Note to the Project Helper

This project book is designed to help youth explore the amazing world of trees. It can be used with a 4-H club, classroom, family outings, or at camp. The project book can be completed in a week as a concentrated unit, or over many months of sporadic activity. You might use this material with an entire club or class, or sponsor an individual. The ideas are here to help guide the exploration and should not limit the journey. There are other resources you might tap including experts in your community who will have other ideas of interesting projects.

This book is the second in a series of three. A Leader Guide for this series provides background information and suggestions for assisting youth with the activities in each book. Youth can continue in the Forest Resources Series with Florida’s Fabulous Forests. Groups can conduct a community service project with Give Forests a Hand.

Sunshine State Standards
Teachers may wish to use these activities to enhance their work on the following Sunshine State Standards:

SC.G.1 – understands the competitive, interdependent, cyclic nature of living things in the environment.
SC.D.2 – understands the need for protection of the natural systems on Earth.

Additional activities to teach your students about trees and forests are in the national curriculum resource Project Learning Tree (PLT). A list of PLT activities for most of the exercises in this project book can be found in the Forest Resources Series Leader Guide. Contact your County Extension Office or the Florida Forestry Association (850-222-5646) for the next PLT workshop near you.

Experiential Learning
The activities in this book were designed to include the three basic steps of the Experiential Learning Model. 4-H members should 1) do an activity, 2) reflect on this experience by discussing it with you and by answering questions, and 3) apply this experience to a new situation.
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Close your eyes for a moment and imagine a world without trees. What do you think you'd miss first - shade, a green horizon, paper, or oranges? Thankfully, we don't have to live in a world without trees. Many communities protect urban trees and encourage people to plant more. Florida has protected thousands of acres of forest in state parks and conservation areas, so we can enjoy the many benefits of trees. Even more forest land is owned and carefully tended by numerous Florida families. Our forest industry also works hard to harvest and replant trees efficiently so we always have a multitude of wood products.

In this project book, you will learn more about trees - how they grow and how you benefit from them. Since the process of getting to know someone usually begins with learning their name, you'll have an opportunity to learn the names of several trees, too.

Florida is rather unusual when it comes to trees because our climate encourages so many different things to grow. There are eight distinctly different forest ecosystems across Florida, and that means that different sets of plants and animals prefer to live in each one. Of course, since animals move and plants spread their seeds, you can find some of these animals and plants in other forests as well.

Trees are very special plants. Come learn more about them!
Use this chart to keep track of your project. With your Project Helper, decide which 8 activities and 4 or more challenges you want to do. As you complete each activity and challenge, ask your Project Helper to sign that you have finished it.

<table>
<thead>
<tr>
<th>Activity</th>
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<td>1.2 Food Factories</td>
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<td>2.2 The Key to Trees</td>
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<td>3.3 Tree Surprises</td>
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Chapter 1: Tree Basics

There's a lot to learn about trees and a good place to start is with basic, essential information about what a tree is and how it grows. The next three activities give a general overview of trees but be sure to consult other sources if you have more questions or if something catches your interest!

Activity 1.1: What's a Tree?

Life Skill: Learning to learn
Project Skill: Defining the word 'tree'
What to Do: Compare a definition that you create with other definitions.

Sometimes very simple questions are very hard to answer. What do you think? What is a tree?

Do the Activity

1. Go outside and carefully examine at least 5 different plants that you think are trees.
   Write down at least 3 characteristics that all 5 plants have in common:
   a. 
   b. 
   c. 

2. Using these common characteristics, write a definition that would help someone who just landed from outer space know what a tree is - and what a tree is not.
3. Now test out your definition on some plants that could be tricky to define. Look at the pictures on page 7 and read the descriptions. Circle the plants that you think should be called trees, and make sure your definition would categorize them as trees.

4. Now look up the definition of a tree in several different books (a dictionary, a science book, and a tree identification book). How close is your definition?

Talk it Over

Share with your helper

• Describe the trees you observed.
• Explain your definition of a tree.

Tell what's important

1. What are the most important characteristics of a tree?

Explore what you learned

1. How did your definition of a tree change as a result of this activity?

Imagine what's next

1. When you think about trees, what would you like to know more about?

More Challenges

1. Have you ever noticed sayings that refer to trees? Barking up the wrong tree. Can't see the forest for the trees. He's all spruced up. What do these phrases mean? What other phrases have you heard about trees? Can you make up some phrases that refer to characteristics of trees?

2. Talk to other people about their definitions of a tree. Ask friends, family members, teachers, and neighbors. Contact tree experts such as a park ranger or someone who works for a lumber company. Ask them for their definition of a tree. How are these definitions the same? How are they different?
Strangler fig often starts its life in the branches of another tree, acting like a vine. It grows quickly and as it matures, sends down its own roots to support itself. Eventually a strangler fig will stand on its own, independent of the original host tree. Strangler fig grows to a height of 50-60 feet and is mainly found in South Florida.

The 700 species of bamboo in the world are all members of the grass family. Dwarf varieties of bamboo may grow only one foot high; whereas giant varieties can be over 100 feet. Bamboo stems are hollow, usually round, and jointed. Switchcane is a bamboo with a woody, hollow trunk and long, slender leaves that is native to Florida. It can grow to be 25 feet high.

Gallberry, a common plant in pine flatwoods and savannas, is a member of the holly family. It is evergreen with black, berry-like fruits and small, shiny leaves. Gallberry grows to be seven to nine feet tall and is found throughout Florida. Rather than one central stem it has many branching stems.

Palm trees grow up from a single terminal bud in the central part of the trunk. The cabbage palm is Florida's state tree and can grow to be 50-80 feet tall. Its leaves, called fronds, are five to eight feet long and also grow from that same terminal bud.
Activity 1.2: Food Factories

Life Skill: Applying science process skills  
Project Skill: Conducting an experiment  
What to Do: Experiment with photosynthesis

Leaves are food factories for plants. The food they produce is sugar. It is not as sweet as refined table sugar, but like table sugar, it is a carbohydrate that stores energy. Trees do a very good job of getting their factories all the ingredients they need to produce food:

• Leaves are turned toward the sun and positioned in a way that helps capture sunlight.
• Roots absorb water and nutrients from the spaces in the soil.
• Sapwood carries the water and nutrients up the trunk to the leaves.
• Tiny holes on the bottom of the leaves, called stomata, allow carbon dioxide gas and oxygen gas to move in and out of the leaves and cells that make food.
• Phloem carries the sugar throughout the tree so the stem and roots can grow.

The process that converts water and carbon dioxide in the presence of sunlight into food and oxygen is called photosynthesis. All green plants photosynthesize. The ability to make food energy is something that green plants have and animals do not have.

Sugar is produced from carbon dioxide and water in the presence of light.

Cross section of a leaf showing movement through a stoma
Do the Activity
Experiment 1: Drinking Plants

Materials:
1. 4 stalks of celery, the same size, with leaves
2. 4 glasses
3. Blue food coloring
4. Measuring cup
5. Paper towels
6. Vegetable peeler
7. Ruler

Method:
Lay the four pieces of celery in a row so that the joint where the leaves meet the stalk lines up. Cut the four stalks so they extend 6 inches from this joint.

Place 1/2 cup of water in each glass and mix 10 drops of blue food coloring into each glass. Put a celery stalk into each glass.

Every 15 minutes from the time you started, take one stalk out of the water and examine it closely. Can you see any color appearing in the leaves? Use the vegetable peeler to shave the stalk to see how far up the stalk the colored water traveled. Record the distance below:

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<tr>
<th>Time</th>
<th>Distance Traveled</th>
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<tbody>
<tr>
<td>0 hours</td>
<td>0 inches</td>
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<tr>
<td>15 minutes</td>
<td></td>
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<tr>
<td>30 minutes</td>
<td></td>
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<tr>
<td>45 minutes</td>
<td></td>
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<tr>
<td>1 hour</td>
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</tbody>
</table>

How fast does water move to the top of a celery stalk under these conditions?
Experiment 2: It's a Cover-Up

Materials:
1. Tree or shrub in your yard with large, flat leaves you can reach
2. Ruler
3. Scissors
4. Cardboard
5. Paper clips

Method:
Measure the length and width of the leaves of your selected tree or shrub. Cut out several pieces from the cardboard that are as long as the leaves and twice as wide. Fold the cardboard pieces in half. Paper clip them to several leaves so that both the top and bottom of one half of each leaf is covered.

Mark the leaves with a string so you can watch them over the next four days. What do you think will happen? What will the parts of the leaves covered by cardboard look like? Why?

After four days take the clips off the leaves and examine the results. What happened? Why?

Talk it Over
Share with your helper
• Describe how you measured water movement in the celery stalks.
• Describe what you saw when you removed the cardboard pieces from your leaves.

Tell what's important
1. If a tree were 35 feet tall, how quickly could a water droplet travel from the surface of the ground to the highest leaf, if water moved through trees at the same rate it moved through celery?
Explore what you learned
1. Some animals eat animals; some animals eat plants. Animals that eat animals eventually eat animals that eat plants. Why are plants at the “bottom” of every food chain?

2. The tiny stomata in leaves are needed to let carbon dioxide and oxygen get in and out of the leaf. They also enable water vapor to escape into the air. If a tree does not have enough water, those little holes could allow the tree to become dehydrated. What design features could prevent leaves from “leaking” precious water during a dry spell?

Imagine what’s next
1. Why do you think forests are called the Lungs of the Earth?

2. Draw a picture of a make-believe plant that is really good at moving water from the roots to the leaves and at keeping its leaves in the sun. Explain how the plant accomplishes these tasks.

More Challenges
3. Make a poster of a leaf showing the stomata and explain how photosynthesis occurs.
4. Visit a greenhouse to observe how they raise trees and how they provide each ingredient needed for photosynthesis.
5. If the amount of carbon dioxide gas in the atmosphere increases as a part of global warming, how might this increase affect trees? What might become a limiting factor for tree growth?
Activity 1.3: How Wood You Like That?

**Life Skill:** Problem solving

**Project Skill:** Applying given information

**What to Do:** Answer questions and label pictures about tree trunks

Have you ever thought much about wood? Wood is the main source of energy for heating and cooking in more than 50% of the homes in the world. Here in Florida, some homes are heated with wood stoves, but most of our wood is used for lumber, furniture, tools, and paper. Several activities in this project book explore the different things we make from trees but for now, let’s look at wood.

Most of our wood comes from softwood or hardwood trees: trees with needles and trees with leaves. Other woody plants like palms, vines, shrubs, and bamboo are not used for commercial wood production in Florida. So when we talk about wood, we are referring to the woody trunks of trees like pines and oaks.

**Do the Activity**

Most of the woody material in a tree trunk is xylem – columns of hollow cells arranged end to end. Living xylem tissue is called sapwood; it carries water from the roots to the leaves. Every year, new sapwood is produced in a period of slow growth and fast growth – together they make an annual ring. Really old sapwood in the center of the tree may become heartwood that stores various wastes and chemicals produced by the tree. In some trees, this heartwood becomes rot resistant or colorful and is highly prized for its durability and quality.

Cells in the cambium layer produce new sapwood. These cells are located in a thin layer between the phloem and sapwood. The cambium layer produces two types of cells, sapwood on the inside of the cambium layer and phloem cells on the outside. Phloem is made of columns of tube-like cells that carry food made in the leaves to the stems, trunk, and roots.

Dead outer bark protects the tree from insects, fire, lawnmowers and other injuries.

Label the picture with these terms: sapwood, phloem, heartwood, cambium, and outer bark.
A horizontal cross section of a tree shows the tree's annual rings. These rings can tell a story about how the tree grew. Each ring has a light and dark band; together they usually represent a year of growth. When a tree grows quickly, it forms a wide ring. Annual rings also record information about the health of the tree.

a. In the drawing below on the left, count how many years the young tree grew very quickly. ____

b. Then something happened to reduce the tree's growth—perhaps there was a drought, or perhaps insects attacked the tree and made it difficult to grow by eating the leaves and preventing the tree from producing food. How many years did it take to get over this stress? ____

c. In the drawing on the right, how old was the tree when a fire burned one side of the trunk? ____

Branches are a part of trees, and it is interesting to see how tree trunks include them. In the picture below on the left, trace the annual rings of sapwood as they carry water to the branch every year. In wood, you can see the evidence of a branch in a knot. A knot is formed where a branch comes out of the tree trunk. The drawing on the right shows typical knots on a tree.
Talk it Over

Share with your helper

- Identify the parts of a tree trunk and describe the function of each.
- Point to the youngest part of a tree and the oldest part(s) of a tree trunk.

Tell what's important
1. What characteristics of a tree might increase the value of its lumber?

Explore what you learned
1. Which will certainly kill a tree - shaving a 3 foot long and 3 inch wide patch on one side until you reach the sapwood, or cutting a 3 inch wide band completely around the tree deep enough to reach the sapwood? Why?

2. Which tree will have harder, denser, stronger wood - a tree that grows very quickly with wide annual rings, or a tree that grows more slowly and has narrow annual rings? Who could you ask to find out?

Imagine what's next
1. The rings of very old trees can be used to interpret the history of an area. Some trees have confirmed that the early settlers in Jamestown Virginia experienced one of the worst droughts in the history of that area. What would those tree rings look like? What other mysteries might living and fossil trees reveal?

More Challenges
6. Visit a sawmill and see how trees become lumber.
7. In this activity you explored how trees get wider. Now, find out how trees grow taller. Be sure to learn about terminal and lateral buds.
Knowing how to identify trees is an important skill for anyone interested in trees and forestry – plus it's fun to be able to walk into the woods and know the names of the surrounding trees. Because Florida has such varying climates, there are many types of interesting trees. This chapter will help you begin to learn to identify some of the important trees in Florida.

**Activity 2.1: Tree Traits**

**Life Skill:** Learning to learn  
**Project Skill:** Observing characteristics of trees  
**What to Do:** Go on a scavenger hunt

There are lots of different trees in Florida. Each one has some characteristic that makes it unique. These characteristics may be the shape of the leaf, the furrows in the bark, or the type of flower. Some characteristics are not good for identification, because they are not consistent or stable between the same trees – like the exact size of leaf. You can find small leaves and large leaves on the same tree. However, these characteristics are helpful if they are used in combination with other distinct tree characteristics.

In this activity you will learn about the characteristics that are used to identify trees.

**Do the Activity**

Have you ever been on a scavenger hunt? A scavenger hunt is where you become a hunter, looking for the items on a list. You go wherever necessary to find the items. The next page has a list of tree characteristics for you to find. Look in your neighborhood and local parks. Travel to a nearby forest to search and explore. Find as many of these characteristics as you can. Take along a few friends or club members and see who can find the most tree characteristics. Information, explanations, and examples of the tree characteristics can be found here and on the 4-H Florida Forest Ecology website. Happy hunting!