off faucet while brushing teeth.
- Take shorter showers.
- Fix leaks in faucets, showerheads and toilets.
- Only wash full loads.

Sustainability Through Conservation

Directions: Water is crucial to the quality of life that has attracted so many people to Florida. As demand for water continues to grow, so does the need for sustainable water sources. Do your part to help preserve the environment that makes Florida unique with these easy-to-implement strategies. You could even get your friends and family to implement some of these strategies, too. Together we can save even more water.

1. Read the list of conservation strategies below and choose three that you are NOT doing but are willing to TRY, whether by doing it yourself or encouraging a family member to do it.
2. Write your three strategies on the Water Conservation Pledge.
3. If you are pretty confident you can put at least three strategies into action, then sign the promise to help protect water supplies for our future!

Conservation Strategies:

IN THE KITCHEN: WHIP UP A BATCH OF BIG WATER SAVINGS!

- Plug up the sink when washing dishes by hand instead of running the water.
- Use a dishwasher; and when you do, make sure it's fully loaded!
- While you're at it, scrape that plate instead of rinsing before loading it into the dishwasher.
- Thaw food in the refrigerator overnight rather than using a running tap of water.
- Add food wastes to your compost pile instead of using the garbage disposal.
- Clean vegetables in a pan of water instead of under the running faucet.

IN THE BATHROOM: MORE THAN HALF OF ALL WATER USE TAKES PLACE HERE!

- Turn off the tap while brushing your teeth.
- Take showers instead of baths, as long as you keep an eye on how long you've been lathering!

IN THE LAUNDRY ROOM: WHERE YOU CAN BE CLEAN AND GREEN

- Wash only full loads of laundry or use the appropriate water level or load size selection on the washing machine.

OUTDOORS: IN DRY CLIMATES, A HOUSEHOLD'S OUTDOOR WATER USE CAN BE AS HIGH AS 70 PERCENT!

- Use native plants or plants well suited to their environment. If the area is dry, use plants that don't need much water.
- Group plants according to their water needs.
- Sweep driveways, sidewalks and steps rather than hosing off.
- Wash the car on the grass, not in the driveway. Use water from a bucket rather than letting a hose run, or use a commercial car wash that recycles water.
- Use a cover to reduce evaporation when your pool is not in use.

HERE, THERE AND EVERYWHERE

- Did you know fixing leaks and installing a few inexpensive water-saving devices in your home could save up to 20,000 gallons of water each year?
- Insulate your water pipes — you will get hot water faster, plus avoid wasting water while it heats up.
- Never put water down the drain when there may be another use for it, such as watering a plant or cleaning.



Water Conservation Pledge

I will make a sincere effort to take action on at least the following three water conservation strategies during the next six months:

1. _____

2. _____

3. _____

I'm confident I can do my part toward making sure we all have plenty of clean, fresh water to use in the future.

(Student Signature)

Section Three:

Rise in Sea Levels

What's Causing Sea Levels to Rise?

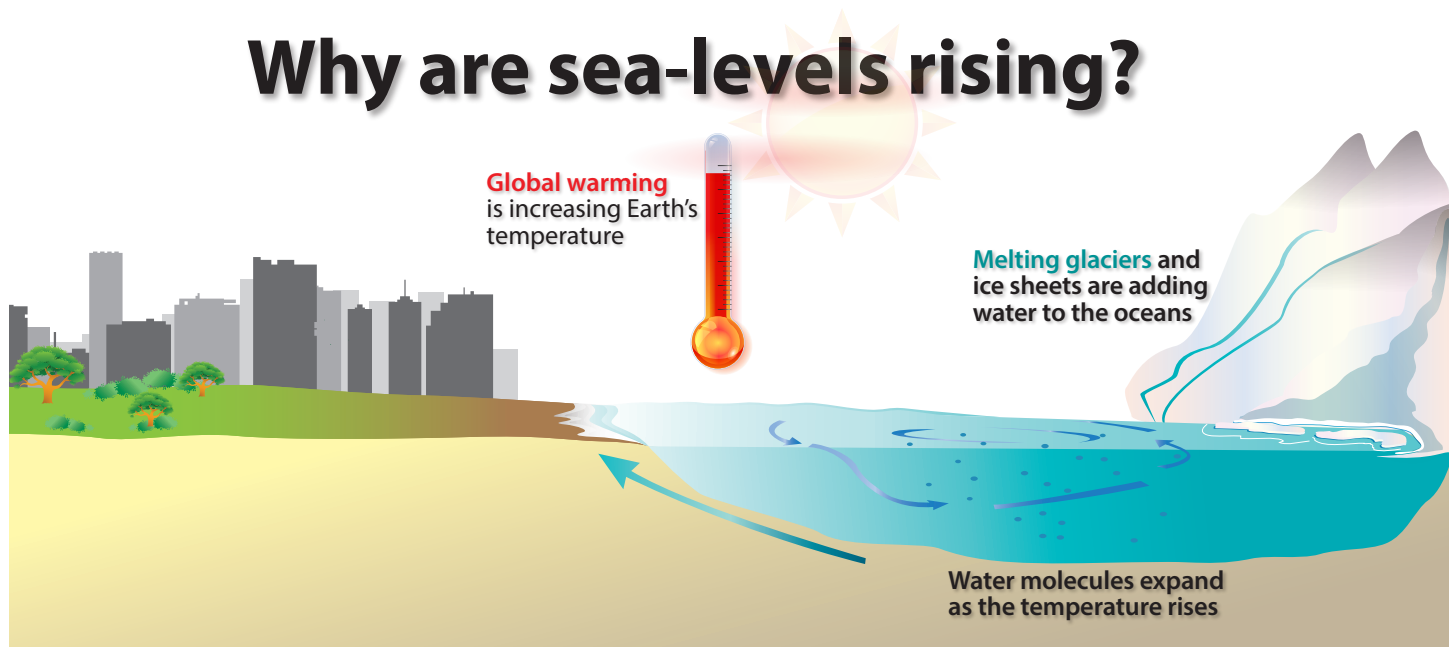
Over the past century, Earth's sea levels have been rising at a rate of 0.04 to 0.1 inches per year, or about eight inches, since reliable record keeping began in 1880. Research by the National Oceanographic and Atmospheric Administration (NOAA) shows sea levels are now rising at an accelerated rate, approximately 0.12 inches per year, and are expected to rise another one to four feet by 2100. What's causing sea levels to rise?

Global warming is the increase in the Earth's temperature. It is caused by burning **fossil fuels**, such as gas, oil and coal. Over time, the burning of fossil fuels for energy has resulted in excess carbon dioxide in our atmosphere. The build-up of these gases creates a blanket effect, known as the greenhouse effect, which traps heat around the world. The result is an increase in the Earth's surface temperature, which can lead to changes in climate. (Source: *United States Environmental Protection Agency*)

The effects of global warming have caused sea levels to rise. According to NOAA, the two main causes of global sea-level rise are thermal expansion and loss of land-based ice:

- **Thermal expansion:** As oceans warm, water molecules become more active and expand. The more active the molecules are, the more space they need between each other, which increases the volume of ocean water, causing sea levels to rise. This is referred to as "thermal expansion."
- **Loss of land-based ice:** NASA satellite images show that the area of accumulated ice cover on the Earth's surface is shrinking. This increased melting of ice from global warming is causing glaciers, polar ice caps and ice sheets to melt. The water then becomes part of the oceans, thus contributing to sea-level rise.

Why are sea-levels rising?



How Will Sea-Level Rise Effect Florida?

The coastal areas of Florida are extremely vulnerable to sea-level rise, and the potential hazards are serious because Florida has a large number of residents living along the coastlines.

As sea-level rises, salt water moves inland, both on land and underground. As a result, it can increase **saltwater intrusion** into freshwater aquifers, erode the shoreline, flood wetlands and development along the coastline, and contaminate soils, thus affecting plant growth. Also a threat is a loss of habitat for freshwater-aquatic and non-aquatic wildlife. In fact, coastal spring systems in west-central Florida are already being affected. Sea-level rise, combined with changes in rainfall and spring discharge, have shifted these freshwater systems to more brackish ecosystems. As a result, freshwater vegetation has a hard time surviving in this saltier environment and unwanted vegetation then moves in. This reduces desirable habitat and food sources for wildlife.

Saltwater intrusion into freshwater aquifers also is affecting parts of Florida. As sea levels rise, groundwater in our aquifers is more susceptible to saltwater intrusion. The aquifer systems naturally have layers, or zones, that may contain fresh or salt water. Fresh water "floats" on top of the denser salt water. If less fresh water is stored in the aquifer, the salt water can move up into a freshwater zone because it does not have as much weight and pressure holding it down. Once saltwater moves into the freshwater zone of an aquifer, the damage may be permanent.

What Can We Do to Stop Global Warming?

Reducing global warming will help slow the rate of sea-level rise. The more fossil fuels (gas, oil and coal) burned, the more heat-trapping gases, known as greenhouse gases, are produced and the higher the Earth's temperature will be. Reducing our use of fossil fuels is one step in the right direction.

Here are some suggestions to help protect the future of Florida from sea-level rise:

- Incorporate the threat of sea-level rise into infrastructure planning
- Conserve energy and water
- Minimize coastal development
- Continue acquisition of sensitive lands
- Focus on wetland restoration projects
- Minimize the use of fossil fuels on a community-wide scale

Today's generation along with future generations have a vested interest in fighting global warming. Do your part!

Vocabulary Exercises

Words Bank

Evaporation	Transpiration	Saltwater intrusion
Condensation	Sustainability	Watersheds
Karst terrain	Reclaimed water	Conservation
Precipitation	Climate	Alternative
Aquifer	Point-source pollution	Desalination
Stormwater runoff	Nonpoint-source pollution	Groundwater
Surface water	Percolation	

Vocabulary Questions

- _____ is using a resource in such a way that the resource is not depleted or permanently damaged.
- _____ is highly treated wastewater that can be used for irrigation, industrial purposes and other uses.
- The process that changes water from a liquid into a vapor is called _____.
- _____ occurs when tiny droplets of water are formed when water vapor rises into the air and cools, forming clouds.
- _____ is moisture released from clouds in the form of rain, snow, sleet or hail.
- As sea levels rise, aquifers are more susceptible to _____.
- Process by which plants and trees give off moisture through leaves is called _____.
- The downward movement of water through the ground is known as _____.
- The type of pollution that can be traced to a particular point is _____.
- The type of pollution that cannot be traced to a single point or location is _____.
- Approximately 80 percent of the water supply in west-central Florida comes from _____.
- The practice of using less water is known as _____.
- Untreated _____ is considered the state's leading source of water pollution.
- A(n) _____ can hold water like a sponge.
- Sinkholes and springs are often part of a _____.
- The process of converting salt water into fresh water is called _____.
- Water sources other than groundwater may be called _____ water supplies.
- _____ can be very large, draining thousands of square miles to a major body of water, or very small, draining a few acres to a small pond.
- Rivers, lakes and wetlands are all examples of _____.
- Humid subtropical and tropical savannah are two types of _____.

