Educator's Manual

St. Johns River
Water Management District

4049 Reid Street • P.O. Box 1429 • Palatka, FL
32178-1429 • Phone (386) 329-4500
On the Internet: *www.sjrwmd.com*

Contents

Introduction
*The Great Water Odyssey*SM

*The Great Water Odyssey*SM was created, funded by and is made available by the St. Johns River Water Management District (SJRWMD) for schools (Grades 2–5) throughout SJRWMD's service area. The goal of this project was and remains to increase students' understanding of the importance of protecting and conserving Florida's water. By making students aware that water is a valuable resource, SJRWMD hopes to assist in increasing community awareness.

This project aligns with the Florida Standards throughout all subject areas for Second through fifth grades. With the emphasis on reading, technology and science, SJRWMD set out to create an informative, interactive program that will motivate students and provide practice with necessary skills.

An essential component of the learning modules is to reinforce reading skills while teaching students to understand water concepts. Resources for educators include reading response questions to assist educators in building students' skills. Science, math, and technology standards are also emphasized.

- Module Water Cycle
- Module States of Matter
- Module What's a Gallon
- Module Natural Aquatic Habitats
- Module Aquifer Travels

After an animated introduction is given at the beginning of each module, an exploration screen(s) will appear. This screen allows students to click on objects to learn and review facts. When a module's introductory animation and exploration screen(s) have been completed, students should complete the quizzes, where they can test their knowledge. Links to quizzes self- score and student can report their results.

Summary

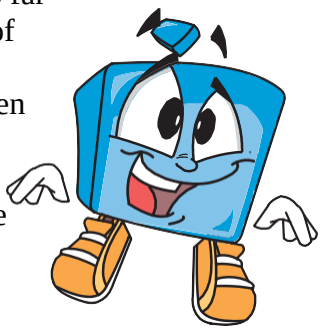
Water on Earth today has been here for perhaps millions and billions of years. Many scientists believe water originated early in the Earth's history from the hydrogen and oxygen in the gas cloud that formed our universe. Even so, many people on Earth are unaware of the sources and processes used to obtain the water we depend on for daily use. *The Great Water Odyssey*SM was developed to raise students' awareness of this information through implementation of the following modules:

- The Water Cycle
- States of Matter
- What's a Gallon
- Natural Aquatic Habitats
- Aquifer Travels

Why is Water Important?

Many people take water for granted, not realizing how important water really is. It is the substance that makes this Earth come alive. As a solid (ice), a liquid (water), or a gas (water vapor), water is the most common substance on Earth. It is almost three times as common as every other substance on Earth combined. In fact, the total water supply for the world consists of more than 326 million trillion gallons of water.

Considering that more than three-fourths of the Earth's surface is covered with water, it would appear that we have plenty of water available for our use. Most of it — 97 percent — is in the oceans and cannot be used for human consumption or for crops due to its salt content. Salt can be removed from ocean water, but the process is very expensive and methods must be developed to dispose of the salt that is removed.



That means that only 3 percent of Earth's water is fresh, with 2 percent of this water locked inside ice caps and glaciers. Because it is frozen and so far away, this water is not available for our use. That leaves only 1 percent of Earth's water in a form that is usable to humans and land animals. This freshwater is found in lakes, rivers, streams, ponds; underground and even in the atmosphere. It is our source for drinking water. Given the fact that our bodies are made of between 70 and 75 percent water, a human being can only live for a few days without water. In other words, water is more precious than gold.

It is up to us to do our part to protect our source of life, water.

Guide for

The Water Cycle Module

Overview

Students will become familiar with each phase of the water cycle as they follow Hydro, a waterdrop, on his adventure in finding his lost cousin, Agua. Students will understand that water on Earth moves in a continuous cycle.

Florida Standards

2nd grade
Science:SC.2.E.7.1, SC.2.E.7.2, SC.2.N.1.1, SC.2.L.17.1, SC.2.P.8.4, SC.K2.CS-PC.1.1, SC.K2.CS-PC.1.2, SC.K2.CS-PC 2.2, SC.K2.CS-CA.4.2
Social Studies: SS.2.C.2.4
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFS.2.RI.1.3

3rd grade
Science: SC.3.N.1.1, SC.3.L.17.2, SC.3.E.6.1, SC3.P.9.1
English Language Arts: LAFS.K12.R.1.3, LAFA.K12.R.2.4, LAFS.K12.R.3.7, LAFS.3.RI.1.3, LAFS.3.RI.2.4

4th grade
Science: SC.4.N.1.1, SC.4.P.8.2
English Language Arts: LAFS.4.RL.2.4, LAFS.K12.R.1.3, , LAFA.K12.R.2.4, LAFS.K12.R.3.7

5th grade
Science: SC.5.E.7.1, SC.5.E.7.2
English Language Arts: LAFS.5.SL.1.2, LAFS.K12.R.1.3, , LAFA.K12.R.2.4, LAFS.K12.R.3.7

Background Information about the Water Cycle

The water cycle, also known as the **hydrologic cycle**, is the cycling and recycling of water through the biosphere. That means, all of the water that has been on Earth for perhaps billions of years is continuously circulating through the atmosphere, the land, and the ocean.

Water enters the atmosphere by a process known as evaporation. Evaporation is the change of liquid water into a vapor. Sunlight aids this process, as it raises the temperature of liquid water in oceans, lakes, and other water bodies. As the liquid heats, molecules are released and change into a gas. Along with these water molecules are tiny particles called **condensation nuclei**. These particles might be little pieces of salt remaining after seawater evaporates or a particle of dust or smoke. When the warm air rises up into the atmosphere as water vapor and meets cold air, the vapor condenses, collecting on the small particles. The process known as **condensation** occurs when the water vapor wraps itself around the tiny particles. Each particle (surrounded by water) becomes a tiny droplet between 0.0001 and 0.005 centimeter in diameter.

Once the water droplets are formed, they begin to flow freely within the swirling winds from the atmosphere and form clouds. As the movement of the waterdrops within the cloud occurs, the smaller drops bond with the larger drops, rapidly increasing their size.

As the droplets get larger, they become too heavy for the cloud and begin to fall back to Earth as **precipitation**. The waterdrops continue to bond with other drops and grow as they fall. When the growing drop reaches the size of 0.5 millimeters in diameter or bigger, it becomes a raindrop. Raindrops that become larger than 4 millimeters will usually split into two separate drops.

The raindrop will continue falling until it reaches the ground. As it falls, sometimes a gust of wind will force the drop back up into the cloud, where it continues bumping into other droplets and getting bigger. When the drops finally reach the ground, the biggest drops will be the ones that bumped into
and coalesced with more droplets. The smaller drops are the ones that didn't run into as many droplets. Raindrops are different sizes for two primary reasons. First is the initial difference in particle size that the water molecule as a vapor wrapped itself around. The second reason is the difference in the rates of coalescence, that is to say, the number of bumps made by the drops.

As precipitation occurs, some water is absorbed by vegetation or evaporates before it reaches the ground. Some water evaporates after it reaches the surface. Some soaks into the ground and is taken up by the roots of plants and then released back into the air through the leaves of the plants in a process called **transpiration**. Some rain soaks beneath the water table into underground units of water-bearing rock called aquifers. Some of the water becomes surface or stormwater runoff that flows over the ground to wetlands, lakes, ponds, rivers, and oceans. The remainder — more than 2.5 trillion gallons — returns to the atmosphere through **evaporation**, and the process begins again.

At any given time, just 0.005 percent of the world's total water supply is moving through the hydrologic cycle. Once a drop of water returns to Earth as precipitation, it can spend thousands and thousands of years either in glaciers, underground, or in other bodies of water such as oceans. However, every drop of water is part of the hydrologic cycle.

A water molecule's trip from the atmosphere and back may be very long or very short. It may stay in the atmosphere for only a few days, or it may remain deeply buried in cavities in the Earth or frozen in polar ice caps for thousands of years. However, in a waterdrop's journey through the water cycle, there are many jobs it may perform. A drop of water might carry dissolved nutrients from the soil to plants in order to aid their growth. It may quench the thirst of a child, a songbird, or any other living thing. A drop may seep into the groundwater and become water that passes through our faucets. It may even be a player in industry, helping to provide products to the world. No matter what course water chooses to take in its cycle, the fact remains that water is an essential part of life on our planet.

The Water Cycle Module (Instructions)

This module begins with an animation that explains how water moves through the different stages of the water cycle. After the animated story is completed, the student will scroll down to the exploration screen.

The exploration screen requires students to click on all items that are part of the water cycle. Students can either read or click on the play button (white triangle) to hear the facts about that part of the water cycle. When all 15 clickables have been located, the student can test their knowledge by taking a quiz. There are two different quizzes that students can take by clicking the appropriate link. Quizzes are self-grading and will report to the student upon the completion of the quiz.

The following is the text/audio associated with each clickable.

The Water Cycle Exploration Screen

Hi! I'm Raleigh the Otter. I'm the St. Johns River Water Management District's mascot. Otters use their webbed feet and thick tails to swim and catch fish to eat. Hmm, hmm, hmm, boy! We're playful and fun to watch swimming in Florida's rivers and lakes. Having good, clean water is very important to me. Click anywhere to begin your journey and learn about the incredible water cycle.

1. **Well** — Aquifer

   Most of the water used in Florida is groundwater. The Floridan aquifer is where lots of our groundwater comes from. An aquifer is an underground layer of sand, gravel, or rock that holds water. In addition to the Floridan aquifer, there are other aquifers in Florida, such as the surficial, intermediate, and Biscayne.

2. **Groundwater** — Percolation

   Water underground, or groundwater, usually flows slowly through the ground, taking years to move a short distance. However, in some areas, groundwater moves through the ground rapidly. Underground water may eventually flow into a river or a lake, come out of a spring, or be pumped and used.

3. **Plants** — Transpiration

   In the same way humans sweat, plants transpire. Transpiration is the process by which plants give off vapor through their pores in their leaves. Plants take in water through their roots. This water travels up their trunks, through their branches, and into their leaves. Some of the water that plants absorb from the soil will leave through transpiration, while some of it will remain in the plant.

4. **Center cloud** — Condensation

   When water vapor reaches cool air, it condenses and turns into very small droplets, or ice crystals, that hang together in the form of clouds.

5. **Large cloud** — Precipitation

   Droplets in clouds keep moving closer together. When the droplets become too heavy, it rains. Another word for rain is precipitation. Rain, snow, fog, hail, sleet, and drizzle are all different forms of precipitation.

The Water Cycle Exploration Screen

6. **Sun** — Energy

   When it's energized, water takes on a different form of matter known as vapor. Energy causes water to evaporate and rise into the atmosphere. The sun provides the energy for the water cycle.

7. **Grey cloud** — Condensation and Precipitation

   Once water reaches the cloud, it can condense and fall to the ground or into a lake, river, or ocean. Depending on location, temperature, and air pressure, water may condense and snow onto a glacier. It may also remain a droplet and be stuck in a cloud for a long time.

8. **River** — Evaporation and Percolation

   River water usually flows toward the river's mouth. Before it gets there, some of the water will evaporate and some of it will flow into lakes and streams. Some water may enter an animal's body. Also, water may be pulled by gravity into the soil, where it may be absorbed by a plant or go into an aquifer.

9. **Soil** — Percolation, Runoff, or Evaporation

   Water that falls onto the ground may stay in the soil, be absorbed by a plant, flow over the ground into a river or a lake, or evaporate into the atmosphere.

10. **Bear** — Transportation

    As animals, we're part of the water cycle. We carry water in our bodies and help it move from place to place.

11. **Lake** — Evaporation and Percolation

    Water in lakes will most likely evaporate into the atmosphere. However, it could soak into the ground as well and be used by plants, animals, and humans.

12. **Deer** — Pass Through

    Once water enters an animal's body, it helps to keep the body healthy. Eventually, it may leave the body as either waste or perspiration.

13. **Glacier** — Evaporation, Runoff, or Frozen

    There are four paths that water can take from a glacier. It can melt and filter into the ground. It can evaporate and turn into a cloud. It can melt into a body of water, or it can remain frozen for a long time.

14. **Buoy** — Evaporation

    Heat energy from the sun causes water to evaporate and rise to form clouds, big fluffy ones! But sometimes water remains in the ocean for a long time.

15. **Ocean**

    About 97 percent of Earth's water is found in the oceans. Because ocean water is salty, it's not easily used by humans. The remaining 3 percent is freshwater. Only 1 percent of the freshwater can be easily used. The other 2 percent is frozen in ice caps or deep underground.

Vocabulary

Aquifer: an underground layer of sand, gravel, or rock that stores or carries water

Condensation: the process of changing a vapor into a liquid, which occurs when warm vapor mixes with cooler air in the atmosphere

Energy: usable power or sources of such usable power

Evaporation: the process caused by heat energy that allows a liquid, water, to turn into an invisible gas known as water vapor

Glacier: a huge mass of ice that moves slowly over land

Groundwater: water below the ground, usually found in aquifers

Hydrologic cycle: another term for the water cycle- the continuous movement of water from the earth into the atmosphere and back to earth again

Precipitation: the moisture that falls back to the earth in the form of rain, snow, skeet, or hail

Transpiration: the process by which plants give off moisture or vapor through the pores in the surface of their leaves

Vapor: the invisible gaseous state of water that occurs when water is energized by heat, causing it to rise into the atmosphere; water that is in the air

Water cycle: the continuous movement of water from the earth into the atmosphere and back to earth again

Trivia

- There is exactly the same amount of water on Earth now as there was when the dinosaurs lived here millions of years ago. (U.S. Geological Survey [USGS])
- Water is the "universal solvent." It dissolves more substances than any other liquid. (USGS)
- At any given time, there are approximately 3,100 cubic miles of water in the atmosphere, mostly as water vapor. If all of this fell as precipitation at once, the Earth would be covered with only about 1 inch of water. (USGS)
- If all of the world's water were poured on the U.S., water would cover the land to a depth of 90 miles. (USGS)
- Up to 60 percent of the human body is water — the brain is composed of 70 percent water; blood is 82 percent water; and the lungs are nearly 90 percent water. (USGS)
- If all of the world's water fit into a gallon jug, the freshwater available for us to use would equal only about one tablespoon. (National Wild and Scenic Rivers Systems)
- Water regulates the Earth's temperature. It also regulates the temperature of the human body, carries nutrients and oxygen to cells, cushions joints, protects organs and tissues, and removes wastes. (EPA)
- About 75 percent of a living tree is water. (EPA)

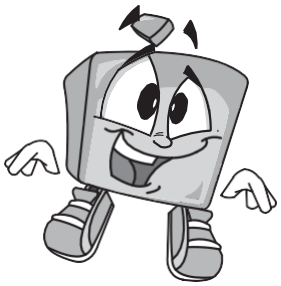
Water, Water Everywhere

By Cindy Cranford

Water on Earth is used over and over as it constantly moves through the atmosphere, the ocean, and the land. This cycling is an important process that helps life on Earth. The following processes make up the water cycle.

Evaporation occurs when a liquid changes to a gas and becomes vapor. Temperature is the primary factor in this process. Within the water cycle, some of the water in oceans, rivers, streams and ponds, and on land, is warmed by the sun and evaporates into the air.

Condensation is the opposite of evaporation. Condensation takes place when a gas is changed into a liquid. When the temperature of the water vapor decreases, condensation occurs. Water condenses into droplets when small waterdrops form around small dust particles. These droplets are very small, and remain in the atmosphere until they join together. Then they form either clouds in the sky or fog at ground level.



Precipitation occurs when large droplets of water form in the clouds. When the drops become too heavy, they fall back to the Earth. They fall as rain, snow, sleet, or hail, depending on the temperature in the atmosphere. As a result of evaporation, condensation and precipitation, the water that falls once again travels into the atmosphere, and the cycle continues.

Surface runoff occurs when water returns to earth as precipitation. A lot of the water runs off the surface of the land and flows into streams, rivers, ponds, and lakes. Small streams flow into larger bodies of water. This water eventually flows into the ocean, where a lot of evaporation occurs.

Percolation occurs when rainwater soaks through the soil and the layers of earth underneath. Some of the water remains underground and is called groundwater. Some returns to the surface through springs or in low land areas. As the water soaks through the soil and rock layers, many of the impurities in the water are filtered out, cleaning the water.

Transpiration is the process of evaporation through plant leaves. As plants absorb water from the soil, the water moves from the roots through the stems to the leaves. Once the water reaches the leaves, some of it evaporates from the leaves.

Reading Response Questions

Water, Water Everywhere

- **Short Response** (2-point rubric)

  Evaporation is an important part of the water cycle. Think about evaporation and how the process occurs within our own environment. Use details and information from the text to explain how evaporation takes place.

- **Extended Response** (4-point rubric)

  Scientists suggest that the water we use on Earth today is the same water that has been used for millions of years. Based on what you have learned about the water cycle, explain how this statement can be true. Use information from the text to support your answer.

- **Extended Response** (4-point rubric)

  Draw a picture showing the different processes that take place within the water cycle. Be sure to label each part and use arrows to show how the processes work within a cycle. In order to receive full credit, the drawing should include arrows that show evidence that the student understands the six traits of the water cycle and each process should be labeled appropriately.

Name _____

The Water Cycle

Fill-in-the-Blanks Quiz

1. Placing a_____on a hose can help conserve water.
   a. handle
   b. bubbler
   c. nozzle
   d. kink

2. To evaporate, water molecules gain energy and move_____.
   a. faster
   b. slower
   c. sideways
   d. forward

3. When cool air mixes with warm water vapor, the vapor condenses into_____or water droplets.
   a. puddles
   b. tiny ice crystals
   c. molecules
   d. rain

4. There is water in the air you are breathing, but you can't see it because it is in the form of an invisible gas called_____.
   a. ozone
   b. molecules
   c. aquasphere
   d. water vapor

5. Rain, snow, sleet, hail, and fog are all different forms of_____.
   a. evaporation
   b. condensation
   c. precipitation
   d. transpiration

6. Most of the water on Earth is stored in the_____.
   a. groundwater
   b. oceans
   c. rivers
   d. lakes

7. Only_____percent of freshwater can be easily used.
   a. 1
   b. 10
   c. 13
   d. 75

8. Water that falls to Earth's surface may stay in the soil,_____a plant, flow over the ground to a river or lake, or evaporate into the atmosphere.
   a. pass by
   b. flood
   c. stay by
   d. be absorbed by

9. Water under Earth's surface is called_____.
   a. surface water
   b. groundwater
   c. Earth water
   d. underground water

10. Using the process of transpiration, a tree releases 30 gallons of water every day. In one week, a tree would transpire___gallons of water.
   a. 200 gallons
   b. 210 gallons
   c. 150 gallons
   d. 400 gallons

Name _____

The Water Cycle

Pop Quiz

1. What happens to precipitation after it falls to Earth?
   a. Flows over the land
   b. Seeps into the ground
   c. Evaporates into the air
   d. All of the above

2. The sun heating the water on Earth's surface causes what?
   a. Evaporation
   b. Condensation
   c. Precipitation
   d. Percolation

3. What state of matter is a waterdrop when it evaporates?
   a. Solid
   b. Liquid
   c. Gas
   d. Mineral

4. What supplies the energy for the water cycle to occur?
   a. The power company
   b. The atmosphere
   c. The sun
   d. The moon

5. Water in lakes can do many things. Which of the following is the most likely for the water in lakes to do?
   a. Soak into the ground
   b. Be pumped onto lawns
   c. Used by plants
   d. Evaporate into the atmosphere

6. How does groundwater get back to Earth's surface?
   a. It flows into a river or lake.
   b. It comes out a spring.
   c. It is pumped and used.
   d. All of the above

7. In the same way humans sweat, plants transpire. What is transpiration?
   a. The process by which plants wilt if exposed to the hot sun for too long
   b. The process by which plants give off vapor through the pores in their leaves
   c. The process by which plants get water from the soil or ground through their roots
   d. The process by which plants grow taller

8. On a hot day, condensation will appear on the outside of a cool glass. What causes the condensation?
   a. Warm air coming in contact with the cool surface of the glass
   b. The cool surface of the glass mixing with ice cubes
   c. The sun heating up the liquid in the glass
   d. Surface winds blowing over the glass

9. What is the name of the aquifer from which most Floridians get their drinking water?
   a. Biscayne aquifer
   b. Sand and gravel aquifer
   c. Floridan aquifer
   d. Surficial aquifer

10. Which of the following is **NOT** an example of surface water?
   a. Oceans
   b. Rivers
   c. Aquifers
   d. Lakes

Answer keys

Fill-in-the-Blanks Quiz

1. c. nozzle
2. a. faster
3. b. tiny ice crystals
4. d. water vapor
5. c. precipitation
6. b. oceans
7. a. 1
8. d. be absorbed by
9. b. groundwater
10. b. 210 gallons

Pop Quiz

1.	d.	All of the above
2.	a.	Evaporation
3.	c.	Gas
4.	c.	The sun
5.	d.	Evaporate into the atmosphere
6.	d.	All of the above
7.	b.	The process by which plants give off vapor through the pores of their leaves
8.	a.	Warm air coming in contact with the cool surface of the glass
9.	c.	Floridan aquifer
10.	c.	Aquifers

Guide for

States of Matter Module

Overview

Students will explore with water drops Hydro and Agua as they learn about the different states of matter for water, and will determine the location of various bodies of water within Florida, our country and on Earth.

Students will become familiar with the characteristics of the three common states of matter (solid, liquid, gas) in which water can be found and become familiar with bodies of water found on Earth.

Florida Standards

2nd grade
Science: SC. 2.E.7.1, SC.2.E.7.2, SC.2.E.7.3, SC2.N.1.1, SC. 2.P.8.2, SC.2.P.8.3, SC.2.P.8.4, SC.K2.CS-PC.1.1, SC.K2.CS-PC.1.2, SC.K2.CS-CS.1.3, SC.K2.CS-CA.4.2
Social Studies: SS2. G.1.1
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4, LAFS.2.RI.1.3

3rd grade
Science: SC3.P.8.2, SC3.P.9.1
Social Studies: SS.3.G.1.1, SS.3.G.1.2, SS.4.A.8.4, SS.4.C.2.1, SS.4.G.1.1, SS.4.G.1.2, SS.4.G.1.3, SS.4.G.1.4
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4, LAFS.3.RI.1.3, LAFS.3.RI.2.4

4th grade
Science:SC.4.E.6.6, SC. 4.P.8.1, SC.4.P.8.2
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4

5th grade:
Science: SC.5.E.7.1, SC5.P.8.1, SC.5.P.9.1
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4

Background Information

Water has unique properties that allow it to be used for many different purposes. One special characteristic of water is its ability to change states very easily under conditions found on Earth. It can readily be found all over Earth in all of its three forms — solid, liquid, and gas.

Water on Earth is always changing, creating a continuous cycle of water moving through the **hydrosphere**. As water goes through its cycle, it can be a solid (ice), a liquid (water), or a gas (water vapor). Ice can change to become water or water vapor. Water can change to become ice or water vapor. Water vapor can change to become ice or water.

These changes occur when heat is added or subtracted, thus making the cycle work. When heat is added to ice, it melts. When heat is added to water, it evaporates. The process known as evaporation turns liquid water into a gas called water vapor. Evaporation causes the water to become invisible, as it appears to "vanish into thin air." When heat is taken away from water vapor, it condenses. Condensation is the process that turns water vapor into a liquid. When heat is taken away from liquid water, it freezes and becomes ice.

Temperature is the primary factor that determines water's state (solid, liquid, or gas).

Water in liquid state	Fahrenheit	Celsius
Pure water boils (changes to water vapor)	212 degrees	100 degrees
Pure water freezes (changes to solid)	32 degrees	0 degrees
At higher elevations, due to lower atmospheric pressures, water's boiling temperature decreases. This is why it takes longer to boil an egg at higher altitudes — the temperature does not get high enough to cook an egg properly. If a substance is dissolved in water, then the freezing point is lowered. That is why we spread salt on streets in winter to prevent ice formation. (U.S. Geological Survey)		

Water has some remarkable properties due to its molecular makeup. A water molecule is formed from two hydrogen atoms that are positively charged and bound to one oxygen atom that is negatively charged. The two hydrogen atoms are always at an angle of exactly 104.5 degrees from each other and tend to form a triangular shape, with the oxygen atom similar to that of a panda's head. Because opposite electrical charges attract, water molecules tend to attract each other, making water molecules stick together. The angle arrangement of the atoms, along with their charges, causes the properties of water.

With all of these water molecules attracting each other, they tend to clump together. This is why waterdrops are, in fact, drops! If not for gravity, a waterdrop would be in the shape of a sphere. Because the fit between the atoms is so perfect, water is one of the most stable compounds in nature.

Although water continuously changes states from solid to liquid to gas, the amount of water on Earth remains constant. There is as much water now as there may have been millions of years ago.

States of Matter Module

This module begins with an animation that explains how water moves through the state of matter in the water cycle. After the animated story is completed, the student will scroll down to the exploration screen.

The exploration screens requires students to click on all the items that are related to water in Florida, then the United States and then the world. Students can either read or click on the play button (white triangle) to hear the content. There are 23 clickables in Florida, 12 clickables in the United States, and 20 clickables on the world maps. There are three different screens for the waters of the world that can be navigated between: Water in the Americas (seven clickables), Water in Europe and Africa (seven clickables), Water in Water in Asia and Australia (six clickables). Once all clickables are found, the students should test their knowledge with the two different quizzes available. Click on the link for a self-evaluated quiz.

Once all clickables in Florida are found, click on the button to go to the U.S. map page. Students can click around the screen to learn about water bodies throughout the U.S. Again, all of the clickables on the screen will give information that may be found on the quiz.

When all clickables have been found, click on the button for Water in the World. There will be three different pages to freely navigate between to find all the information about waters across the world.

The following is the text/audio associated with each clickable.

Florida Map Exploration Screen

Click around the screen to explore the waters of the world, starting with Florida. Florida is a peninsula. A peninsula is land surrounded by water on three sides. That's most of Florida. Explore the Florida map to learn more about its water resources.

1. **Compass rose**

   The compass rose is used to tell directions on a map.

2. **? Sign- What is a river?**

   A river is a natural stream that empties into an ocean or a lake or other body of water.

3. **Apalachicola River**

   The Apalachicola River is formed by the confluence of the Chattahoochee and Flint rivers. A confluence is the place where two rivers join together. The Apalachicola River flows through the Jim Woodruff Dam just south of the Georgia-Florida border in the Florida Panhandle. It's one of the few Florida rivers that has a dam. The river flows 109 miles through relatively undeveloped coastal plain into Apalachicola Bay.

4. **Suwannee River**

   The Suwannee River flows out of the Okefenokee Swamp in Georgia, south to the Gulf of Mexico. Because of its distinctive brown color, it's often called a blackwater river. More of Florida's springs are found along the banks of this river than any other river in Florida.

Florida Map Exploration Screen

5. **Okefenokee Swamp**

   The Okefenokee Swamp is the largest swamp in North America. Okefenokee, which in Seminole language means the Land of Trembling Earth, is made up of approximately 700 square miles. It is located in the southeast corner of Georgia. This swamp is the beginning, or headwaters, of both the Suwannee River and the St. Marys River.

6. **St. Marys River**

   The St. Marys River forms part of the border between the states of Florida and Georgia. This river begins deep within the Okefenokee Swamp and twists for 130 miles to flow out into the Atlantic Ocean. As the crow flies, it's only 40 miles from the headwaters to the mouth of this river.

7. **False teeth- Heads and mouth**

   Did you know that rivers have heads and mouths? The beginning of the river is known as its headwaters. The river's mouth is where it ends and flows into another body of water. Can

you find the headwaters of the St. Johns River? Hmm? (Response with correct answer: You've got it! The St. Johns River's headwaters are in the freshwater marshes of Indian River County.)

8. **Black Creek**

   Black Creek is named for its dark water, which is caused by the tannins that run into the creek from forested areas surrounding the creek. High sandy and limestone bluffs are visible in many areas as the creek winds through ravines on its way to the St. Johns River.

9. **Shark**

   Have you ever seen sharks in the river? Oh, I hope not. The St. Johns River has a high salt content. That's why sharks have been found as far as 150 miles upstream.

10. **Trees- Detritus**

    Many Florida rivers have a naturally brown color from decaying leaves and plant material, which is called detritus. This decaying material contains tannins that stain the water just like tea.

11. **Ocklawaha River**

    The Ocklawaha River, a tributary of the St. Johns River, begins south of Lake Apopka and flows north. A tributary is a river that flows into a larger river. Some land surrounding the Ocklawaha River was used for farming. In the past, agricultural runoff severely impacted, or caused changes to, this river.
    Work is now taking place to restore this region to a more natural system. The Silver River, which is a spring-fed river, is a tributary of the Ocklawaha River.

12. **Arrow sign- River flow**

    The St. Johns River is one of the few rivers in the United States that runs from south to north.

13. **Wekiva River**

    The Wekiva River begins at the confluence, where two rivers join together, of Wekiva Springs Run and Rock Springs Run. It is joined on its way to the St. Johns River by two tributaries, the Little Wekiva River and Blackwater Creek.

14. **Indian River Lagoon**

    The Indian River Lagoon is not really a river or a lagoon. It's really a special place called an estuary. The Indian River Lagoon stretches approximately 156 miles. Its unique location on the east coast of Florida contains both tropical and temperate climates, which allow many different habitats and a wide diversity of species to be found in one area.

15. **Message in a bottle**

    When the sun heats the water to a certain temperature, it causes the water to evaporate and turn into an invisible gas called water vapor. Water is constantly evaporating from oceans, rivers, and lakes.

16. **Tampa Bay**

    Tampa Bay is Florida's largest open-water estuary. An estuary is a place where freshwater and salt water meet and mix.

17. **St. Johns River**

    The St. Johns River begins in southeast Florida and flows 310 miles north to Jacksonville, where it turns east and joins the Atlantic Ocean.

18. **Gauge**

    The average depth of the St. Johns River is 11 feet. At its deepest point, the river can be more than 80 feet deep.

19. **Lake Okeechobee**

    Lake Okeechobee is one of the largest lakes east of the Mississippi River that is not one of the five Great Lakes. Water from the Orlando area flows down the Kissimmee River into this lake.

20. **Everglades**

    The Everglades is a wetland located in South Florida. Wetlands provide a vital habitat for fish and wildlife, store water, and even help filter or clean the water.

21. **Florida Keys**

    Key West is the southernmost city in the continental U.S. and is found on an island in the Florida Keys. An island is a land area completely surrounded by water.

22. **Straits of Florida**

    The Straits of Florida connect the Gulf of Mexico with the Atlantic Ocean. The Straits are found between the Florida Keys, Cuba, and the Bahamas. The Straits mark where the Florida Current, the beginning of the Gulf Stream, flows east out of the Gulf of Mexico.

23. **Buoy** — States of matter

    Water is the only substance that is found in nature in the form of a liquid, solid, and gas. All living things need water to survive.

United States Map Exploration Screen

Wow Florida has some incredible rivers. Keep learning about changes in states of matter in the waters across the United States of America! Move your mouse over the different areas of the picture and click to read information or hear a description of water resources found on this map. Can you find all 12 pieces of information?

The following is the text/audio associated with each clickable.

1. **Lake Tahoe**

   Lake Tahoe is one of the clearest and most beautiful lakes in the world. A lake is a large body of water surrounded by land.

2. **Message in a bottle**

   Temperature can be measured using the Fahrenheit scale or the Celsius scale. Water freezes at 32 degrees Fahrenheit, which is the same as zero degrees Celsius. Water boils at 212 degrees Fahrenheit or 100 degrees Celsius.

3. **Great Salt Lake**

   The Great Salt Lake is the fourth-largest saltwater lake in the world. The water is salty because the minerals are carried into the water from the surrounding land and the three rivers that flow into the lake. Water constantly evaporates from the lake, leaving behind the minerals, or salts.

United States Map Exploration Screen

4. **Missouri River**

   The Missouri River is the longest river in the U.S. and is commonly referred to as the "Big Muddy" due to its muddy waters. The Missouri River is a tributary of the Mississippi River.

5. **Ohio River**

   The Ohio River actually begins in western Pennsylvania and flows west to the Mississippi river. It's the principal tributary for the Mississippi River.

6. **Minnesota River**

   The Minnesota River flows 335 miles from its headwaters at Big Stone Lake into the Mississippi River.

7. **Mississippi River**

   The Mississippi River is the second-longest river in the United States. From its headwaters in northern Minnesota, it runs 2,340 miles south, all the way to the Gulf of Mexico.

8. **False teeth- River Mouth**

   The mouth of the Mississippi River is in the Gulf of Mexico. Remember, the mouth of a river is where it flows into another body of water, such as an ocean. Open wide!

9. **? Sign- What are tributaries?**

   Tributaries are small streams or rivers that flow into larger streams or rivers.

10. **Great Lakes**

    There are five Great Lakes found in Canada and the U.S. These lakes are where the largest amount of available freshwater on Earth is stored. Ahh! Yessiree! Did you know that the Great Lakes are visible from the moon?

11. **Gulf of Mexico**

    The Gulf of Mexico is found between the U.S., Central America, and South America. The states of Alabama, Florida, Louisiana, Mississippi, and Texas border the Gulf. Water from as far away as Canada drains into the Gulf. (This click triggers the appearance of a message in a bottle.)

12. **Message in a bottle**

    Molecules are made of two or more different kinds of atoms. Water molecules are close together when they're cold and move away from each other when they get warmer. A water molecule is known as H_20. It consists of two atoms of hydrogen and one atom of oxygen.

Americas Map Exploration Screen

You've done a great job learning about water in Florida and the U.S. Now, learn about the rest of the world. Starting with the Americas you will find more information about changes in matter across the globe and important water bodies. Move your mouse over the different areas of the picture and click to read information or hear the information read to you. Can you find all 7 pictures?

The following is the text/audio associated with each clickable.

1. **Iceberg- Density of water**

   Almost everything on Earth becomes more dense as it becomes colder. This is also true of water, until it freezes and becomes less dense. This means that water as ice takes up more space than water as a liquid. Ice is about 9 percent less dense than liquid water. That's why an iceberg floats and doesn't sink.

2. **Message in a bottle** — What is matter?

   Matter is anything you can see, feel, touch, taste, or hear. There are three states of matter: solids, liquids, and gases. All matter is made up of very small particles called atoms. In a gas, the atoms are far apart and moving at a rapid rate of speed. In a liquid, the atoms are closer together and move at a slower speed. A solid has atoms that are tightly packed together with little movement.

   Can you see the cool breeze on your face? No, but you can feel it. Can you see the smell of pizza? No, a smell and a breeze are both gaseous states of matter. So this tells you matter can be something you can't see.

3. **Animals in the Amazon**

   The Amazon River is home to some incredible animals. For example, the giant otter that can be over 6 feet long and weigh more than 70 pounds can be found here. Another rare animal

found only in the waters of the Amazon River is the boto, or Amazon River dolphin.

4. **Amazon River**

   The Amazon River is the largest and second-longest river in the world. It empties more than 500 cubic meters of water into the Atlantic Ocean every hour. Hmm, let's see. That would be like pouring 250,000 two-liter bottles of water into the ocean every hour.

5. **Atlantic Ocean**

   The Atlantic Ocean is the second largest ocean and borders the eastern U.S., which includes the east coast of Florida. The Atlantic Ocean makes up 28 percent of the world's oceans.

6. **Pacific Ocean**

   The Pacific Ocean makes up 48 percent of the world's oceans. It's the largest and deepest ocean in the world and spreads nearly halfway around the world. It's so large that it could hold all of the continents and almost all of the other three oceans.

7. **Snow**

   Snow is water in its solid state. Each flake is made up of an ice crystal. It is very rare for any two snowflakes to have the same shape. The average snowflake can take two hours to fall to the ground.

Europe and Africa Map Exploration Screen

Moving onto Europe and Africa, will find even more exciting information about changes in matter and important water bodies. Move your mouse over the different areas of the picture and click to read information or hear the information read to you. Can you find all 7 pictures?

1. **The Arctic Ocean**

   The Arctic Ocean is the smallest and shallowest of the world's oceans. It is located around the North Pole and makes up only 4 percent of the world's oceans.

2. **Sun**

   Heating and cooling can change water from one state of matter to another.

3. **Penguin**

   The density of an object is determined by how close molecules are to each other in a certain space. The closer they are, the more dense the matter.

4. **Volga River**

   The Volga is the longest river in Europe. It begins northwest of Russia and flows very slowly south to the Caspian Sea. It is connected by canals to the Baltic Sea, Black Sea, and Don River. Because of its importance to the Russian people, they often call it "Mother Volga."

5. **Message in a bottle – Surface water or groundwater?**

   Water on Earth is found either above the ground, below the ground, or in the air. Surface water is water that is above the ground. Oceans, rivers, lakes, and streams are all forms of surface

water. Groundwater is water that is under the ground. Water that is in the air is called water vapor.

6. **Nile River**

   The Nile is the longest river in the world. It's 4,180 miles long and flows through Egypt and nine other countries in Africa. It empties into the Mediterranean Sea.

7. **Antarctica**

   Antarctica is constantly covered by a layer of ice. The average thickness of the ice sheet is 5,900 feet.

Asia and Australia Map Exploration Screen

For the last page, you will explore Europe and Africa, where you will learn about how heat changes the states of matter and important water bodies. Move your mouse over the different areas of the picture and click to read information or hear the information read to you. Can you find all 6 pictures?

The following is the text/audio associated with each clickable.

1. **Cloud** — Changes in states of matter

   Water changes from a liquid to a solid when heat is taken away, and it changes from a liquid to a vapor when heat is added.

2. **Lake Baikal**

   Lake Baikal is located in central Asia. It's the deepest lake in the world. At its deepest point, the lake is 1,620 meters deep. That's over 5,300 feet, or almost a mile deep.

3. **Camel** — Changes caused by energy

   Heat has the ability to transfer or move from one thing to another. That's why you get hot when you're in the sun for a while. It's also the reason why water changes from a solid to a liquid to a gas.

4. **Yangtze River**

   The Yangtze River is the longest river in China and the third- longest river in the world.

5. **Indian Ocean**

   The Indian Ocean lies mostly in the world's southern hemisphere between Africa, southern Asia, Australia, and Antarctica. It makes up 20 percent of the world's oceans.

6. **Murray River**

   The Murray River runs through the eastern side of southern Australia. It's an important source of water for the area. Water from this river is used for irrigation. Many farms are dependent on this water to grow their crops.

Vocabulary

Canals: man-made waterways that are used for draining and irrigating land and for navigation

Coagulate: to cause a liquid to change into a soft, semi-solid, or solid mass

Coastal plains: broad, flat areas near coastlines called lowlands that are characterized by low rolling hills, swamps, and marshes

Compass rose: the symbol used to show cardinal direction on a map (N, S, E, W)

Condensation: the process of changing a vapor into a liquid, which occurs when warm vapor mixes with cooler air in the atmosphere

Confluence: the place where two rivers join together

Density: how close molecules are to each other within a given space: the closer together they are, the more dense the matter

Detritus: decaying leaves and plant material

Estuary: a place where freshwater and salt water meet and mix, such as bays, lagoons, or saltwater marshes

Gas: a property of matter in which the atoms are far apart and move at a rapid speed

Gulf Stream: a warm ocean current that flows north out of the Gulf of Mexico along the east coast of the United States, toward Newfoundland, and then eastward toward the British Isles

Headwaters: the source or starting point of a river

Island: a body of land completely surrounded by water

Lake: a large body of water completely surrounded by land

Liquid: a property of matter where the atoms are close together with little movement

Marsh: a wetland or area of shallow water (be fresh water, brackish or salt water) covered with grasses

Matter: anything that takes up space and has mass. Matter is made up of small particles called atoms and can be found as either a solid, liquid, or gas. Anything we can see, feel, touch, taste, or smell is matter.

Mouth of a river: the end of a river where it empties into another body of water

Peninsular: land surrounded by water on three sides

River: a large flowing body of water that empties into an ocean, a sea, a lake, or another body of water

Solid: a property of matter where the atoms are tightly packed together with no movement

Surface water: water that is found on the surface of the earth, such as in oceans, river, lakes, ponds, wetland, streams, or seas

Swamp: flat, low-lying freshwater wetland with trees and other vegetation

Tributary: a small river or stream that flows into a larger river or stream

Vapor: the invisible gaseous state of water that occurs when water is energized by heat, causing it to rise into the atmosphere; water that is in the air

Water molecule: known as H_2O, it consists of two molecules of hydrogen and one molecule of oxygen

Wetlands: land where the soil is very wet or soaked with water during certain parts of the year that supports plants adapted to growing in these conditions and contains hydric soils. These important ecosystems can be found across Florida and provide a vital habitat for fish and wildlife, store water, and even help filter or clean the water.

Trivia

- When water freezes, it expands 9 percent. (U.S. Environmental Protection Agency [EPA])
- Water expands rather than shrinks when cooled, causing ice to be less dense than water. Thus, water is lighter in its solid state than it is in its liquid state. (EPA)
- A one-acre field of corn gives off 4,000 gallons of water per day in evaporation. (National Wild and Scenic River Systems)
- Florida's coastline, excluding the Keys, is 1,300 miles. (Florida Department of Environmental Protection [DEP])
- The St. Johns River is the longest river in Florida at a length of 310 miles. Among its many distinct characteristics, the St. Johns is one of a few major rivers in the nation that flows north. The St. Johns River and its tributaries drain about one-sixth of the state of Florida, or about 8,700 square miles. The river flows from its headwaters in marshes southwest of Cape Canaveral, evolving into a series of lakes, finally maturing into a river averaging two miles in width for its final 100 miles into Jacksonville and the Atlantic Ocean. (EPA)
- Florida's largest lake is Lake Okeechobee, covering 730 square miles (448,000 acres), with an average depth of 9 feet (2.7 meters). It is the second-largest freshwater lake in the continental U.S., second only to Lake Michigan. (South Florida Water Management District [SFWMD])
- There are 4,000 named lakes in Florida. (DEP)
- The total water area of Florida's inland lakes, rivers, and coastal bays is 3 million acres. (DEP)
- Florida has 40 rivers and 740 springs. (Florida Geological Survey Bulletin 66)
- You would have 12,000 miles of river if you connected all of Florida's rivers. (DEP)
- No part of Florida is greater than 60 miles from salt water. (DEP)
- Canada has the longest coastline of any country, with 56,453 miles. (Naval Meteorology and Oceanography Command)
- In the unlikely event that all of the polar ice were to melt, the sea level all over the world would rise 500 to 600 feet. As a result, 85 to 90 percent of Earth's surface would be covered with water as compared to the current 71 percent. The U.S. would be split by the Mississippi Sea, which would connect the Great Lakes with the Gulf of Mexico. (Naval Meteorology and Oceanography Command)

- The Challenger Deep is the deepest point on the ocean floor at 35,802 feet. It is located off the coast of Guam in the Marianas Trench. This depth was recorded in 1960 by the Trieste, a manned submersible owned by the U.S. Navy. (Naval Meteorology and Oceanography Command)
- One layer of water completely connects Earth. Even though this water is broken up into seven ocean parts, all the oceans are connected, one flowing into the other. (Naval Meteorology and Oceanography Command)
- The Pacific Ocean is the world's deepest ocean, having an average depth of 14,049 feet, and contains the deepest trench, which is 35,802 feet deep. (Naval Meteorology and Oceanography Command)
- The largest ocean in the world is the Pacific Ocean, covering 64,186,000 square miles. In fact, it is nearly as large as the Atlantic and Indian oceans combined. It contains a little more than half of all the water in the world's oceans. (Naval Meteorology and Oceanography Command)
- The longest river in the world is the Nile River, in Egypt, Africa. It is 4,160 miles long and flows northward into the Mediterranean Sea. (Naval Meteorology and Oceanography Command)
- The tallest iceberg ever known measured 550 feet and was located off the coast of Greenland in 1958. This iceberg was only 5 feet 6 inches shorter than the Washington Monument in Washington, D.C. (Naval Meteorology and Oceanography Command)
- The Caribbean Sea is the deepest sea in the world at 8,448 feet. (Naval Meteorology and Oceanography Command)

Water's Unique Qualities

By Cindy Cranford

Water is the only natural substance on Earth that is found in all three states — liquid, solid (ice), and gas (steam and water vapor). Earth's water is constantly changing, based on Earth's normal temperatures.

The best-known form of water is its liquid form. Water is in its liquid form when its temperature is anywhere between 0 and 100 degrees Celsius (°C). On the Celsius scale, water's freezing point is 0 degrees and its boiling point is 100 degrees. Water's freezing and boiling points are the baseline with which temperature is measured. (Water freezes at 32 degrees Fahrenheit [°F] and boils
at 212°F.)

When water reaches its boiling point, 100°C, it becomes an invisible gas known as vapor. When the temperature of the vapor gets below 100°C, it reaches its condensation point. At this point, the vapor changes back into liquid water.

Freezing occurs when water falls below the temperature of 0°C and the water coagulates (thickens). This is one of water's most unique characteristics. It expands in size by 9 percent as it changes into its solid form known as ice. Frozen water is less dense than water in its liquid form, making it light enough to float in a liquid. When water in its solid form reaches a temperature above 0°C, it returns to its liquid form. This process is known as melting.

Water has a high specific heat index. This means that water can absorb a lot of heat before it begins to get hot. That is why water is valuable to industries and is extremely helpful in acting as a coolant in a car's radiator. The high specific heat index of water also helps regulate the rate at which air changes temperature. That is why the temperature change between seasons is gradual rather than sudden.

Reading Response Questions

Water's Unique Qualities

- **Short Response** (2-point rubric)

When water's temperature is below 100° Celsius, it reaches its condensation point. Use information from the text to explain what happens to the state of water when it reaches its condensation point.

- **Short Response** (2-point rubric)

Use details from the text to explain what is meant when we say Earth's waters are constantly changing based on normal Earth temperatures.

Name _____

States of Matter

Fill-in-the-Blanks Quiz

1. Water is the only substance found on Earth that is naturally_____.
   a. found in the form of a solid, liquid, or gas
   b. made by the sky, trees, and mountains
   c. available in stores everywhere
   d. transparent

2. The St. Johns River and many other rivers in Florida have a naturally brown color from decaying leaves and plant material, which is called_____.
   a. decayus
   b. teastus
   c. detritus
   d. plantritus

3. The headwaters of the St. Marys River is_____.
   a. the Okefenokee Swamp
   b. Lake Okeechobee
   c. Indian River marshes
   d. Black Creek

4. An estuary is a place where salt water and freshwater_____and mix.
   a. cross
   b. meet
   c. pass
   d. bypass

5. Wetlands provide a vital _____for fish and wildlife, ____ the water, and even help__the water.
   a. place, flush, clean
   b. habitat, store, flush
   c. habitat, store, clean
   d. storage, clean, flush

6. The mouth of the Mississippi River is found in the_____.
   a. Atlantic Ocean
   b. Ohio River
   c. Gulf of Mexico
   d. Missouri River

7. Ice, or solid water,_____than liquid water. That's why it can float and doesn't sink.
   a. is more dense
   b. is less dense
   c. weighs less
   d. weighs more

8. Water has a different density in each of its states of matter. The density of an object is determined by how close or how far apart molecules are to each other in a certain space. The closer they are, the_____the matter.
   a. more dense
   b. less dense
   c. more equal
   d. more unequal

9. Matter is anything you can see, feel, touch, taste, or hear. The three states of matter are solid, _____ , and gas.
   a. slush
   b. vapor
   c. ice
   d. liquid

10. A famous wetland area found in South Florida is_____.
   a. the Everglades
   b. the Ocala National Forest
   c. the St. Johns River Marsh
   d. Lake Okeechobee

Name _____

States of Matter
Pop Quiz

1. At what temperature does water freeze?
   a. 32 degrees Fahrenheit or 0 degrees Celsius
   b. 42 degrees Fahrenheit or 15 degrees Celsius
   c. 22 degrees Fahrenheit or -15 degrees Celsius
   d. 0 degrees Fahrenheit or -32 degrees Celsius

2. Why are sharks and other ocean or marine creatures found far upstream in the St. Johns River?
   a. The river connects with the ocean, which pulls these creatures in with the tides.
   b. The river is wide and quiet and provides a calm shelter for these creatures during a storm.
   c. The river has a high salt content.
   d. The river is adjacent, or next to, the Intracoastal Waterway, which has lots of marine creatures.

3. What is the steam rising up over a hot bowl of soup?
   a. Soup leaking out of the top of the bowl
   b. A special kind of cooking smoke
   c. Fog being chased away by heat
   d. Water that is in the form of water vapor

4. What is a tributary?
   a. A river or stream that flows into a larger river
   b. A branching and braided stream
   c. A series of lakes that flow into each other
   d. A river that flows into the ocean or sea

5. What is a confluence?
   a. A river or stream that flows into a larger river
   b. A place where two rivers join together
   c. A place where a river flows over its banks into the streets
   d. An area where beavers and otters like to make their homes

6. Some of Florida's clear spring-fed waters are changing because algae are clouding the waters due to runoff from surrounding areas. What is in the runoff that causes algae to grow?
   a. Sediments and soils
   b. Litter and sticks
   c. Fertilizers and nutrients
   d. Pesticides and debris

7. What is the correct grouping between the state of mater and form of water?
   a. Cloud- solid
   b. St. Johns River- gas
   c. Precipitation- liquid
   d. Evaporation-liquid

8. A water molecule is known as H_2O. What does this mean?
   a. It consists of two atoms of helium and one atom of oxygen.
   b. It consists of one atom of hydrogen and two atoms of oxygen.
   c. It consists of two atoms of hydrogen and one atom of oxygen.
   d. It consists of one atom of helium with one atom of oxygen.

9. Animals have many reasons for needing water. Which of the following is not a reason water is important to animals?
   a. Breeding grounds
   b. Home
   c. Food source
   d. Transpiration

10. Wetlands do many things. Which of the following is **NOT** a function of a wetland?
   a. Provides places for recreation
   b. Cleans and purifies the water by filtering out pollutants
   c. Stores rainwater and helps control flooding
   d. Provides an ideal home site for a house

Answer keys

Fill-in-the-Blanks Quiz

1. a. found in the form of a solid, liquid, or gas
2. c. detritus
3. a. the Okefenokee Swamp
4. b. meet
5. c. habitat, store, clean
6. c. Gulf of Mexico
7. b. is less dense
8. a. more dense
9. d. liquid
10. a. the Everglades

Pop Quiz

1. a. 32 degrees Fahrenheit or 0 degrees Celsius
2. c. The river has a high salt content.
3. d. Water that is in the form of water vapor
4. a. A river or stream that flows into a larger river
5. b. A place where two rivers join together
6. c. Fertilizers and nutrients
7. c. precipitation- liquid
8. c. It consists of two atoms of hydrogen and one atom of oxygen.
9. d. Transpiration
10. d. Provides an ideal home site for a house

Guide for

What's a Gallon Module

Overview

Students will become familiar with various liquid measurements as Hydro continues his search for Agua. Students will understand why our dependency on water demonstrates the need for water conservation. These ideas will be addressed, as liquid measurement is explored using both metric and standard units.

Florida Standards

2nd grade
Science: SC. 2.P.8.1, SC.2.P.8.6
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4, LAFS.2.RI.1.3

3rd grade
Science: SC.3.N.3.1
Social Studies: SS.B.1.2.1, SS.B.2.2.3, SS.B.2.2.4
Math: MA.3.A.1.1, MA.3.A.1.2
English Language Arts: LAFS.3.RI.1.1, LAFS.3.RI.1.3, LAFS.3.RI.2.4, LAFS.K12.SL.1.2

4th grade
Science:SC.4.E.6.3, SC. 4.E.6.6, SC.4.P.8.1, SC.4.P.8.2, SC.4L.17.4
Math: MAFS.4.MD.1.1
English Language Arts: LAFS4.L.3.6, LAFS.K12.W.3.8

5th grade:
Science: SC.5.E.7.2, SC.5.P.9.1
Math: MAFS.5.MD.1.1
English Language Arts: LAFS.5.RI.2.4, LAFS.5.L.3.6

Background Information

We know that water is an important resource to every living thing. Water is all around us, but only about 1 percent of all the water around us is available for our use. Every day, the average American uses about 70 gallons of water for drinking, bathing, cooking, and cleaning. That's a lot of water when you determine the population. Is this water always going to be available for us?

Usable water is more abundant in some places in the world than in other places. This means the demand for water varies in different locations around the world. However, many humans have come to think

of usable water as an endless fountain. Because water moves in a continuous cycle between the air, the ground, plants, and animals, water will always be around us, but it may not always be safe for us to use.

This module will emphasize amounts of water that are used at home, at school, and in businesses, while focusing on both metric and standard measurement. Students will practice measuring equivalent amounts of liquid in order to better understand the idea of water conservation and the importance of every person saving what he or she can.

What's a Gallon Module

On the introduction screen, students must click around the kitchen and locate the 21 clickables. There are clickables located inside the refrigerator, which can be opened by clicking on the handles. The refrigerator can be closed by clicking on its side. Students must find and listen to all of the clickables on the screen. Once all clickables are found, the students should test their knowledge with the two different quizzes available. Click on the link for a self-evaluated quiz.

The following is the text/audio associated with each clickable.

Kitchen Exploration Screen

Click around the screen to hear cool facts about water.

1. **Water on Earth**

   About 97 percent of the water on Earth is salt water, like you find in the ocean. Only 3 percent of Earth's water is fresh or drinkable, and two-thirds of that is in the form of ice, like the polar ice caps, or deep underground.

2. **Faucet**

   A steady drip of water from your faucet can waste as much as 20 gallons of water a day. Installing low-flow faucets in your kitchen and bathroom can help save a lot of water. Freshwater doesn't come easy to everyone. About 2 billion people in the world spend an average of three hours a day just getting their water.

3. **Fish bowl**

   Water is colorless in small amounts, but can have a bluish color in larger quantities, like in a pool. Water is essential for all living things to survive.

4. **Red tea kettle**

   When water is boiled, it vaporizes into steam. The boiling point for water is 212 degrees Fahrenheit or 100 degrees Celsius.

5. **Glass of water**

   Americans drink more than 1 billion glasses of tap water a day. Always keep a pitcher of water in the refrigerator; that way, you don't have to let the faucet run while you wait for your water to get cool.

6. **Coffee maker**

   The water we drink is constantly being recycled, or reused. In fact, the water that was on Earth during prehistoric times is the very same water we still use today. Think about that.

7. **Yellow flower**

   The best time to water plants outside of the house is during the cooler hours of the day, early in the morning or late in the afternoon. Avoiding the heat can prevent the water from evaporating too soon.

8. Pink-flowered plant

Never put water down the drain when there may be a use for it, such as watering plants or cleaning.

Kitchen Exploration Screen

9. Broom

Using a water hose to clean your sidewalk or driveway is a waste of water. Use a broom instead.

10. Picture of boy on refrigerator door

Did you know that about 70 percent of the human body is water? Your body temperature is controlled by water. When your body loses water, it becomes dehydrated and your body temperature rises, and drinking water isn't the only way for you to get fluids into your body. Eating fruits and vegetables also helps. Humans can survive for a month without food, but they can only live two to three days without water. Two-thirds of the human brain is made up of water. Drinking plenty of liquids keeps your brain working.

11. Picture of outer space on refrigerator door

Scientists known as astronomers have found evidence of water in many places in the universe, including the moon, Mars, Jupiter's moons, comets, and interstellar clouds. The Earth is blue when seen from space. That's because of all the water that's on our planet.

12. Dishwasher

A dishwasher uses an average of 11 gallons of water when it runs. That's a lot of water. To save water, always make sure that the dishwasher is fully loaded before you run it.

13. Pot

Vegetables that are boiled actually lose some of their water content, weighing less after boiling in water than they did before. Steaming vegetables instead of boiling helps retain the vegetable's water content and its vitamins.

14. Pitcher

You know, most of the water we drink here in Florida comes from water underneath the ground. This kind of water is called groundwater. The Floridan aquifer is a large aquifer that is underneath most of Florida, and it is used as a water source by many people in Florida.

Vocabulary

Aquifer: an underground layer of sand, gravel, or rock that stores and carries water

Conservation: the process of using or managing a natural resource to prevent its waste, harm, or destruction

Conserve: to use only what is needed

Dehydration: the process of losing or removing water

Evaporate: to change or convert into a vapor

Gallon: used to measure volume in the standard system. There are 4 cups in a quart, 4 quarts in a gallon and 2 pints in a gallon.

Groundwater: water below the ground, usually found in aquifers

Irrigation: the process of putting water on land to help plants grow

Liter: the basic unit of measuring volume in the metric system. There are 1,000 milliliters in a liter and 3.7854 liters in a gallon.

Metric measurement systems: system of measurement used by scientist which uses liters for volume, meters for length and grams for weight.

Pollution: contamination of water or air by harmful chemicals or waste materials

Potable: drinkable; safe to drink

Recycle: to make a new product from an old one

Reduce: cutting back on the amount of a resource that is used

Reuse: the act of using something after it has already been used

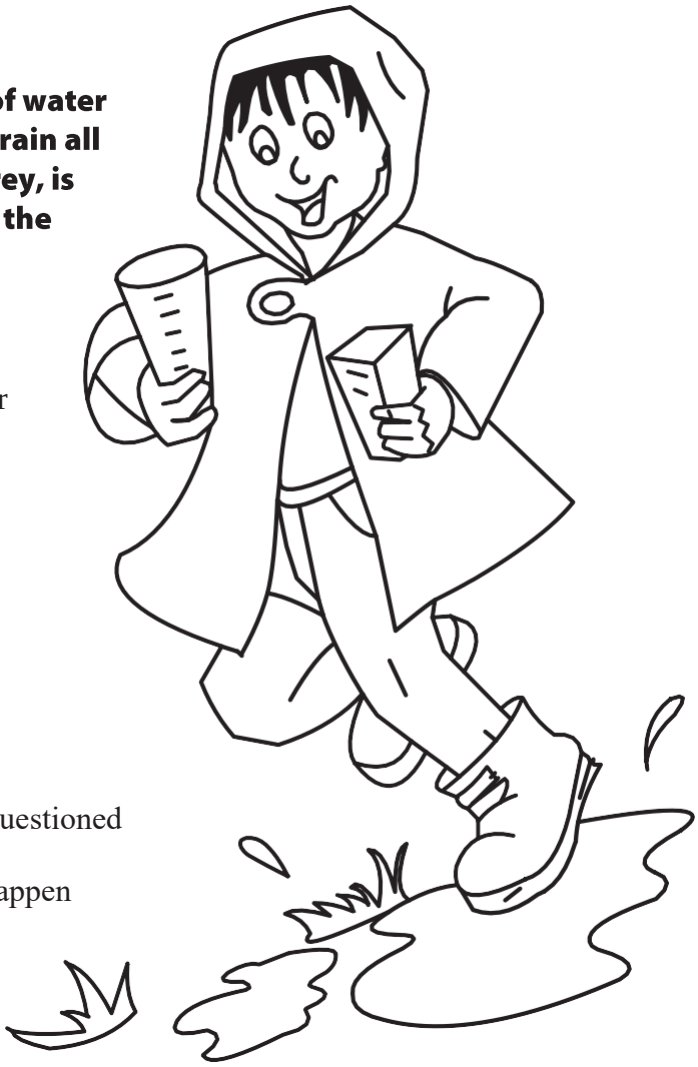
Standard measurement system: system of measurement used in the United States which uses gallons for liquids, feet for length and pounds for weight.

Trivia

- A person should consume at least 2½ quarts of water per day (from all sources of water, food, etc.) to maintain health. (American Water Works Association [AWWA])
- One inch of rainfall drops about 7,000 gallons on a 60- by 180-foot area of land. (AWWA)
- One gallon of water weighs approximately 8½ pounds. (AWWA)
- Here's a quick rundown of some of water's properties (U.S. Geological Survey [USGS]):
- Weight: 62.416 pounds per cubic foot at 32 degrees Fahrenheit
- Weight: 61.998 pounds per cubic foot at 100 degrees Fahrenheit
- Weight: 8.33 pounds per gallon, 0.036 pounds per cubic inch
- A small drip has a volume of about one-quarter of a milliliter, which is estimated to be about 4,000 drips in a liter of water. A gallon is equal to 3.7854 liters, so, by the math (4,000 times 3.7854), there are approximately 15,100 drips in a gallon.
- It takes about 1 gallon of water to process a quarter pound of hamburger. (U.S. Environmental Protection Agency [EPA])
- It takes about 2,072 gallons of water to make four new tires. (EPA)
- To manufacture a new car, including tires, it takes about 39,090 gallons of water. (EPA)
- An acre of corn growing in a field gives off about 4,000 gallons of water during evaporation. (EPA)
- When you flush a toilet, 1.6 to 7 gallons of water are used. (EPA)
- On the average, we use about 2 gallons of water each time we brush our teeth. (EPA)
- A tomato is made up of 95 percent water. (EPA)
- 70 percent of an elephant is water. (EPA)
- An ear of corn consists of 80 percent water. (EPA)
- To grow the cotton for a pair of jeans takes about 1,800 gallons of water. (USGS)

The Rainy Day Blues

By Cindy Cranford



Jerry stomped into class, leaving a trail of water behind. "I can't believe it is supposed to rain all weekend," he grumbled. "My friend, Corey, is coming to visit, and we'll be stuck inside the whole weekend."

"My parents say we need rain," said Rebecca. "They are concerned that everything is drying up and our aquifer is getting lower. Remember when we learned about the water cycle? Mrs. Parker told us that precipitation helps to replenish our groundwater sources."

"Yeah, I know that … but does it have to rain this weekend?" Jerry whined.

"Why don't you make the rainy weekend an adventure?" offered Mark.

"How can we do that if we're stuck inside?" questioned Jerry. "Easy! Just think of all the things that happen outside because of water," Mark said with a smile. "Have you ever wondered how much water we get from a rainstorm?
Or how much water stays in a puddle? Or how much water your dog drinks? Or does the same amount of rainwater fall in two different places? Or…."

"OK, OK, I get the message. Maybe we can create a rainy day scavenger hunt," Jerry said thoughtfully as he glanced out the window. Suddenly, things were starting to get better.

That afternoon the rain had almost stopped when Corey arrived. Jerry shared his idea for the weekend with Corey. They excitedly began to make their plan. Soon they grabbed a pencil, paper, and their rain gear and shot out through the door.

They busily began gathering rain gauges and buckets and other containers they found around the neighborhood. To get accurate information, they knew they would either need to empty all the containers or measure the amount of water in each before the rain started up again.

Later that night they could hear the rain pounding on the roof of the house. Both boys could hardly wait until morning so they could get outside and gather their information.

Finally, it was morning and the boys quickly got dressed and hurried to breakfast. Jerry noticed his mom using a measuring cup to measure the water she added to the pancake mix. She also pulled out measuring spoons and was measuring the amount of oil the mixture needed. "Wow," thought Jerry, "I've never thought about measuring water and oil to cook."

After breakfast, the boys grabbed their gear and hurried out the door. Due to the rain, the yards were soggy with water, but they didn't care. After all, this was an adventure. Jerry suggested they begin by checking his dad's rain gauge in the flower garden. They noticed that the rain gauge was about half full, but knew they needed a more accurate measurement. The gauge showed that 120 milliliters of rainwater had collected overnight. Corey recorded the amount of water collected, along with the time of this observation.

Next, they checked Mr. Jones' rain gauge. They found that his gauge had collected four ounces of rainwater. "Houston, we have a problem," piped up Corey. "Your dad's gauge uses metric measurement and Mr. Jones' gauge uses standard measurement. What do we do now?"

Jerry replied, "Hmmm, that's a good question."

Suddenly, Corey shouted, "I have an idea! What if we empty your dad's rain gauge and pour the water from Mr. Jones' gauge into your dad's? Then we can compare the metric amounts on both."

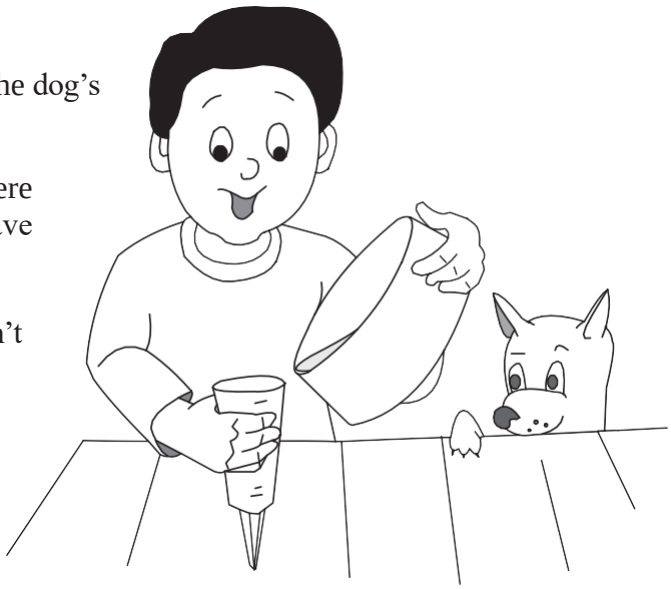
"Yeah, that'll work," said Jerry.

Jerry quickly ran back to get his dad's rain gauge. He emptied it and carefully poured the water from Mr. Jones' rain gauge into his dad's. "This is awesome!" shouted Jerry. "It's the same as dad's
… about 120 milliliters."

"Come on," said Corey. "We've got to check the dog's water bowl."

Looking at the water bowl, Corey realized there were no measurements on the dish. "We'll have to pour the water into a measuring container and
see how much is here," said Corey. "Why don't we use the rain gauge again to measure?"

"Good idea," said Jerry, as he handed the rain gauge to Corey. "You measure this time."



Pouring the water from the dog's dish into the rain gauge was a little more difficult than expected, but Corey cautiously emptied the dog's dish without spilling a drop. He checked the measurement on the rain gauge and noticed it contained 100 milliliters of water. "Www…wait a minute!" he stammered. "Why doesn't the dog's dish have the same amount of water as the rain gauges? I didn't spill any of the water, and the dog hasn't been out this morning to drink any."

"Hmmm, another good question," remarked Jerry. "For now, let's record the amount. Maybe we'll come up with the solution later."

The boys busily went about checking containers. They were still puzzled that the dog's dish had 20 milliliters less rainwater than most of their other sources. As they sat and pondered, Corey suddenly jumped up and shouted, "I've got it! Think about the location of all the containers. The dog's dish was by the back door and under the overhang of the porch. The other containers were in the open where nothing was hanging over them. I bet some of the rainwater hit the porch covering and bounced off, so not all of the drops fell in the dish. What do you think?"

"I think you're right," agreed Jerry. "Problem solved!"

Corey grabbed Jerry's hand and pulled him up. "Come on Jerry," said Corey. "Let's go measure more. Do you think your parents will mind if we measure how many gallons of water it takes for a bath? I'm feeling really muddy right now."

Smiling, Jerry followed along. "I'm with you, buddy," he said.

Reading Response Questions

The Rainy Day Blues

- **Short Response** (2-point rubric)

  Corey and Jerry ran into a problem when Mr. Jones' rain gauge was in ounces. Explain why this concerned them.

- **Short Response** (2-point rubric)

  The boys discovered the dog's water dish had less water than other places because it was partially covered. Explain what this tells us about the amount of water our yard gets when we use sprinklers to water the grass.

- **Extended Response** (4-point rubric)

  In the story, the boys realize they must find a way to measure the water in the dog's dish. They decided to pour it into Jerry's father's rain gauge. Explain why this was a better idea than pouring it into Mr. Jones' rain gauge.

- **Extended Response** (4-point rubric)

  The end of the story suggests that the boys will measure the amount of water used in the bathtub with cups. Explain why this is or is not the best measurement tool they could use.

Name _____

What's a Gallon?

Fill-in-the-Blanks Quiz

1. Many vegetables and foods contain large amounts of_____.
   a. gold
   b. oil
   c. water
   d. vegatonium

2. Many people in Florida get most of their drinking water from an underground water source called the_____aquifer.
   a. Biscayne
   b. North Florida
   c. water table
   d. Floridan

3. Most humans can live a long time without food, but will only survive for_____without water.
   a. one day
   b. one week
   c. three days
   d. two weeks

4. When your body loses water and you become overheated, tired, and thirsty, you are said to be _____ .
   a. dehydrated
   b. hypertense
   c. hungry
   d. sweaty

5. Earth is called the blue planet because of all the_____that is found on the planet.
   a. plants
   b. water
   c. clouds
   d. smoke

6. When your body loses water, you become dehydrated and your body temperature_____.
   a. flattens
   b. lowers
   c. rises
   d. peaks

7. The metric system is used for_____and_____things in most places around the world.
   a. stretching and wrapping
   b. holding and weighing
   c. measuring and holding
   d. measuring and weighing

8. Water freezes at_____degrees Fahrenheit or 0 degrees Celsius.
   a. 39
   b. 0
   c. 32
   d. 25

9. Earth's surface is covered by about_____percent of water.
   a. 50
   b. 65
   c. 70
   d. 80

10. Cups, pints, quarts and gallons are used to_____liquids, such as water.
   a. measure
   b. weigh
   c. recycle
   d. reclaim

Name _____

What's a Gallon?

Pop Quiz

1. Which of these containers could hold the most water?
   a. Gallon
   b. Liter
   c. Quart
   d. Your pocket

2. Which of these is a metric measurement for liquid?
   a. Inches and feet
   b. Liters and milliliters
   c. Gallons, quarts, and pints
   d. Meters and centimeters

3. When is the best time to water plants outside your house or school?
   a. Only at night
   b. During the afternoon
   c. In the early morning or late afternoon
   d. During a full moon

4. What does watering before 10 a.m. and after 4 p.m. do?
   a. It keeps the sidewalks from getting wet when people are walking to school or work.
   b. It gives you time to see if it's going to rain that day.
   c. It keeps caterpillars cooler.
   d. It prevents the water from evaporating before the plants can soak it up.

5. What does installing flow restrictors on faucets help you do?
   a. Use more water
   b. Conserve water
   c. Recycle water
   d. Have clean water

6. What should you do to conserve water when running the dishwasher?
   a. Have clean water.
   b. Only wash full loads of dishes.
   c. Only put the dishwasher on once a day.
   d. Empty the dishwasher as soon as it's done.

7. How much of the Earth's water is freshwater?
   a. 3 percent
   b. 6 percent
   c. 10 percent
   d. 12 percent

8. If a gallon holds 4 quarts and a quart holds 2 pints, how much would a half-gallon hold?
   a. 2 quarts or 4 pints
   b. 3 quarts or 6 pints
   c. 1 quart or 2 pints
   d. 2 pints or 2 quarts

9. Which is NOT an example of recycling water?
   a. Watering plants with leftover water from a water bottle or cup
   b. Taking the water from washing floors to water your garden or lawn
   c. Pouring leftover ice down the drain
   d. Using water left over from boiling your vegetables to water potted plants

10. Why does drinking plenty of water help keep your brain working?
    a. Your brain is made up of two-thirds water.
    b. Water helps your thoughts float from one idea to another.
    c. Water conducts electricity.
    d. Water keeps your eyes from drying out.

Answer keys

Fill-in-the-Blanks Quiz

1. c. water
2. d. Floridan
3. c. three days
4. a. dehydrated
5. b. water
6. c. rises
7. d. measuring and weighing
8. c. 32
9. c. 70
10. a. measure

Pop Quiz

1. a. Gallon
2. b. Liters and milliliters
3. c. In the early morning or late afternoon
4. d. It prevents the water from evaporating before the plants can soak it up.
5. b. Conserve water
6. b. Only wash full loads of dishes.
7. a. 3 percent
8. a. 2 quarts or 4 pints
9. c. Pouring leftover ice down the drain
10. a. Your brain is made up of two-thirds water.

Guide for

Natural Aquatic Habitats

Overview

Students will learn about Florida's natural aquatic habitats, their inhabitants, and how they interact. Hydro and Agua are in a cloud and soon become raindrops. They end up in a river in Florida. From there, they explore various aquatic habitats, including a wetland, an estuary, a lake, and a river. Students will: (1) understand that most living things use energy from the sun to live and grow; (2) know how plants and animals interact with one another in an ecosystem; (3) understand the relationship among organisms in aquatic food chains; (4) and be able to trace the flow of energy in a system.

Florida Standards

2nd grade
Science: SC.2.L16, SC. 2.L.17.1, SC2.L.17.2,
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4, LAFS.2.RI.1.3

3rd grade
Science: SC.3.L.17.1, SC3.L.17.2
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4, LAFS.3.RI.1.3, LAFS.3.RI.2.4

4th grade
Science:SC.4.L17.2, SC. 4.L.17.3, SC.4.L.17.4, SC.4.E.6.6
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4

5th grade:
Science: SC5.L.15.1
English Language Arts: LAFS.K12.R.1.3, LAFS.K12.R.3.7, LAFA.K12.R.2.4

Background Information

An ecosystem is made up of all of the plants and animals of a particular area, plus all of the environmental conditions (air, land, water, etc.) supporting that living community. Each species of plant and animal lives in a particular place, or **habitat**, that provides food, water, and shelter necessary for its survival.

Some kinds of **invertebrates** (animals without backbones, such as insects and crustaceans) that live in or near water feed on aquatic plants or depend on aquatic plants for shelter. Without plants, these aquatic invertebrates would not have a habitat. Aquatic plants and invertebrates are eaten by other animals such as fish, reptiles, amphibians, birds, and mammals. These animals all have backbones and are known as **vertebrates**.

The way in which energy is passed from plants to animals is called a **food chain**. All of the food chains that are connected in an ecosystem make up a food web. Animals are called **consumers**

because they get the energy they need by eating plants and other animals. Animals cannot make their own food, so they depend on plants for energy. A particular species of animal or plant may be food for several other species.

Plants store energy from the sun. Both aquatic plants and plants on land are **producers** that make their own food through a process called **photosynthesis** (plants use energy from the sun to change carbon dioxide and water into sugar or food). Plants use some of the sugar and minerals they get from soil to make plant parts. On land, plants get carbon dioxide from the air and release oxygen back into the air. Plants that grow underwater get carbon dioxide from the water and release oxygen back into the water.

Native plants are those that have been living in Florida since before European contact. Plants brought to Florida from other places, such as Asia, South America, and Africa, are known as **exotic** plants. Some exotic plants have become a problem in Florida because they escape from the places where they were planted and take over areas where native plants live. Exotic plants often reduce fish and wildlife populations by changing the habitat.

Decomposers such as fungi and bacteria and **detrivores** such as some insects are living things that get energy from dead animals and decaying plant matter (**detritus**). They break down dead animals and plant parts (e.g., grass clippings and leaves) into minerals and nutrients that are put back into the soil, air, and water for use by other living plants and animals.

Natural habitats

An **estuary** is a body of water where freshwater and salt water meet and mix (such as bays, lagoons, or saltwater marshes). Freshwater from a river mixes with salt water and moves in and out of the estuary with the tide, just as its Latin meaning states ("estuary" is Latin for "tides"). Nutrients and pollutants run off of the land after a rain and travel to the river to the estuary, where they are captured and slowly released into the ocean. Nutrients are beneficial to microscopic plants known as **phytoplankton**.

Phytoplankton, in turn, become food for **zooplankton**, which are tiny floating animals found in water. Crustaceans and insects also feed on zooplankton. Phytoplankton and larger aquatic plants provide food for **primary consumers** (invertebrates such as mussels) that, in turn, provide an energy source for crabs and fish (**secondary consumers**), which support a variety of wading and shore birds.

A **lake** is a large body of water surrounded by land. Lake Okeechobee, the second-largest freshwater lake in the continental United States, covers 730 square miles, with an average depth of 9 feet. Because of its size and importance to our state, it is known as the "liquid heart" of south Florida. Nutrients and pollutants that flow into the lake affect its health and are closely monitored in efforts to protect this great resource.

A **marsh** is an area of shallow water covered with herbs, grasses, and sedges. Both freshwater marshes and salt marshes can be found in Florida. The Everglades is a huge **freshwater marsh**, where water from Lake Okeechobee flows south to mix in **salt marshes**, mangroves, and the salt water of Florida Bay. Salt marshes are especially important to fish, shellfish, and birds. Mud flats, open water, and shallow grassy areas are common in salt marshes. Only plants that can live in **brackish** (somewhat salty) water grow in salt marshes.12

A **river** is a natural stream that empties into an ocean or a lake or other body of water. The St. Johns River, which extends for 310 miles, is Florida's longest river. It is one of the few rivers in the United States that flows north.

A **swamp** is a wetland with trees and shrubs. Cypress, red maple, ash, and tupelo are prevalent wetland trees in Florida. Pines, mangroves, and other hardwoods are also found in swamps.

A **watershed** is an area of land and water, usually located near a stream, river, or lake, that water moves over, moves through, and drains into. Large watersheds are sometimes called basins.

With its tributaries, the St. Johns River basins drain about one-sixth of Florida and empty into the Atlantic Ocean.

The Suwannee River Basin begins in Georgia in the Okefenokee Swamp and ends in the Gulf of Mexico.

Northwest Florida's rivers include the Escambia, Apalachicola, and Choctawhatchee. This area borders the Gulf of Mexico and has experienced a critical drop in groundwater levels.

Because of drought conditions in southwest Florida, which is a water use caution area, there is a greater risk of water quality problems and for an increase in sinkhole development. A comprehensive plan is in place to restore coastal habitat by controlling pollution within this watershed.

Increasing development has resulted in higher water use beyond what south Florida water resources (Kissimmee River-Lake Okeechobee-Everglades-Florida Bay) can provide, so they rely on other places to supply water for their populations. Drainage in this watershed is mainly by canals.

Wetlands are lands where the soil is very wet or soaked with water part of the year. Wetlands are among Florida's most important natural resources. There are several types of wetlands, such as coastal and freshwater marshes, swamps, and sloughs, to name a few. They provide habitat for many species of fish, birds, and animals. Food, shelter, and protected nesting grounds can be found here.

Many wetland plants form the beginning of the food chain for many plant-eating creatures. An example of this would be mosquito larvae eating tiny microscopic plants in the water, a dragonfly eating the mosquito, a frog eating the dragonfly, a snake eating the frog, and an egret eating the snake.

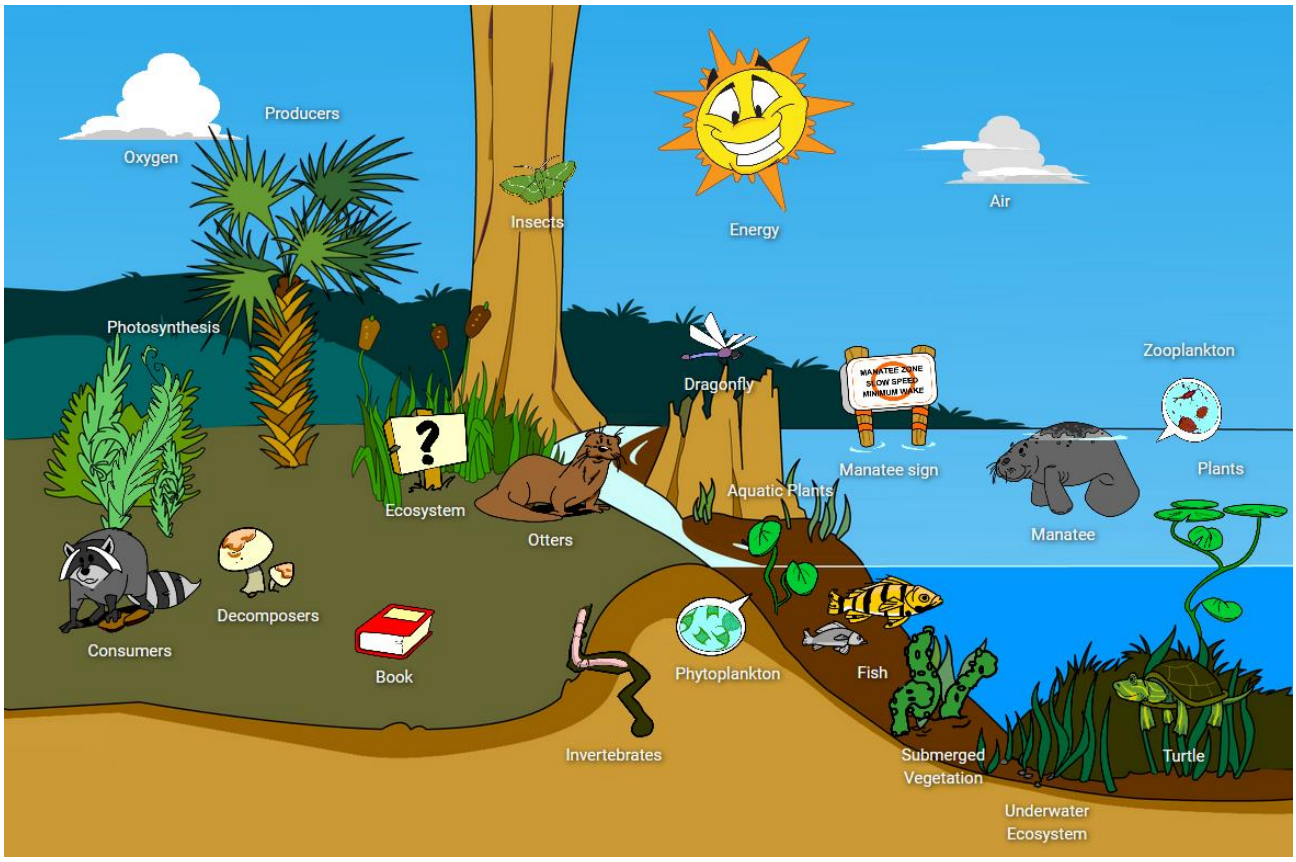
One of the most important features of a wetland is to help filter pollutants, such as chemicals and fertilizers, which are removed from the water when they are absorbed by plants. Additionally, silt or sediments are captured or settle out, helping to purify the water. Water that soaks into the soil helps replenish our drinking water supply. Wetlands also act as natural sponges to absorb floodwaters, and they help to protect the coast from erosion.

Natural Aquatic Habitats Exploration Screen

Hi! I'm Raleigh the Otter. Otters are fun creatures that love the water and are great swimmers. Having good, clean water is very important to me. Choose a habitat to explore. Then, have some fun and click around the habitat to learn about each.

Lakes and Rivers Exploration Screen

Lakes are bodies of water that are completely surrounded by land. They can be isolated where water flows into them but doesn't flow out. Or they can be connected to other water systems where water flows into and out of the lake. Find out more about what can be found in our lakes by clicking around the screen. Be sure to take the quiz when you have found them all.



Lakes and rivers aquatic habitat exploration screen

The following is the text/audio associated with each clickable.

1. **Fern** — Photosynthesis

   Plants use sunlight to change carbon dioxide and water into sugar. Mmmm. This process is called photosynthesis. Plants also use nutrients from the environment to make food. Did you know plants were so important? Wowee!

2. **Raccoon** — Consumers

   Consumers are living things that get their energy by eating plants or other animals. Examples of some consumers in this ecosystem are manatees, otters, fish, turtles, and dragonflies.

3. **Cabbage palm** — Producers

   Producers are living things that make their own food by changing energy from the sun into food. Plants are producers. Examples of some producers in this ecosystem are cypress trees, aquatic plants, and ferns.

4. **? Sign** — Ecosystem

   An ecosystem is a natural community of living things that interact with each other and with nonliving parts of the environment. Humans change ecosystems with their activities. Most people don't realize that they are part of the ecosystem too. It took a long time for people to realize how human activities affect Florida's ecosystems.

5. **Mushrooms** — Decomposers

   Decomposers are fungi, bacteria, and insects that get their energy by breaking down wastes and dead organisms. They cause dead things to decay. Examples of decomposers found in this lake scene are the mushrooms.

6. **Book**

   Living things, including people, depend on rivers and lakes that have good water quality. How do we know if a lake or river has good water quality? One way is to test the water for chemicals that are harmful to plants and animals.

   These chemicals are a type of pollution that may also affect the natural balance of the habitat. Another way to test for healthy water is to find out what's living there. Scientists catch and count macroinvertebrates to learn about the water quality of rivers, streams, and lakes in Florida.

   Macroinvertebrates are animals without backbones that can be seen with your eyes. Many macroinvertebrates can't survive in poor quality water, so they're often used as a way to determine the health of the water. If the water quality is good, there may be many different "macros" living in the water. These macros are an important part of the food chain.

7. **Worm** — invertebrates

   Worms are invertebrates. That's what scientists call animals that don't have a backbone. Invertebrates that can be seen without a microscope are called macroscopic invertebrates, or "macros" for short.

8. **Otter**

   Otters are consumers that like to eat fish. They use their webbed feet and thick tails to help them swim. They have to be quick swimmers to catch a fish.

9. **Sun** — Energy

   All living things need energy to live. Food chains, or webs, are used to show how energy moves through an ecosystem.

10. **Dragonfly**

    Dragonflies are insects that live in the water for part of their lives and out of the water for part of their lives. They're important animals that are part of the river and lake ecosystems.

11. Green moth — Insects

Small organisms like insects are an important part of the aquatic food chain because larger animals eat them, and then those animals are eaten by even larger animals.

12. Manatee sign

Manatees are large, endangered animals that live in Florida waters. They have big, flat teeth for chewing up aquatic vegetation. Some people call them sea cows.

13. Aquatic plants near stump

Just like plants on land, aquatic plants use energy from the sun to make food. They use sunlight and nutrients to produce food and oxygen. Animals that live in the water use the oxygen to breathe.

14. Fish

Many kinds of fish live in rivers and lakes. They come in all sizes and are a part of the food chain.

15. Submerged vegetation

There are some plants that live completely underwater. Where are they? Oh, there they are. Scientists describe these plants as submersed aquatic vegetation. Submersed aquatic vegetation grows in freshwater habitats like ponds, lakes, and rivers. Some submersed aquatic vegetation is adapted to grow in saltwater habitats along the coast of Florida.

16. Cloud— Oxygen

Plants use carbon dioxide and give off oxygen when they're making food. Animals use the oxygen to live. What a deal!

17. Manatee

Manatees graze on aquatic vegetation in rivers and springs during cool winter months. During summer months, they graze in coastal seagrass beds. There is even a sea grass called manatee grass.

18. Phytoplankton

Phytoplankton are microscopic plants, mainly algae, that float around in the rivers, marshes, and lakes. Even though we can't see them, these tiny plants are an important part of the ecosystem too.

19. Underwater Ecosystem

Although you may not be able to see the plants that grow underwater in rivers and lakes, they're a very important part of the ecosystem. These plants provide food, shelter, and even oxygen to animals that live in underwater habitats.

20. Turtle

If you look closely, you might see a turtle searching the aquatic vegetation for fish and small animals to eat. Aquatic turtles normally surface to breathe air through their lungs, but some can absorb oxygen directly from the water through their skin or the lining of their throat.

21. Zooplankton

Zooplankton are microscopic animals that have no backbone. Many other animals, like insects, do not have a backbone. These animals are called invertebrates. Zooplankton eat microscopic plants called phytoplankton.

22. Floating aquatic plants

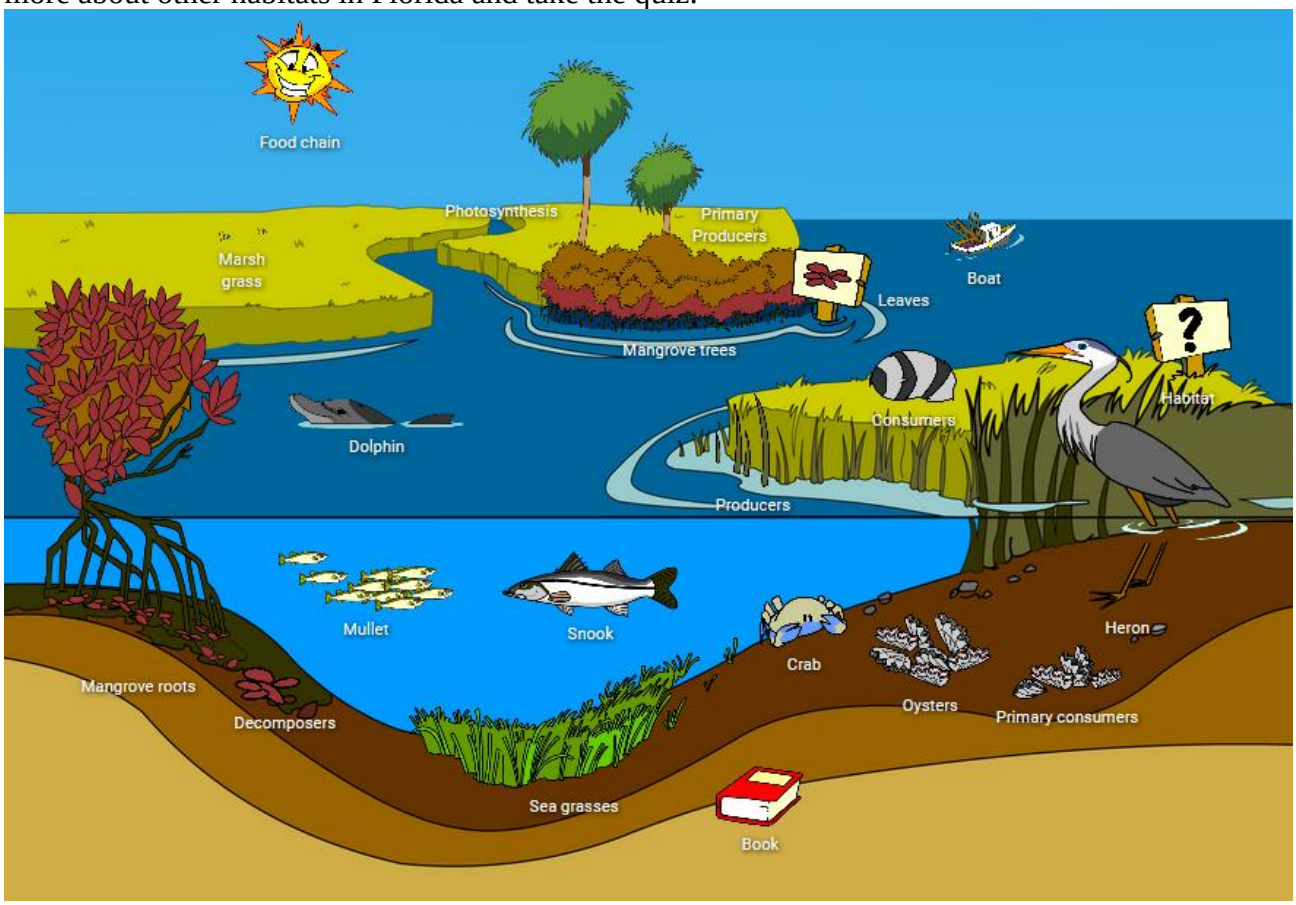
Plants are producers that change energy from the sun into food and provide energy for other living things through the food chains or food webs.

23. Small cloud

Do you use air? Of course you do. When you breathe, you take in oxygen that your body needs and you breathe out carbon dioxide that plants need to make food.

Estuary Exploration Screen

Find out more about what can be found in our estuaries by clicking around the screen. You will find 19 clues to learn more about estuary habitats. When you are finished with this page you can learn more about other habitats in Florida and take the quiz.



Estuaries aquatic habitat exploration screen

The following is the text/audio associated with each clickable.

1. Mangrove roots

Wow! A mangrove tree is a busy place. The roots of the red mangrove provide a nursery area to young fish where they can find food and hide from predators. The roots prop up the red mangrove and provide a place for oysters, barnacles and other animals to attach and grow. Mangrove branches provide a place for birds to rest and nest.

2. **Leaves**

   Mangrove leaves are tough and difficult to eat. Not many animals will eat them on the tree, but when they fall into the water and begin to decay, the leaves become food for small fish and other creatures. The mangroves are primary producers. The decaying plant matter is called detritus.

3. **Crab**

   Blue crabs are scavengers that will eat anything they can find, even decaying leaves called detritus and animal remains.

4. **Seagrasses**

   Seagrasses are submersed aquatic vegetation that live in shallow salty water where there is plenty of light from the sun. These primary producers make food and provide shelter for animals that live in the estuary and for visiting animals that come just for food.

5. **Mullet**

   Mullet are called primary consumers because they eat plants called algae, and detritus. Many living creatures, including people, like to eat mullet.

6. **Sun** — food chain

   There are food chains in every ecosystem. People become part of the aquatic food chain when they eat fish, oysters, clams, and other things from a lake, river or ocean.

7. **Saltmarsh grasses**

   Saltmarsh grasses grow in areas around the estuary that are partly covered with water when the tide comes in and not covered when the tide goes out.

8. **Dolphin**

   Dolphins are top consumers that come into the estuary to catch fish. They like to eat mullet because the mullet live in schools, and that makes them easier to catch.

9. **Snook**

   Snook are called secondary consumers because they eat other animals.

10. **Oysters**

    Small organisms like insects are an important part of the aquatic food chain because larger animals eat them, and then those animals are eaten by even larger animals.

11. **Primary producers**

    Oysters are found stuck to a hard surface in oyster beds. Since they can't move around to get food, they open their shells just a little and filter food out of the water. Can you imagine having to stay in one place your whole life?

12. Consumers

Consumers are living things that get their energy by eating plants or other animals. Examples of consumers in an estuary are oysters, fish, herons, dolphins, and crabs.

13. Producers

Producers are living things that make their own food by changing energy from the sun into food. Plants are producers. Examples of producers in the estuary are sea grasses and mangroves.

14. Decomposers

Decomposers are fungi, bacteria, and insects that get their energy by breaking down wastes and dead organisms. They cause dead things to decay. An example of a decomposer in the estuary is the microorganisms found on detritus.

15. Photosynthesis

All organisms need energy in one form or another, but only plants can use energy from the sun to make food. They use sunlight to combine water and carbon to manufacture food. Mmmm. Oxygen is given off when plants make food. Boy, plants are great.

16. Primary producers

Plants are called primary producers because they provide food for all animals. So many plants live in and around the estuary that there's plenty of food for animals of all sizes.

17. Mangrove trees

Mangrove trees grow along the shores of estuaries and provide valuable habitat for many animals. They can survive in the brackish water of the estuary.

18. Boat

The Indian River Lagoon is a very long, important estuary along the east coast of Florida. It's home to more than 4,300 species of plants and animals, more than any other estuary in the United States.

19. Heron

Blue heron are consumers because they cannot make their own food the way the plants do. Consumers must get their food from either plants or other animals.

20. Habitat

A habitat is the place where plants and animals live and grow. Florida has many different types of habitats that provide the water, shelter, food, and space needed by the living things found there. The amount of water available in a habitat is one thing that determines which plants and animals can live there.

21. Book

Freshwater enters the estuary through rivers, creeks, and canals. Salt water enters from the ocean through narrow openings between barrier islands that parallel the coast. The Indian River Lagoon seems like a river, but it's not. Hundreds of miles of seagrass beds are found along Florida's shores.

Seagrass beds are submersed aquatic vegetation found in salty water. When healthy, these beds of sea grass provide food and habitat for a variety of wildlife, including fish, blue crabs, water birds, and manatees. The seagrass beds also act as nurseries that protect and provide food for young fish and other animals.

These grasses add dissolved oxygen to the water, which aquatic animals need to breathe. The health of seagrass beds can indicate the overall health of the aquatic system. An acre of healthy sea grass provides habitat for 50 million small invertebrates and 40,000 fish.

Wetlands Exploration Screen

Find out more about what can be found in our wetlands by clicking around the screen. You will find 18 clues to learn more about wetland habitats. When you are finished with this page you can learn more about other habitats in Florida and take the quizzes.

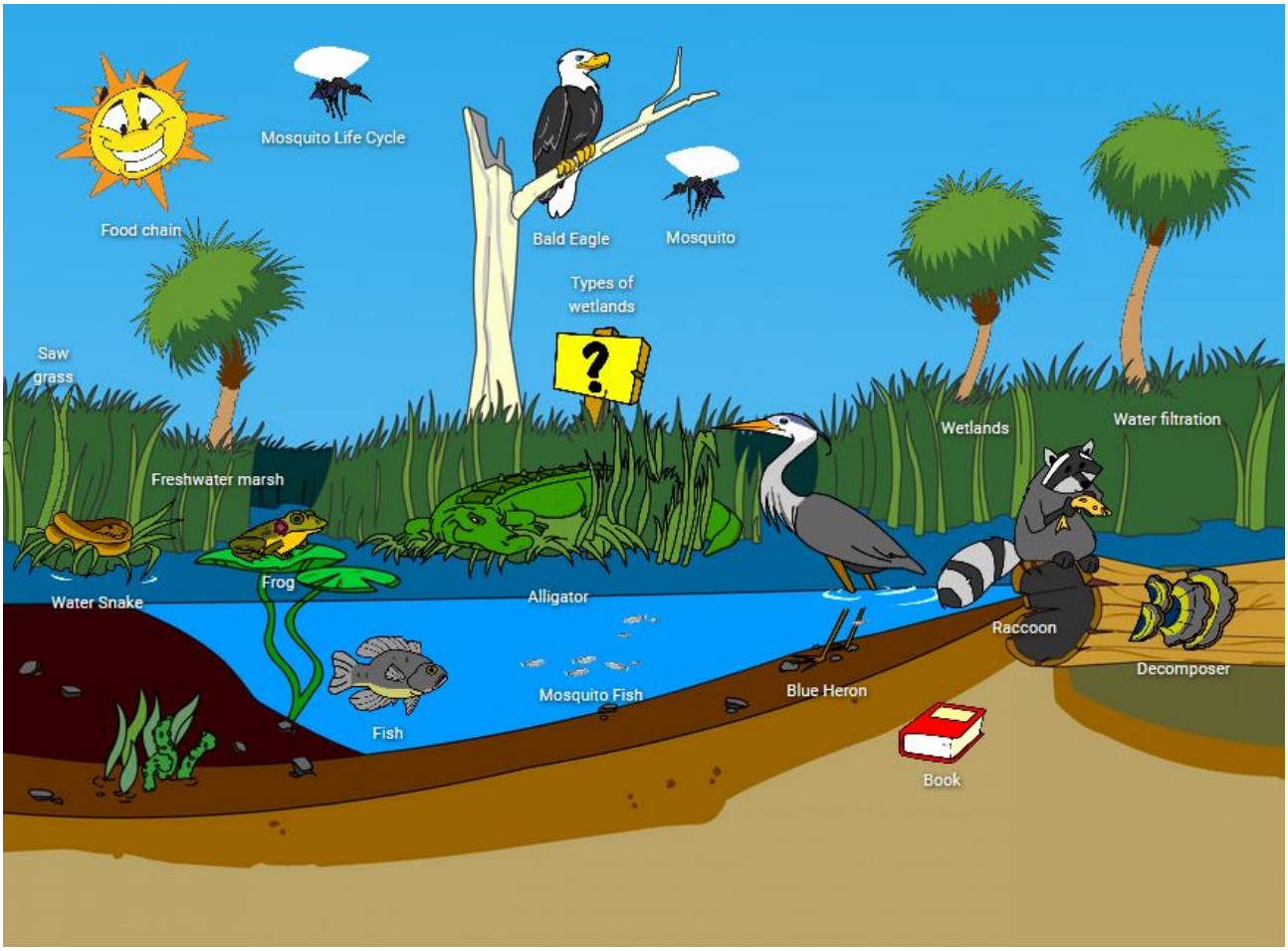
The following is the text/audio associated with each clickable.

1. **Sun** —food chain

Energy that comes from the sun is changed into food by plants and then transferred from one organism to another in the food chain.

2. **Saw grass**

Saw grass is a common vegetation that lives in freshwater marshes in Florida. This sedge grows in places where your feet would get wet if you tried to walk through the area. The name "saw grass" comes from the saw-like edges of the blades of the plant.



Wetlands aquatic habitat exploration screen

3. Water snake

If you look closely in the marsh, you'll see snakes, but don't worry. Most of them are harmless to humans. Be careful, though, some are poisonous.

4. Freshwater marsh

A freshwater marsh is a type of wetland where grasses grow, but trees do not. Florida has many freshwater marsh ecosystems. Wetlands are land areas that are flooded during some part or all of the year.

5. Frog

The frog is an amphibian. It starts out as a tadpole swimming in the water and grows into a frog that can sit beside the water waiting for an insect to eat. Frogs are hard to see because they blend into their surroundings.

6. Fish

There are many freshwater fish in Florida. Some common fish that are eaten by other animals and by people are the bluegill, crappie, and sunfish.

7. Mosquito life cycle

Mosquitoes are insects that have a four-part life cycle. Eggs are laid in or near the water. When the eggs hatch, the larvae and pupae live in water, providing food for other animals. The adult mosquitoes are a favorite food for dragonflies.

8. Alligator

Alligators eat fish and other animals. They're called top predators because no other predator eats the adult alligator except humans.

9. Bald eagle

Eagles and ospreys are large birds that dive from the sky to catch fish from the water to eat.

10. ? Sign – Types of wetlands

Wetlands are lands that are covered by shallow water all or part of the year. There are freshwater wetlands like marshes and swamps. There are also saltwater wetlands, some of which are found along the coast of Florida.

11. Mosquito

Even though humans don't like them, mosquitoes are an important part of nature's food chain. Small fish, frogs, and salamanders feed on mosquitoes, their eggs, and larvae.

12. Mosquito fish

In Florida, there's a small fish called a mosquito fish. You'd probably call it a minnow. What do you think it eats? Hmmm? If you said mosquitoes, you're right. It's a very important part of the food chain.

13. Blue heron

Egrets, herons, and many other birds wade around in the marsh looking for fish and other small animals to eat.

14. Center cabbage palm tree – Wetlands

One hundred years ago, Florida's wetlands covered more than half of the state. For a long time, humans thought that wetlands, like freshwater marshes, were not useful. More than one-third of Florida's wetlands have been drained for agriculture, flood control, and residential development.

15. Right cabbage palm tree – Water filtration

Wetlands are known for the good that they do. Wetland ecosystems in Florida are important because they filter and clean water, control floods, and provide habitat for many animals that live in or near the wetlands.

16. Raccoon

Raccoons don't live in the marsh, but they come to the marsh looking for food. Raccoons go to dry land to hide and sleep.

17. Shelf mushroom — Decomposers

Producers found in this wetland scene are the different trees and plants. Consumers are the alligator, heron, eagle, raccoon, frog, fish, and mosquito. Decomposers are the shelf mushrooms.

18. Book

Wetlands are one of the most productive ecosystems on Earth. Wetland plants provide food and shelter for many living things. Some animals, like raccoons, bears, and birds, feed in the wetlands, even though they don't live there all the time.

Wetlands are important for other reasons too. They clean the water naturally and help protect against floods. As water runs through these lands, nutrients are absorbed by the plants. If there's too much rain, the water can collect in wetlands, reducing flood damage.

Vocabulary

aquatic vegetation: plants that live in water

barrier island: long narrow strips of sand that form islands which protect inland areas from ocean waves, storms, and tidal surges

brackish water: a mixture of freshwater and salt water

consumer: living things that get their energy by eating plants or other animals

decomposer: fungi, bacteria, and insects that get their energy by breaking down wastes and dead organisms

detritus: decaying leaves and plant material

drought: a long period of time with little or no rain that results in a shortage of water

ecosystem: a natural community of living things that interacts with both living and nonliving things in the environment

estuary: a place where freshwater and salt water meet and mix, such as bays, lagoons, or saltwater marshes

food chain (food web): a series of organisms showing the movement of energy through an ecosystem; a community of organisms where each member is eaten in turn by another member, transferring energy through the ecosystem

freshwater marsh: a type of wetland where grasses grow, but trees do not

habitat: Place that provides food, water, and shelter necessary for an organism's survival.

invertebrate: animal without backbones, such as insect and crustaceans

lake: a large body of water completely surrounded by land

macroinvertebrates: animals without backbones that can be seen without a microscope

marsh: an area of shallow water covered with grasses

photosynthesis: the process by which plants use energy from the sun to make food and oxygen

phytoplankton: microscopic plants, such as algae, that thrive in rivers, marshes, and lakes

pollution: contamination of water or air by harmful chemicals or waste materials

primary consumer: the first class of animals in the food chain, such as rabbit, that eats plants or detritus

producer: living things that make their own foods, or that become food for others to eat

river: a large, flowing body of water that empties into an ocean, a sea, a lake, or another body of water

scavenger: living things that will eat refuse, other decaying organic matter, or material left over by other organisms

seagrass: a type of submersed aquatic vegetation found in salty water

secondary consumer: the second class of animals in the food chain; animals that feed on plant eating primary consumers

submerged aquatic vegetation: aquatic plants such as sea grasses that live completely underwater

swamp: flat low-lying freshwater wetland with trees and other vegetation

vertebrate: animal with backbone

watershed: the land and water areas that water moves over, moves through, and drains into

wetlands: land where the soil is very wet or soaked with water during all or certain parts of the year that supports plants adapted to growing in these conditions and contains hydric soils

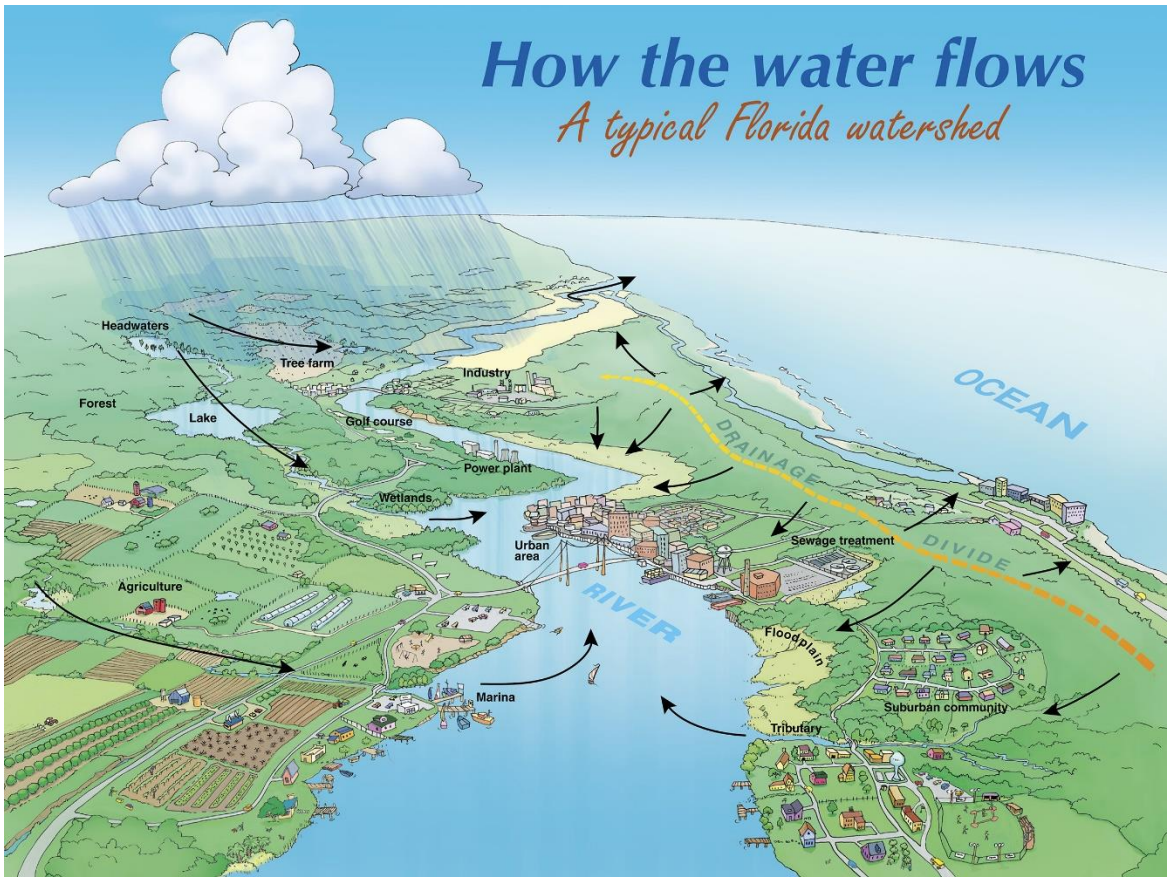
zooplankton: microscopic animals that have no backbone, eat phytoplankton, and float in the water

Trivia

- The St. Johns River is the longest river in Florida (310 miles) and is one of the few rivers in the United States that flows north. (St. Johns River Water Management District)
- Of all the estuarine wetlands located in the lower 48 states, more than 20 percent are located in Florida. (U.S. Geological Survey [USGS])
- The lower 48 states once contained more than 200 million acres of wetlands. (Learning on the Wing, sponsored by the U.S. Fish and Wildlife Service)
- Florida's northwest coast has approximately 120,000 acres of coastal wetlands. (USGS)
- Wetland areas make up only about 5 percent of the total land area in the lower 48 states. (Ranger Rick's NatureScope — Wading Into Wetlands)
- Ocean algae create much of the oxygen in Earth's atmosphere. (Center for Global Environmental Education)
- More than 60 percent of commercially harvested fish rely on wetlands for at least part of their life cycle. (National Wildlife Federation — Facts About Wetlands)
- Washington, D.C., and Boston are two cities that have been built on wetlands. (National Wildlife Federation — Facts About Wetlands)
- Per acre, there is more life in a healthy wetland than there is in almost any other kind of habitat. (Ranger Rick's NatureScope — Wading Into Wetlands)
- About 43 percent of all plants and animals listed as threatened or endangered in the United States either live in wetlands or depend on them in some way. (U.S. Fish and Wildlife Service)
- Water is the most common substance found on Earth. (Give Water a Hand Action Guide)
- Water is the "universal solvent." It dissolves more substances than any other liquid. (USGS)
- When it rains one inch, an acre receives 27,000 gallons of water. (U.S. Environmental Protection Agency Water Trivia Facts)

- Roughly 50 percent of the historic wetland area in the Everglades has been lost to human use and development. (Discover a Watershed: The Everglades, from the South Florida Water Management District)

What's a Watershed?



You are part of a watershed. This means that everything you do can affect nearby surface water and groundwater, for better or worse. Your watershed is a geographical community that includes all the humans, plants, and animals that live in it and all nonliving parts, such as rocks and soil.

As China's Emperor Yu understood long ago, whatever happens upstream in a watershed affects everything downstream. To improve the water quality of a stream, look at the whole area, including where it drains. Anything dumped on the ground in the watershed can end up in any of its bodies of water just like anything released into the air can come down again, nearby or thousands of miles away. We must remember, we all live downstream in our own watershed or downstream from someone else's.

Think about this: Most of us drink water from our local watershed. Although some people get water from elsewhere (Los Angeles gets water from distant mountains, for example), most of us get it from a local well or a nearby lake or river. It may come directly from a private well, but more often it comes through a government water department or utility. Typically, the utility draws water from a nearby source, treats or cleans it, then pipes it to homes, schools, and businesses.

After water is used, it goes down the drain, to a private septic system or through the sewer or a wastewater treatment plant. There it is treated, or cleaned, before it is sent back into local lakes, oceans, or rivers. You can help yourself and the public utilities by using less water and by keeping pollutants out of wastewater. You'll also help reduce the money your family pays for water and sewer service.

Text reprinted by permission from: *Give Water a Hand Action Guide* (1998), American Water Works Association.

Reading Response Questions

What's a Watershed?

Extended response *(4-point rubric)*

We all live downstream in our own watershed or downstream from someone else's. Think about the activities you do every day that could have an effect, for better or worse, on surface water or groundwater. Now, write about three or more of the things you do and tell how it could affect surface water or groundwater. Use information from the text to support your answer.

Short response (2-point rubric)

There are many things that affect the quality and availability of water in a watershed. Think about ways you can help protect our water supply. Use details from the text to explain how you might help your family and the water utilities protect our water supply.

Name _____

Natural Aquatic Systems

Lakes and Rivers Quiz

1. Which is an example of photosynthesis?
a. A fern turning sunlight into food
b. A raccoon eating plants or other animals
c. Worms and other animals that do not have backbones
d. Fungi, bacteria, and insects breaking down wastes and dead organisms

2.Which is an example of a consumer in a lake or river?
a. Zooplankton and phytoplankton
b. Manatees, otters, and fish
c. Mushrooms, bacteria, and insects
d. Trees, aquatic plants, and ferns

3. How do aquatic animals get the oxygen they need to live?
a. From large animals eating smaller animals
b. From decaying waste and dead organisms
c. From photosynthesis
d. All of the above

4. What are phytoplankton?
a. They are vertebrates.
b. They are invertebrates.
c. They are microscopic insects.
d. They are microscopic plants.

5. Why is good water quality important to food chains?
a. It increases the number and kinds of animals.
b. It increases algae.
c. It allows animals to play in the water.
d. It changes the chemicals in the water.

Name _____

Natural Aquatic Systems

Estuaries Quiz

1. Which of the following is part of the food chain?
   a. oysters
   b. mangroves
   c. people
   d. all of the above

2. Which of the following is not a reason sea grasses are important in an estuarine habitat?
   a. They provide habitat for wildlife.
   b. They provide food for consumers.
   c. They provide food for deepwater organisms.
   d. They can indicate the health of an aquatic ecosystem

3. Which aquatic animal is a scavenger?
   a. mullet
   b. blue crab
   c. dolphin
   d. oyster

4. Oysters are filter feeders. What does this mean?
   a. They are carnivores.
   b. They must swim around to find their food.
   c. They are predators.
   d. They get food from the water they draw into their shells.

5. Estuaries are ecosystems found between freshwater and saltwater habitats. What is the main difference between estuarine, freshwater, and saltwater habitats?
   a. animals found in the region
   b. amount of sunlight penetrating the water
   c. amount of salt in the water
   d. how many waves there are

Name _____

Natural Aquatic Systems

Wetlands Quiz

1. What is a wetland?
    a. Land covered with deep water, like a lake
    b. Land that is dry, like a desert
    c. Land covered by shallow water for all or part of the year
    d. Land where no animals can live

2. Which is not a top producer in a wetland?
    a. Saw grass
    b. Seagrass
    c. Mangrove
    d. Alligator

3. Why are alligators called top predators?
    a. Very few things can eat full-grown alligators.
    b. They are at the bottom of the food chain
    c. They eat mosquitoes
    d. They are poisonous

4. What role do mosquitoes play in the food chain?
    a. They are not important in the food chain.
    b. They are food for fish and other insects.
    c. They are producers.
    d. They are filter feeders, and they filter and clean the water.

5. Minnows eat underwater vegetation and are eaten by crappies. What animal eats the crappie?
    a. Shark
    b. Mosquito fish
    c. Heron
    d. Manatees

Answer keys

Lakes and rivers quiz

1. a, a fern turning sunlight into food
2. b, manatees, otters, and fish
3. c, from photosynthesis
4. d, they are microscopic plants
5. a, in increases the number and kinds of animals

Estuary quiz

1. d, all of the above
2. c, they provide food for deepwater organisms
3. b, blue crabs
4. d, they get food from water they draw into their shells
5. c, amount of salt in the water

Wetlands quiz

1. c, Land covered by shallow water for all or part of the year
2. d, Alligator
3. a, Very few things can eat full-grown alligators.
4. b, they are food for fish and other insects.
5. c, Heron

Guide for
Aquifer Travels Module

Overview

Students will learn about Florida's aquifer system and the importance of conserving and protecting this valuable natural resource while Hydro, Agua, and Splat explore the various layers. Students will also learnabout sinkholes and how they are formed.

Students will understand that protecting, conserving, and reducing the use of water, a natural resource,will protect the quality of life. They will also understand the consequences of using limited natural resources. Students will understand the importance of protecting our groundwater and recharge areas.

Florida Standards

2nd grade
Science: SC.2.E.6.1, SC.2.L.17.1, SC.K2.CS-PC.1.1, SC.K2.CS-PC.1.2, SC.K2.CS-PC 2.2, SC.K2.CS-CA.4.2
English Language Arts: LAFS.K12.R.2.4, LAFS.K12.R.3.7, LAFS.2.RI.1.3

3rd grade
Science: SC.3.N.3.1, SC.3.N.3.2, SC.3.L.17.2, SC.3.E.6.1, SC3.P.9.1
English Language Arts: LAFS.K12.R.2.4, LAFS.K12.R.3.7, LAFS.3.RI.2.4, LAFS.3.SL.1.2

4th grade
Science: SC.4.N.3.1, SC.4.E.6.6, SC.4.P.8.2, SC.4.L.17.4
English Language Arts: LAFS.4.RL.2.4, LAFS.K12.R.2.4, LAFS.K12.R.3.7

5th grade
Science: SC.5.E.7.1
English Language Arts: LAFS.5.SL.1.2, LAFS.K12.R.2.4, LAFS.K12.R.3.7

Background Information About Florida's Aquifers

Florida is fortunate to have an abundance of water. However, we are unable to see the majority of ourfreshwater because it lies underground. This is the water we rely on to support life.

What is an aquifer?

In many places, if you looked at a vertical cross section of the earth, you would see that rock is formed or deposited in layers. Some layers have rocks that are more porous (having pores allowing liquid to pass
through) and permeable (pores are interconnected) than others, allowing water to freely move through theearth.

Rock layers made of dense or less permeable materials, such as clay, are known as confining layers. Confining layers substantially slow down or retard any vertical movement of water. Therefore, when waterhits the confining layer, it tends to pool in the porous layers and flow in a more horizontal direction across the aquifer. An aquifer forms when water-bearing permeable rock, sand, or gravel holds water that readilytransmits to wells and springs.

Where do you find aquifers?

Aquifers that provide sustainable fresh groundwater to urban areas and for agricultural irrigation are typically 15 to hundreds of feet below the surface of the ground. The more substantial aquifers are in either carbonate or limestone rock, or sand or shell layers, and they have taken thousands and thousandsof years to form. Florida has three aquifers that are used for water supply — the Floridan aquifer, which iscomposed of limestone; the intermediate aquifer, which is composed of limestone, shell, or a combinationof both; and the surficial aquifer, which is composed of sand and shell.

The Floridan aquifer is referred to as Florida's rain barrel, and it is one of the most productive aquifers inthe world. It covers about 100,000 square miles and is located in southern South Carolina, southeastern Georgia, southern Alabama, and all of Florida. This aquifer is covered by sand, clay, or limestone, and itsthickness ranges from a few feet to hundreds of feet.

The intermediate and surficial aquifers are located throughout much of Florida and are not typically usedas a water supply source. In southeast Florida, the Biscayne aquifer, a surficial aquifer, is used as a source of drinking water for the region. The surficial aquifer in northwest Florida is called the sand and gravel aquifer and is used as a water supply source for the region.

How do we get water from an aquifer?

To tap the groundwater in an aquifer, wells are dug or drilled, and well casing (pipe) is installed to the toplayer of the aquifer that is suitable for the intended use. The water table, which is the area below the land'ssurface that is fully saturated with water, is not as flat as its name implies. It has peaks and valleys that echothe shapes of the land above, called topography.

Within the state, aquifers that are found below the surficial aquifer, such as the Floridan and intermediateaquifers, are usually artesian in nature. That means the water is under pressure. When a lot of water is pumped from an aquifer or when there is a dry spell, the water levels in the aquifers are lowered.

How does water get replaced in an aquifer?

Precipitation eventually adds water into the porous rock of the aquifer through a process known as recharge. The rate of recharge to aquifers is not the same in all locations. Some areas are high recharge areas, but these only occur in about 15 percent of Florida. In other places, water flows out of, rather thaninto, the aquifer. In Florida, this takes place mostly along the coasts and south of Lake Okeechobee.

How do sinkholes form?

Sinkholes are common where rock below the land's surface is either limestone, carbonate rock, salt beds, or rock that can naturally be dissolved by groundwater circulating through it. As the rock dissolves, spacesand caverns develop underground. Lowering of aquifer water levels, such as during a drought or excessive groundwater withdrawals, may cause the overlying rock or earth

to collapse. Another way sinkholes can form is during heavy rainfall when water percolates down, wearing away the limestone, and the weight of the soil and sediments overlying the cavern increases. Sinkholes are dramatic because the land usually
stays intact for a while until the underground spaces get too big. If there is not enough support for the landabove the spaces, then a sudden collapse of the land surface can occur. The sinkhole becomes a primary site of recharge, where surface water can enter the aquifer and replenish the groundwater supply.

How are artesian wells formed?

Some areas have several aquifers, each capped on top by an impervious layer (confined aquifer). If an aquifer is recharged and the recharge area has a higher elevation than the capping layer, the groundwaterin the confined aquifer may be under considerable pressure. As a result, flowing — or artesian wells — arepossible.

Why should we protect our water?

Groundwater can become contaminated by improper use or disposal of harmful chemicals such as lawn care products and household cleaners. These chemicals can percolate down through the soil and rock, intoan aquifer, and eventually into wells. Such contamination can pose a significant threat to human health.
Measures that must be taken by well owners and operators to clean up contaminated aquifers are quite costly.

About 75 percent of the earth's surface is covered with water. Only 1 percent is freshwater, flowing throughrivers, lakes, and underground. Humans have already polluted much of that. That is why aquifers and springs, our natural sources of clean water, are so important.

Aquifer Travels Module

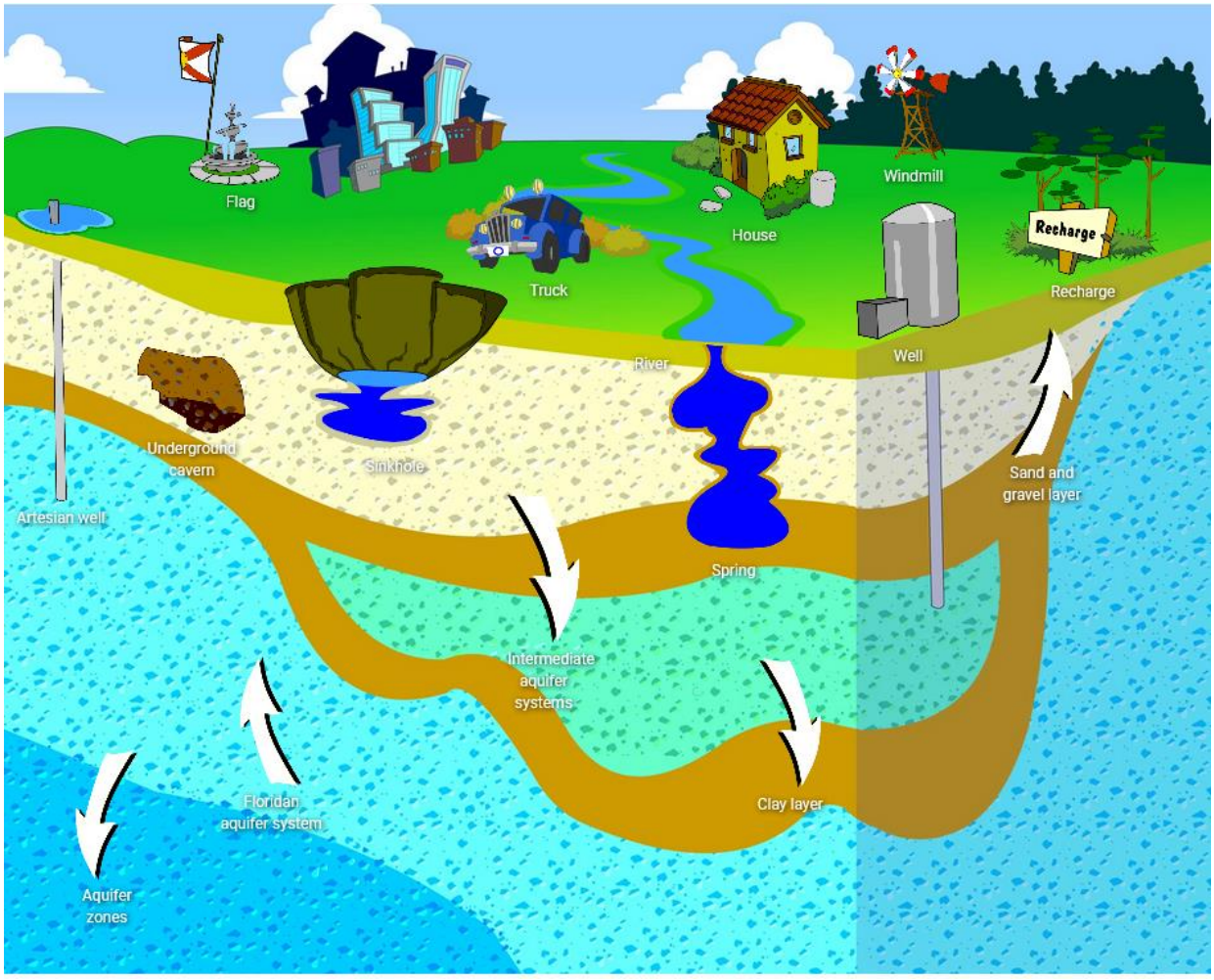
The following is the text/audio associated with clickables.

Aquifer Travels Exploration Screen

Water on Earth is found either above or below the ground. Water above the ground is called surface water. You know, oceans and lakes and rivers. Water below the ground is called groundwater, and that's what we'llbe talking about here. Click around to find out more about aquifers and see if you can find all 16 clues. Once all clickables are found, the students should test their knowledge with the two different quizzes available. Click on the link for a self-evaluated quiz.

1. **Artesian well**

   A free-flowing, or artesian, well is different from a regular well in that it doesn't need a man-made pump to force the groundwater to the surface. Instead, free-flowing wells are drilled directly into the aquifer and the artesian pressure is high enough to make the water rise without using a pump. This artesian pressure is a natural pushing force created when rainwater refills the aquifer, causing the waterlevel to rise on its own.



Aquifer Travels Exploration Screen

2. **Flag** — pop-up shows map of Floridan aquifer

   The Floridan aquifer is one of the largest aquifers in the United States. It extends across Florida andthrough parts of Georgia, Alabama, and South Carolina, but not Kansas.

3. **Underground cavern**

   As rainwater percolates down, or seeps into the aquifer, natural acids in the rainwater wear away the limestone. When this occurs, large cracks and tunnels are formed in the limestone. The very slow moving water in the aquifer has the power to wear away parts of the Earth. This takes place in the limestone of Florida over hundreds of thousands of years. Most of the major caves of the world werecreated by this same kind of erosion.

4. **Floridan aquifer system**

   The Floridan aquifer has many layers of clay above and below it to help keep freshwater in the aquifer.The Floridan aquifer is made mostly of limestone. Limestone is a type of rock that may have many holes, or empty spaces, in it. Water fills these empty spaces and slowly flows through the aquifer.

5. **Sinkhole** —shows formation of sinkholes

   A sinkhole is a hole or depression in the ground caused by the wearing away of underground limestone. Although only a few sinkholes occur in Florida each year, more sinkholes appear here than in any other state. Many natural sinkholes can't be prevented. However, those caused by humanactivity can be avoided.

   During droughts, or times when it's dry, water tables drop in the limestone and cavities. This can helpcause sinkholes to form. Practicing water conservation can help keep water tables high and prevent human-caused sinkholes.

   Sinkholes take a very long time to develop but can appear suddenly with no warning. In March 1998, adrilling company was drilling an irrigation well when a massive sinkhole began to open up. When the sinkhole finished forming, it measured 150 feet wide and 15 feet deep.

   Shortly after this event, more than 700 sinkholes formed in the surrounding area. Each year in Florida,additional sinkholes form; many of Florida's lakes are actually old sinkholes that have filled in with soiland water.

6. **Aquifer zones**

   Above and below the Floridan aquifer are also various layers of water. Some layers contain freshwater,others contain salt water. These layers are called zones.

7. **Intermediate aquifer systems**

   Above and below the Floridan aquifer are layers of sand, clay or gravel, which also hold water. These layers are known as surficial and intermediate aquifers.

8. **Truck**

   Scientists collect information to determine which regions of Florida are high- and low recharge areas, the direction of groundwater flows, and how the aquifer is affected or changing. They do thisby drilling wells deep into the ground and into the aquifer. The well levels are measured to tell about changes in the aquifer.

9. **House** — pop-up shows different types of wells

   Wells come in all sizes. Large ones provide enough water for cities and towns. Smaller wells provideonly enough water for individual families.

10. **River** — pop-up shows aquifer recharge

    Floridians use billions of gallons of water from our aquifers each day. That's a lot of water! So why doesn't an aquifer become empty? Remember, water is a cycle. Water is replaced in the aquifer whenrainwater falls, soaks into the ground, and refills the aquifer.

    This process is called recharge. As water is used and not replaced through rainfall, water is pulled down from the earth's surface. This can cause wetlands, rivers, and lakes to become drier, and in somecases, to even dry up. Our many springs are also affected.

    The amount of water flowing out of springs becomes less, and some springs in Florida have evenstopped flowing.

11. **Spring**

    The large amount of water in the Floridan aquifer is under a great deal of pressure. This pressure can force water out of the aquifer and into new cracks and tunnels. Sometimes this water flows outnaturally at the surface. These places are called springs.

12. **Windmill** — pop-up shows different types of methods for getting water

    How does groundwater get to the surface of a well? Nowadays, an electric pump moves groundwater up from a well. With some wells, windmills provide the energy to pump groundwater. In older times,a hand pump might have been used to get water from the well, or even a crank and a bucket. Methodsfor getting water from a well vary around the world.

13. **Clay layer** — clay

    Clay layers act as shields to help keep water from escaping the aquifer. The layers of clay that are aboveand below the aquifer are called confining layers or confining zones because they confine, or hold, the water in the aquifer.

14. **Well**

    Wells are used to collect water from below the ground.

15. **Light yellow layer** — sand and gravel — pop-up shows sand and gravel layers

    Sand and gravel act to filter or clean water of pollutants because of their ability to trap small particles and bacteria as the water passes through them.

16. **Recharge sign**

    Not all soil absorbs water in the same way. Places where water seeps into the ground and flows back into the aquifer are called recharge areas. A high recharge area is where a lot of water seeps into the aquifer. However, low recharge areas allow less water into the aquifer. There are also discharge areaswhere water flows back to the earth's surface. These could be through seeps, artesian wells, or springs.

Sequence of Aquifers button

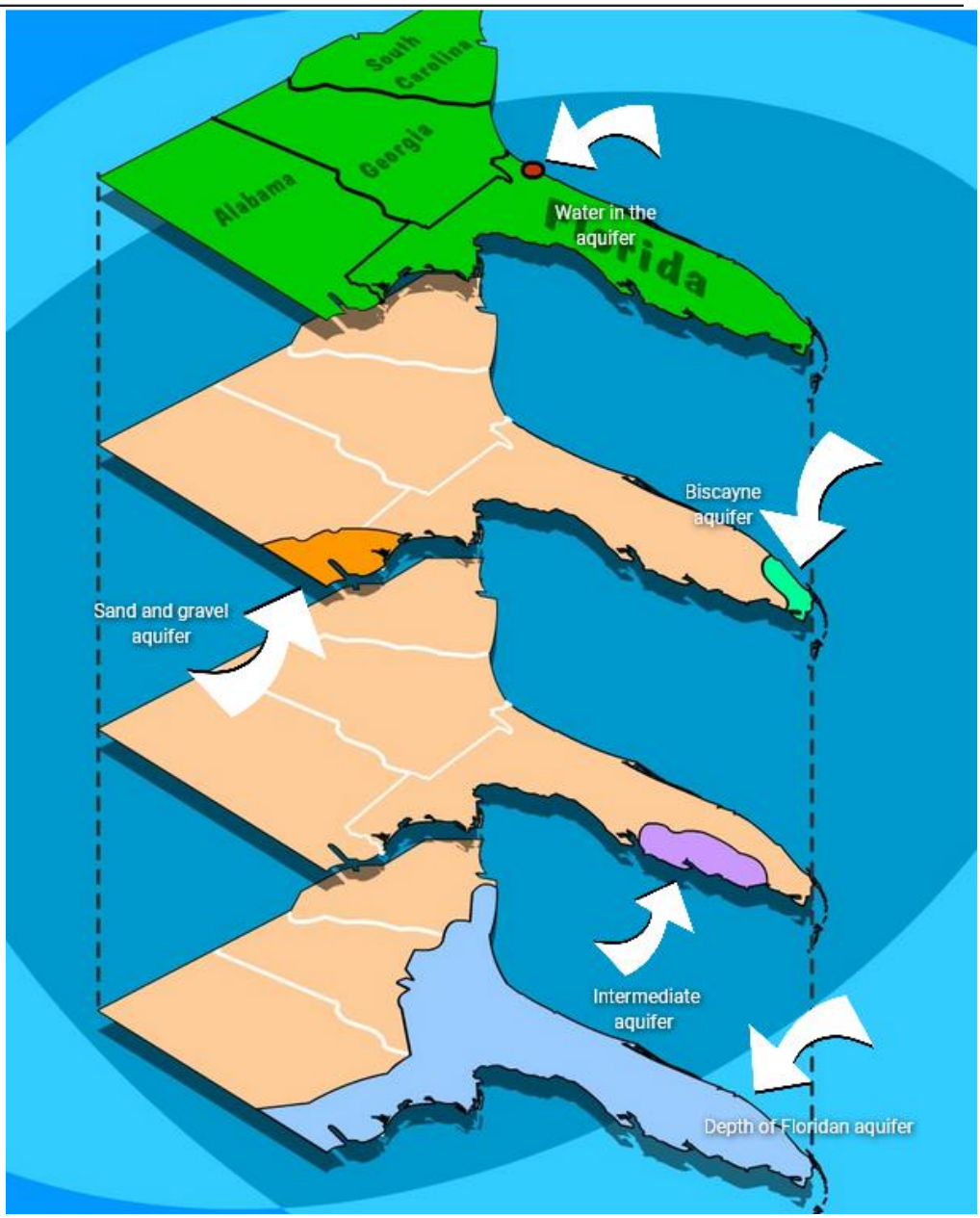
An aquifer is an underground layer of rock or sand that holds water. When it rains, water may soakthrough the ground by a process called percolation. Rainwater percolates down through the surfacesoil, into the aquifer below. Click around to find out more about aquifers.

Florida Aquifers subexploration screen

The following is the subexploration screen text/audio for the Florida Aquifers subexploration screen.

1. **Red dot** — pop-up shows groundwater path to Jacksonville

   Many scientists believe the rock layers in the Floridan aquifer were deposited about 25 to 60 million years ago. It can take water as long as 20 years to 50,000 years to travel north through the aquifer from Keystone Heights to Jacksonville, Fla. People in Jacksonville are drinking water today that may havefallen as rain in the Clay County recharge area a long time ago.



Florida Aquifers Sub exploration Screen

2. **Sand and gravel aquifer**

   The sand and gravel aquifer is composed of mostly sand and gravel, which is how it got its name. It isthe major source of freshwater in Escambia and Okaloosa counties in northwest Florida.

3. **Biscayne aquifer**

   Some cities in southeast Florida get their water from the Biscayne aquifer. This is a shallow, or surficialaquifer that lies on top of the Floridan aquifer and near the earth's surface. The Biscayne aquifer supplies water for almost 4 million Floridians daily.

4. Intermediate aquifer

Besides the Biscayne, the sand and gravel, and the Floridan aquifers, there is another water supply aquifer for the state of Florida, the intermediate aquifer. This aquifer is an important source of freshwater in Sarasota, Charlotte, and Glades counties.

5. Depth of Floridan aquifer

To reach the Floridan aquifer, you would have to dig very deep in some places. The aquifer can be found anywhere from a few feet to 700 feet below the ground. Most of the aquifer is several hundred feet below the earth's surface.

Vocabulary

Aquifer — An underground layer of sand, gravel, or rock that stores or carries water

Confining layer — (confining zone) layers of clay or rock, found above and/or below the aquifer, that confine or hold water in the aquifer

Conservation — the process of using or managing a natural resource to prevent its waste, harm, or destruction

Contaminant — any outside material that makes air, soil or water harmful to humans or the environment

Erosion — the wearing away of the top layer of the earth (such as soil, sand, or rock) by wind, water or glacier

Floridan aquifer — a source of drinking water in most of Florida; one of the largest aquifers in the United States occurring under the state of Florida and portions of South Carolina, Georgia, Alabama and Mississippi

Free-flowing well — a well drilled directly into the aquifer, having natural pressure to push the water to the surface on its own

Groundwater — water below the ground, usually found in aquifers

Intermediate aquifer — layers of sand, clay, or gravel that hold water above the Floridan aquifer

Limestone — highly porous rock formed millions of years ago from shells and bones of sea animals

Recharge — the process of water seeping or soaking in to the ground and refilling the aquifer

Recharge area or zone —the place where water is able to seep into the ground and refill the aquifer because no confining layer is present

Sinkhole — a hole or depression in the ground caused by erosion of underground limestone

Spring — a natural flow of water at the earth's surface, caused by pressures on groundwater or the aquifer

Surface water — water that is found on the surface of the earth, such as oceans, river, lakes, ponds, wetlands, streams, or seas

Surficial aquifer — layers of sand, clay, or gravel that hold water above the Floridan aquifer and close to the surface

Water table —the highest level where underground water is found

Well — a hole or shaft drilled into the earth where water, other liquids, and gasses are pumped to the surface

Trivia

- Most of the water we use comes from aquifers deep underground, with about 90 percent of all households depending on this supply, called groundwater, for drinking, bathing, and everyday use.(The Young Naturalist's Guide to Florida)
- In towns and cities, the major cause of pollution of drinking water sources is stormwater runoff.(Plain Talk About Drinking Water)
- Four quarts of oil can cause an eight-acre oil slick if dumped down a storm drain.
- Scientists estimate North America has enough groundwater to cover the continent with a sheet of water almost 100 feet thick.
- If all the world's water were fit into a gallon jug, the freshwater available for us to use would equal only about one tablespoon. (National Wild and Scenic Rivers Systems)
- Sinkholes vary in size from 1 meter (3 feet) to 18 meters (50 feet) or more in diameter, and 1 meter to18 meters or more deep. (The Young Naturalist's Guide to Florida)
- The amount of water on Earth hasn't changed since the earth was first formed. We've been using thesame water over and over again. (Give Water a Hand Action Guide)
- Americans drink more than one billion glasses of water a day. (Give Water a Hand Action Guide)!
- Florida has more springs than any other state. (The Young Naturalist's Guide to Florida).
- Florida has more than 750 springs. (Florida Geological Survey Bulletin 66)
- In Florida, spring water temperature can range from 68–75 degrees Fahrenheit (20–24 degrees Celsius), plus or minus several tenths of a degree. The temperature tends to reflect the average annual air temperature in the vicinity of the spring. (Florida Geological Survey Bulletin 66)
- Warm Mineral Springs is found in North Port, which is located in southwest Florida. This spring has an average temperature of 87 degrees.
- Floridians use twice the amount of water that is in Lake Okeechobee each year. (Florida Departmentof Environmental Protection)
- A sinkhole known as Squirrel Chimney Cave, located on private land, is the only place in the world that the Squirrel Chimney Cave shrimp is known to live. It is a one-inch-long transparent shrimp that lives in the water at the bottom of the sinkhole. (The Young Naturalist's Guide to Florida)

Springs

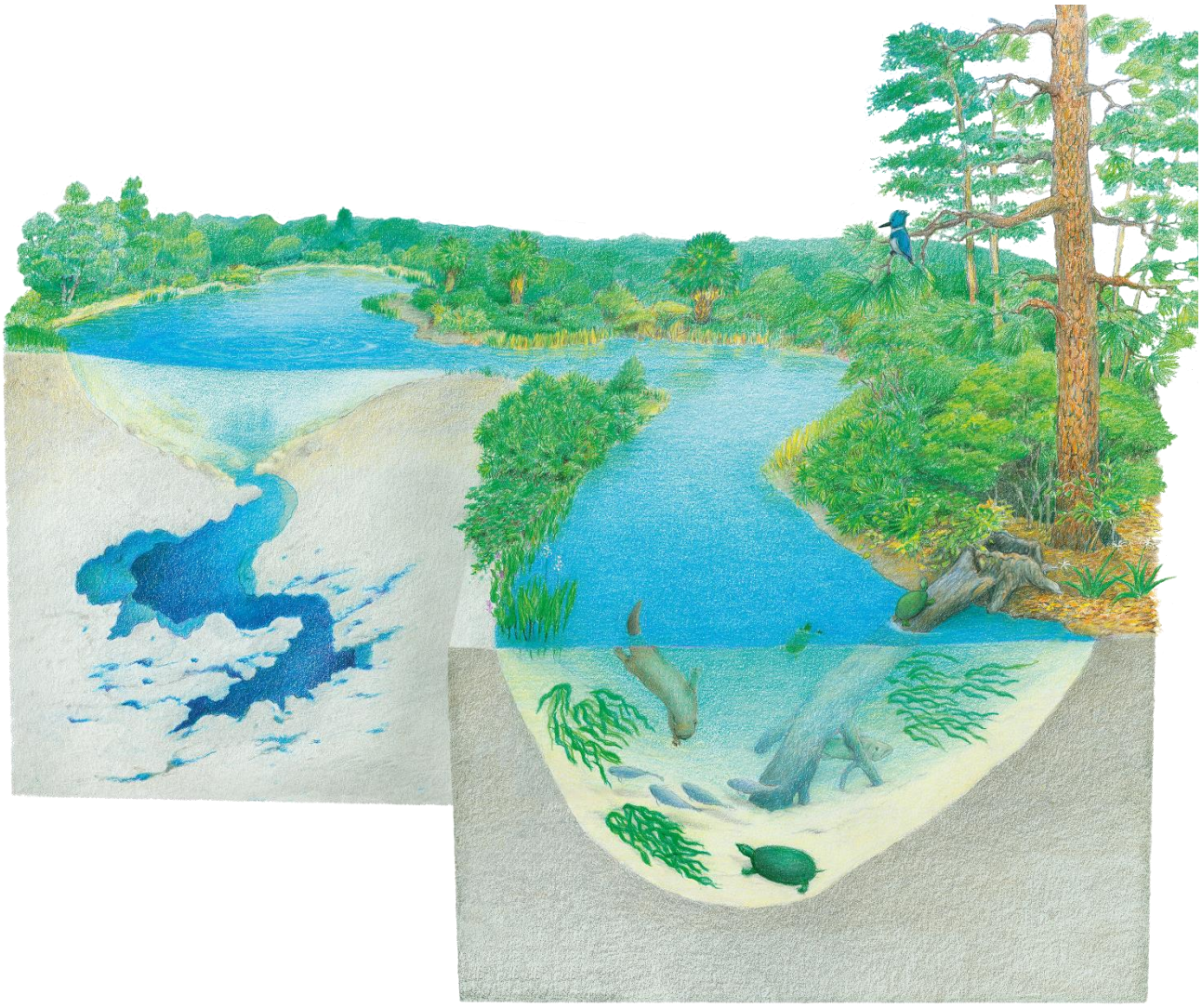
Springs have been important to people for thousands of years. For example, Indians often located villages near freshwater springs for food, water, and transportation. The Spanish located at least two 17th century missions near North Florida springs. Explorer Ponce de Leon searched for a spring believed to be the Fountain of Youth. Health resorts have been built around mineral springs.

The land we live on is much like a sponge. A sponge will absorb water when it rains, as does the earth. When full or squeezed, a sponge releases the water and so does the ground. Springs are the result of water returning to the surface because of pressure.

Under Florida lie massive layers of permeable carbonate rocks such as limestone and dolomite. They can vary in thickness from a few feet to 30,000 feet. These porous layers contain water that once fell as rain. These geological formations form the Floridan aquifer, which is the primary source of our drinking water. As rainwater migrates down to the aquifer, it becomes slightly acidic from dissolved compounds in the soil, and it dissolves the carbonate rock. Water may be confined within an aquifer by overlying layers of clay or rock. Water is held in by pressure from the weightof water entering the aquifer and because the Floridan aquifer is confined. Over time, movement of the earth's crust formed cracks in the aquifer limestone. Acidic groundwater has enlarged the cracks as it dissolved the rock. If the resulting tunnels and caves connect with the land surface, pressure can force water up and form a spring.

In north-central Florida, most springs are found close to rivers. Springs supply 25 percent of the Suwannee River's flow. That percentage increases when river levels are low. While the volume of water emerging from Floridan aquifer springs has generally remained the same over the years because of the large volume of water the aquifer contains, discharge rates of some springs can vary widely.

Spring water is usually clear, sometimes having a blue tint. However, when river levels rise above a spring mouth, the weight of the river water is greater than the springpressure and causes the river water to flow downward into the spring. When river levels drop below the level of the springhead, the dark river water flows back out.



To keep river and spring waters separate, several springs were enclosed within walls by resort developers in the early 1900s.

Most North Florida springs have steep-sided depressions with limestone or sand bottoms. They are often home to a variety of fish and crustaceans. Some rare and endangered species live and breed in spring-run systems. Birds hunt fish, amphibians, and snails in the shallow spring runs. Sunlight reaches through the clear water and allows native underwater grasses to grow. However, these same growing conditions encourage the spread of troublesome exotic plants such as hydrilla. Though some springs have been developed, been enclosed, or had the natural vegetation cleared away, a few are still in a natural state. Overuse and carelessness have had an effect on many spring areas. State agencies, conservation groups, and private landowners are working to preserve many spring systems.

Text adapted from *Springs* (Suwannee River Water Management District)

Name _____

Springs Anticipation/Reaction Guide

Before you read the "Springs" text, read each statement below, and then place a check mark in theagree or disagree column.

After you read the "Springs" text, reread each statement below, and then place a check mark inthe agree or disagree column.

You may discover some changes in your responses from before reading to after reading, based on what you have learned.

Before reading			After reading	
Agree	**Disagree**		**Agree**	**Disagree**
_____	_____	Springs are found only in areas with much rainfall.	_____	_____
_____	_____	Earth absorbs water like a sponge.	_____	_____
_____	_____	Florida has rock layers from just feet thick to 30,000 feet thick.	_____	_____
_____	_____	Groundwater can enlarge cracks in the earth's crust.	_____	_____
_____	_____	Most springs are found along the coastline in north-central Florida.	_____	_____
_____	_____	Water at the surface can flow back down into the spring.	_____	_____
_____	_____	Mineral springs should be avoided.	_____	_____
_____	_____	No animal or plant life can survive in a spring.	_____	_____

Name _____

Fill-in-the-Blanks Quiz

1. The_____is the main source of drinking water in Florida.
   a. aquifer
   b. aquius
   c. waterfield
   d. surface water

2. Water on Earth is found either above or below the ground. Water above the ground is called _____.
   a. groundwater
   b. surface water
   c. the water table
   d. well water

3. When it rains, water may soak or percolate down through the ground and into the aquifer below. This will_____the aquifer.
   a. fill
   b. upcharge
   c. recharge
   d. tank up

4. If groundwater is used and not recharged, wetlands, river, and lakes could become_____.
   a. swampier
   b. drier
   c. wetter
   d. larger

5. The_____layer acts as a shield to help keep water from escaping the aquifer or to protect it from pollutants.
   a. clay
   b. gravel
   c. sand
   d. intermediate

6. The layers of clay that are above and below the aquifer are called_____layers or zones because they hold the water in the aquifer.
   a. holding
   b. restriction
   c. confining
   d. defining

7. A sinkhole is a hole or depression in the ground caused by_____of underground limestone.
   a. the corrosion
   b. the explosion
   c. the implosion
   d. the wearing away

8. Seeps, artesian wells, or springs are examples of_____areas.
   a. recharge
   b. discharge
   c. flow-way
   d. wellfield

9. The Biscayne aquifer is a shallow or surficial aquifer that lies on top of the Floridan aquifer insouthern Florida. This means the Biscayne aquifer is located_____the earth's surface.
   a. far from
   b. above
   c. near
   d. deep under

10. Besides the Biscayne, the sand and gravel and the Floridan aquifers, there is another watersupply aquifer in Florida, it is called the____aquifer.
   a. southern
   b. advanced
   c. panhandle
   d. intermediate

Name _____

Pop Quiz

1. What could help prevent sinkholes caused by human activities?
   a. Practicing water conservation
   b. Planting more trees
   c. Driving smaller cars
   d. Picking up litter

2. It can take 20 to 50,000 years for water to flow from the recharge area to your faucet. What is arecharge area?
   a. The place where your water tank is filled.
   b. The place where water seeps into the ground and flows back into the aquifer.
   c. The place where water is stored.
   d. The place where water flows back to the earth's surface.

3. What is water below the earth's surface called?
   a. Distilled water
   b. Surface water
   c. Groundwater
   d. Lake water

4. The following are important facts about aquifers. Which is not a fact about aquifers?
   a. They are sand, clay, and gravel layers that hold water.
   b. Water in an aquifer can travel quickly or very slowly, depending on the soils or rocks it ispassing through.
   c. Some scientists collect information about water.
   d. Aquifers are the main source of drinking water in Florida.

5. What is percolation?
   a. It is the slow, downward movement of water in the ground.
   b. It is the bubbling up of water into a spring.
   c. It is the term used for the rate at which water flows from one place to another in the aquifer.
   d. It is the process of water raining or falling to the ground.

6. It is important to protect our groundwater from pollution. Which area is least likely to be polluted by human activities?
   a. Surficial aquifer
   b. A deep area of the Floridan aquifer
   c. A recharge area
   d. Biscayne aquifer

7. Above and below the Floridan aquifer are various layers of water called zones. What kind ofwater is found in these layers?
   a. Muddy and clean water
   b. Hot and cold water
   c. Fresh and salt water
   d. Clear and brown water

8. Sand and gravel can trap small particles and bacteria as water passes through them. What does this do to the water?
   a. Stores more water
   b. Lets water move through these layers rapidly
   c. Holds back floods
   d. It helps to filter or clean the water.

9. What are springs?
   a. Places where the earth is cracked and crumbling.
   b. Places where groundwater flows to the surface naturally.
   c. Places where pumps are needed to get the water to the surface.
   d. Places where water is pressurized.

10. Wells are used to get groundwater to the earth's surface, and methods vary around the world. Which of the following is a method used?
   a. Electric pump
   b. Hand pump
   c. Crank and bucket
   d. All of the above

Answer keys

Fill-in-the-Blanks Quiz

1. a. aquifer
2. b. surface water
3. c. recharge
4. b. drier
5. a. clay
6. c. confining
7. d. the wearing away
8. b. discharge
9. c. near
10. d. intermediate

Pop Quiz

1. a. Practicing water conservation
2. b. The place where water seeps into the ground and flows back into the aquifer.
3. c. Groundwater
4. c. Some scientists collect information about water.
5. a. It is the slow, downward movement of water in the ground.
6. b. A deep area of the Floridan aquifer
7. c. Fresh and salt water
8. d. It helps to filter or clean the water.
9. b. Places where groundwater flows to the surface naturally.
10. d. All of the above