Lesson 2

Fire Adaptations!



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**Key Questions**

How is fire beneficial to the habitats of South Florida? In what ways have the plants found within the habitats of Big Cypress evolved with fire? Using plants, what are ways in which fire ecologists can better understand the role of fire in Big Cypress National Preserve?

**Subjects**

**Science, Language Arts**

**Time Estimate**

One 40 minute class period

**Key Vocabulary**

Succession; adaptation; habitat; fire history; fire ecologist; rhizome

**Sunshine State Standards**

**Science**

**SC.4.L.16.2** Explain that although characteristics of plants and animals are inherited, some characteristics can be affected by the environment.

**SC.4.L.16.4** Compare and contrast the major stages in the life cycles of Florida plants and animals…

**SC.4.L.17.4** Recognize ways plants and animals, including humans, can impact the environment.

**Language Arts**

**LAFS.4.RF.4.4** Read with sufficient accuracy and fluency to support comprehension.

**Objectives**

Students will:

1. Understand and define adaptation.
2. List at least three benefits to fire in fire adapted ecosystems.
3. Identify three native plants to Big Cypress National Preserve.
4. List three adaptations that plants have to survive and thrive with fire.
5. See fire as a natural and healthy part of South Florida ecology.

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**Materials**

* Student copies of “Plant Research Notes” and “Adaptation Creation” Worksheets
* Copies of provided resource cards
* Plants of Big Cypress Handout
* Colored pencils

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**Background**

The habitats and ecosystems of South Florida are shaped by unique interactions between seemingly opposing forces: fire and water. The Big Cypress Basin receives approximately 55 inches of rain between May and October in a typical year. This rain drains slowly moving as a sheet towards the Gulf of Mexico. As the topography is virtually flat in South Florida, the difference in a few inches of elevation marks a sharp difference in an area being flooded for a portion of the year or the entire year. These hydroperiods affect the soil and plant communities found in a given area. While plant communities are shaped by the elevation of the landscape, fire also plays a major role in shaping and maintaining these communities and a mosaic of habitats.

Fire is a natural and critical part of the ecosystems and habitats of South Florida. Fires ignited by lightning from thunderstorms occurring in the transition from the dry into wet season would burn. These wildland fires provide several ecosystem services that are beneficial. Mineral elements and nutrients are released and made available for plants. These nutrients in turn stimulate primary production of plants as well as flowering and fruiting. Fire creates open spaces for new plants to grow and thins competing species. Another important role of fire is maintaining the current successional stage of the forest type. For instance, fire keeps hardwood hammock species from shading out pinelands and wood plants from encroaching into the prairies. Ecological succession is the observed process of change in the species structure of an ecological community over time. In addition to the benefits fire has on plant communities, fire is also beneficial for many animals. It increases the amount and availability of food for herbivores, like white-tailed deer, and improves foraging quality for Florida panther and Red-cockaded Woodpeckers.

To understand the relationship between fire and the natural world, both abiotic and biotic, fire ecologists study dependence and adaptation of plants and animals to fire, fire history, fire regime and fire effects on ecosystems. Scientists and land managers see fire as a natural process and one that is critical to the overall health of an ecosystem. Ecologists must look for clues as to how often and how intense fires occurred in a given area to determine fire history. These clues are often found in tree rings (in both living and dead trees) as fire scars. Dendrochronology (the study of growth rings) can sometimes determine the intensity, direction, and weather patterns of the past. Fire ecologists look into the patterns of fire over long periods of time looking at how often (frequency), how intense, and how much fuel was consumed.

As beneficial force of nature, fire affects various habitats differently. In Big Cypress National Preserve, there are five major habitats: hardwood hammocks, pinelands, prairies, cypress swamps, and mangrove estuaries. These five habitats do not all benefit from fire at the same frequency and Big Cypress Fire Management does not set prescribed burns in each habitat equally or as often. While some habitats like prairies and pinelands are adapted for regular burning, others like the cypress swamp experience fire less frequently and only during extreme or prolonged drought.

The marl or wet prairies habitats of Big Cypress and South Florida would not exist without fire and depend on fire for their survival. Fire maintains the sawgrass and marl prairie by preventing woody plants from encroaching and out competing the prairie plants. If fire did not come through at these regular intervals, woody plants would eventually grow and overtake the traditional prairie species pushing out the mammals and birds that utilize those plants. Additionally, these frequent fires reduce the amount of fuel available when fire does come through an area. Sawgrass is a good example of a plant that has adapted to fire. An adaptation is a trait or characteristic that helps a plant or animal survive and reproduce. Sawgrass is tolerant of prolonged flooding in nutrient and oxygen poor waters. This plant also accumulates more phosphorus and potassium than it needs reducing the amounts of nutrients available to other plants. It also grows in a pattern very similar to kindling in a fire helping to spread fire but not inhibit air flow. Sawgrass can reproduce from a rhizome very quickly after a fire. These frequent fires also improve the passage of water, by reducing plant material that would otherwise impede the vital flow of water through the watershed.

The pinelands of South Florida have adapted and evolved to survive frequent low intensity fires every three to five years. Pines prefer to grow in open sunny areas that fire helps to maintain. If fire is suppressed from pineland habitats, subtropical hardwoods would begin to grow eventually shading out and replacing the South Florida slash pines and saw palmetto understory. Pineland plants like the South Florida slash pine and saw palmetto are also adapted to survive these low to moderate intensity fires with insulating bark and well protected meristems. Pineland habitats regenerate very quickly after a burn. Similar to the prairie habitat, fire moving through the landscape helps to clear out hardwood trees that could overcrowd the pine forests if allowed to continue their growth. Additionally, if the understory were not periodically burned, fuel can build up causing fires to burn the roots of trees making them more susceptible to drought and pests.

Cypress trees are also adapted to survive fire. The bark of the cypress, like that of the South Florida slash pine, helps to insulate the tree from the negative effects of fire. While the bark of the cypress trees acts as an insulator cypress swamps also depend on water to help protect them from fire. Due to the high organic content of the peat soil, peat is flammable. Water in the cypress swamps keeps the peat moist and prevents it from burning. However, as cypress swamps have been drained and hydrologic levels (water table) has been changed and altered cypress swamps may show signs of dryer than historical conditions. These dry conditions could result in peat and root burning wildfires that may be harmful to the cypress swamps.



**Advance Preparation**

1. Make a copy of the student worksheet: “Plant Research Notes” and “Adaptation Creation.”
2. If students are conducting computer research on secure the appropriate equipment.
3. Make necessary copies of Research Sheets if using.



**Procedure**

1. Have students share and brainstorm what they know about the habitats of South Florida. Share that while habitats are defined as an area that provides food, water, shelter and space. A habitat can also refer to an area that has specific characteristics of plants, hydrology, and soil. Habitats are defined by both abiotic (non-living) and biotic (living) factors. Discuss some examples of abiotic and biotic factors that would influence a habitat like topography, rain, soil, grazing, and fire!
2. In South Florida most habitats or plant communities are defined by the topography. The topography dictates the amount of time (often measured in months) that these habitats are underwater. Ask students if they can come up with a list of habitats in South Florida that are either wet or dry for all or part of the year. For example beaches, prairies, forests, etc.
3. Share with students the habitats of Big Cypress National Preserve. Within the preserve there are 5 different plant communities: hardwood hammocks, pinelands, marl prairies, cypress swamps, and mangrove estuaries. These habitats are all underwater for different amounts of time. The hardwood hammocks are the highest and driest and are only flooded for a short time in extreme flood years. Pineland habitats are wet during the 3 or 4 months of the wet season in the summer months, then the marl prairies are generally flooded for 6 months out of the year. The cypress swamps that make up the majority of Big Cypress National Preserve are flooded for 9 months out of the year and finally the mangrove estuaries have water year round, but that level changes with the tide.
4. If you have pictures of the 5 different plant communities you can arrange them on the board from highest and driest to lowest and wettest for a visual aid.
5. Ask students think of another important abiotic factor that also shapes these habitats besides elevation and flood duration? You can ask students to think of what the opposite force might be – fire!
6. Discuss with students ways in which fire can be beneficial and harmful to a habitat. Share with students that fire creates new space for plants to grow and returns nutrients to the soil to help plants grow.
7. To survive both flood and fire, plants must be adapted to survive these specific growing conditions. Either define or ask students to define an adaptation as a trait or characteristic that allows an organism to survive and reproduce.
8. Just like some habitats experience more flooding than other, certain habitats experience more fire than others. Hardwood hammocks and cypress swamps see fire on a scale of centuries. Whereas pineland habitats have historically burned once every 3 to 5 years and marl prairies every 1 to 3 years.
9. These frequent and low intensity fires are essential for marl prairies and pinelands because of the benefits of fire and fire maintains these habitats. Without fire, a marl prairie would begin to turn into a pineland. The process of a plant community changing into another community is called succession. Succession is important and natural, but a balance of habitat types needs to be maintained.
10. Tell students that the plants of Big Cypress National Preserve are adapted to survive in their various habitats. And these plants need fire to varying degrees.
11. Students will pick three plants that are found in Big Cypress National Preserve and research the habitats, how the plant grows and reproduces, and the adaptations of the plant to fire.
12. Once students have researched three plants they will design, create, and discover and new species of plant at Big Cypress National Preserve. This is their “Adaptation Creation!”
13. Students will then draw and discuss where their plant lives (what habitat), how it grows and reproduces, and the adaptations it has to survive fire.
14. Once students have created these plants they can share them with the class or in small groups.

**Big Cypress General Plant List**

*Hardwood Hammock Plants*

* Live Oak
* Cabbage Palm
* Gumbo Limbo
* Mahogany
* Wild Coffee
* Strangler Fig
* Coral Bean

*Pineland Plants*

* South Florida slash pine
* Saw palmetto
* Wax myrtle
* Smilax
* Pineland Petunia
* Yellow tickseed
* Sundew

*Marl Prairie Plants*

* Marsh Pink
* Glades lobelia
* Prairie milkweed
* Sawgrass
* Gulf Muhley grass
* Dwarf cypress
* Duck potato

*Cypress Swamp Plants*

* Butterfly orchid
* Bald Cypress
* Pickerel Weed
* Alligator Flag
* Willow
* Floating hearts
* Lemon bacopa
* Cardinal Airplant

**Fire Adaptations! Plant Research Notes**

**Your Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

** Directions:** Choose three plants found in Big Cypress National Preserve to research. In the space below write down notes and information you found on the life history, fire tolerance, adaptations, and habitats of your three plants.

1. My three Big Cypress National Preserve plants:

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2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Information and research on the habitats, life history, adaptations, and other interesting facts of my three plants:

**Plant #1**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Habitat in Big Cypress where this plant is found: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How this plant grows and reproduces: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Special adaptations that allows this plant to survive natural fire: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Additional information or notes on your plant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Plant #2**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Habitat in Big Cypress where this plant is found: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How this plant grows and reproduces: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Special adaptations that allows this plant to survive natural fire: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Additional information or notes on your plant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Plant #3**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Habitat in Big Cypress where this plant is found: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How this plant grows and reproduces: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Special adaptations that allows this plant to survive natural fire: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Additional information or notes on your plant: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Fire Adaptations! Adaptation Creation**

**Your Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

** Directions:** Using information from your research on plants of Big Cypress National Preserve, design your own plant with adaptions to survive natural and prescribed fire. Include a name, three adaptations, and the habitat where your plant lives:

1. My *Adaptation Creation* plant’s name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Habitat in Big Cypress National Preserve where my *Adaptation Creation* plant lives:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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3. Three adaptations my plant has to survive natural and prescribed fire: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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4. Draw a picture of your *Adaptation Creation* plant: