The following is an excerpt from the Aquatic & Marine Ecosystems Leaders Guide, Introduction of Lesson 3: Aquatic Ecosystems Lakes, Springs, & Rivers (2013). The activity lesson plans associated with this section are not currently available (i.e., the "DO" section below). The following is intended to guide 4-H leaders and youth in specific areas to gain knowledge in leading up to the 4-H State Aquatic & Marine Ecosystems Contest.

"OBJECTIVES

For youth to:

- Define the terms; lake, spring, and river.
- Locate the major lakes, springs, and rivers in your county and around the state.
- Identify ways in which aquatic ecosystems are connected.
- Discover how aquatic ecosystems function.
- Describe the effects of vegetation on water quality and soil erosion in aquatic ecosystems.
- Identify common and endangered plant and animal species found in aquatic ecosystems.
- Describe examples of food webs and energy flow in aquatic ecosystems.
- Explain the ways in which humans value and utilize aquatic ecosystems.
- Explain how human activity can enhance or damage aquatic ecosystems.
- Describe ways in which people can protect aquatic ecosystems.

PURPOSE:

To become familiar with aquatic ecosystems such as lakes, springs and streams.

DO

Here are some learning activities and suggested ways to implement the activities in Lesson 3.

3.1 Use WHAT'S A WETLAND to locate the major bodies of freshwater in each youth's county.

3.2 Learn to measure velocity and volume related to stream flow in RUNNING RIVERS.

3.3 Understand why stream banks, and pond edges are an important part of an aquatic ecosystem with STREAM BANK BOXES.

3.4 Use HEALTHY WATER = HEALTHY ECOSYSTEMS to learn how to perform water quality tests for a pond, lake, or river.

3.5 Analyze the kinds and numbers of species present in an aquatic ecosystem to evaluate water quality with HOW MANY BUGS DO YOU HAVE?

3.6 Discover many common and endangered plant and animal species found in local ecosystems with AQUATIC FLORA AND FAUNA.

Reflect

After completing the activities in this lesson, help youth reflect on what they learned with these questions:

- What is the main difference between aquatic and marine ecosystems?

  Aquatic ecosystems are comprised of all water ecosystems (including fresh and salt water) and marine ecosystems refer to saltwater ecosystems only.

- Consider the watershed of the stream you measured. What types of human activities in the watershed might be affecting stream volume?

  Every change in the surface flow of water in a watershed can affect stream volume. Examples may include impoundments or diversions which reduce the volume, or many different activities that prevent rainwater absorption and increase stream volume.

- What happens when heavy rain falls on an undisturbed watershed?

  The water is slowly filtered through the system. The roots of the grasses, shrubs, and trees help hold the soil in place (less erosion occurs) resulting in better water quality for lakes, ponds, rivers and streams.

- Name an animal that was threatened with extinction, but with protection is now doing better.

  The American alligator and the bald eagle were both close to extinction, but with protection are recovering. In fact, the alligator has recovered so well it is now harvested for hide and meat in some areas of Florida.

Apply

Help youth apply what they have learned to their daily lives.

- Select another river to trace on the map. Identify its source (where it begins) and where it discharges, and any streams or springs that feed the river you have selected. If you or someone else pollutes the source of the river, could it affect other places along the river?
- How would changes in stream volume affect plant and animals in this aquatic ecosystem?
- Visit a construction site or a newly plowed farm field after a rainstorm. Can you identify the soil erosion caused by the lack of trees and plants? Write a description or draw a picture of what this erosion looks like. How might erosion effect aquatic ecosystems?
- If the temperature, dissolved oxygen, pH, alkalinity or nitrate level is not adequate for a healthy aquatic ecosystem, what could be the cause of the problem? Are the parameters interrelated?

- Plan a field trip to a nearby pond, river, or stream and make a list of common and endangered plant and animal species seen there.

BACKGROUND BASICS...

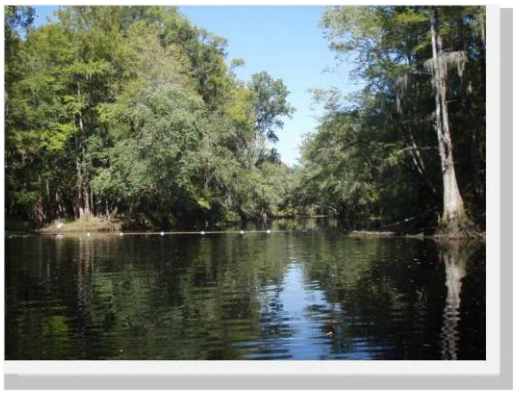
Aquatic Ecosystems: Lakes, Springs, Rivers and Streams

Florida has an abundance of fresh water with more than 7,500 **lakes** (inland bodies of standing water over one half acre in size), 1700 **rivers** and **streams** (flowing bodies of water of all sizes). Florida also has numerous **springs** (water that freely flows from an aquifer into another body of freshwater) of which 27 are of the first magnitude in volume (Meyers and Ewel, 1990). These numbers translate into a tremendous area of aquatic ecosystems that millions of Floridians and visitors enjoy and depend upon. These water resources have developed over long geologic periods. During that time many lakes and rivers have come and gone from the Florida peninsula. The aquatic ecosystems we utilize are the result of interactions between climate, past geological events, and some human intervention.

The current climatic conditions produce 50-60 inches of rain on most parts of the state during most years. The excess rainfall not used in the **evapotranspiration** process nourishes Florida's lakes, rivers and springs by surface runoff and percolation into layers of rock beneath the soil surface. This rainfall is sufficient to maintain a lush vegetative cover with many subtropical plant species present, particularly in southern Florida. Extensive pine and hardwood forests occupy much of the upland areas; cypress swamps, bayheads and wet prairies occur in the lowland areas.

Past geological events have played an important role in the formation and continuation of aquatic ecosystems. During the past several million years the Florida peninsula has been inundated by rising sea levels several times. These marine conditions allowed the formation of limestone layers that are hundreds of feet thick and underlie most of the state. These limestone layers or formations contain water that are collectively known as the **Floridan Aquifer.**

Aquifer formation occurs as water moves downward through the cracks and crevasses in the rock mantle slowly dissolving the limestone. This dissolution (by acids that naturally occur in the environment) has created an immense system of underground caverns, a natural system of "water pipes." The Floridian Aquifer not only supplies the artesian springs we see bubbling forth, but is connected to many of Florida's lakes and rivers by seepage through layers of sand and rock.



Much of Florida's lake formation occurred as recently as 3,000 to 6,000 years ago when the sea began to approach its present level. However, some lakes such as

Lake Annie and Lake Tulane in Highlands County are thought to be over 30,000 years old. Lakes formed under various environmental conditions; some were simply shallow depressions that filled with the rising water table, while others were blowouts in large sand dunes left behind when sea levels fell. Lake Okeechobee, the second largest lake entirely in the United States, is believed to be an uplifted sea-floor depression (Meyers and Ewel, 1990).

Another lake formation process occurs when an immense cavern of the Floridian aquifer collapses to create a depression or **"sinkhole."** These sinkholes, may become clogged with debris, fill with water and in some instances form a circular lake. Notable examples of these types of formations are Kingsley Lake in Clay County and Deep Lake in Collier County (Meyers and Ewel, 1990).

The formation of lakes is an ongoing process: new sinkholes are formed when groundwater levels fall; and humans create reservoirs, abandon phosphate mines, or create borrow pits. Whatever the process, lake ecosystems in Florida continue to undergo change caused by a variety of factors. These factors include the gradual filling of shallow lakes by sediments and decaying plant matter, as well as by human causes such as the rapid eutrophication of systems like Lake Apopka.

Florida has over 300 springs, with many of the larger springs set aside as recreational areas (Meyers and Ewel, 1990). These boils of crystal clear water attract thousands of visitors each year who come to enjoy the year round 70-74 degree water temperatures found in the springs. The spring ecosystems of Florida are far fewer in number than the lake ecosystems, but function as critical habitats for a number of plants and animals.

Some species, such as the manatee, depend on the constant temperatures of the spring water as winter havens from the cold. A number of **endemic** (organisms found only in a particular location) species are also present in the subterranean caverns associated with the larger springs.

Springs, like many of the lakes in Florida, are directly connected to the aquifers below. Therefore water quantity and **water quality** (physical, chemical, and biological attributes) are determined by the **watershed** and variations in sediments and rock strata through which the water travels. Some springs have very **soft water** (small amounts of dissolved minerals), while others including Silver Springs and Weeki Wachee have very **hard water** (large amounts of dissolved minerals). Some springs like Salt Springs and Silver Glenn Springs even have salty water that can support certain forms of marine life far from the ocean (Meyers and Ewel, 1990).

Florida's rivers and streams are also unique and varied in both water quality and the physical features within the watersheds. Water quality is directly influenced by the watershed in which the river originates and travels through; from the muddy Choctawhatchee, with the load of silt and clays it carries through the panhandle, to the St. Johns River that flows north and forms an extensive estuary at its discharge point into the Atlantic Ocean at Jacksonville.

River and stream ecosystems include habitats that are critical for the survival of endemic and endangered species such as the Okaloosa darter found in only a few sand bottomed streams of the western panhandle, and the Gulf sturgeon found in the Suwannee and other panhandle rivers. The state's rivers and streams form a web of life that directly connects the lakes and springs discussed earlier. The many dark tea colored rivers and streams are also linked to the wetland areas discussed in Lesson 2. The flow of water from these wetland areas leaches natural acids, particularly tannic acid, that are present in the decomposing vegetation and "stain" the water.

Our aquatic resources have become workhorses in many ways. Rivers are used to transport goods by barge or ship and are used to the discharge unwanted effluents from our cities and towns. Lakes, springs and aquifers provide water for residential, agricultural, and industrial consumption. Floridians have one of the highest per capita water consumption rates in the nation. Demands for domestic water use run almost twice the national average, and when coupled with agricultural uses, demand for water is exceeding available supplies in some areas of the state.

The demand for water has caused Florida to become a leader in the management of water quantity and quality. The state is divided into five water management districts, each with a respective governmental agency (e.g., the South Florida Water Management District), that are responsible for the basic protection of water within their boundaries. These agencies do not control the distribution of water to municipalities, but rather function as protectors of the watershed. Their functions include: water use permitting, wetlands protection, land acquisition, flood control and water conservation education."