South Carolina Aquarium

3-5 Plants are Producers Activity

Overview

Focus Question
If plants do not eat other things, how do they get their food energy?

Activity Synopsis
Students will use baking goods to simulate what plants do to produce their own food. After this introduction, they will conduct an experiment to see what happens to plant leaves that are deprived of sunlight.

Time Frame
Part 1: one hour
Part 2: two weeks

Objectives

The learner will be able to:

- Define the term "producer" and explain that plants are producers
- Identify the things a plant needs to make food
- Predict what will happen to a plant that is deprived of sunlight

Student Key Terms

- chlorophyll
- photosynthesis
- producer

Teacher Key Terms

- carbohydrate
- chlorophyll
- chloroplast
- enzyme
- food chain
- glucose
- herbivore
- osmosis
- photosynthesis
- producer
- stomata

Standards

South Carolina College- and Career-Ready Science Standards 2021

3rd Grade: 3-LS3-2, 3-LS4-3
4th Grade: 4-LS1-1
5th Grade: 5-PS1-4, **5-PS3-1**, **5-LS1-1**, 5-LS2-1

*** Bold standards are the main standards addressed in this activity**

2014 Academic Standards and Performance Indicators for Science

South Carolina Aquarium

3-5 Plants are Producers Activity

3rd Grade: 3.S.1A.1, **3.S.1A.3**, **3.S.1A.6**, **3.L.5A.2,** 3.L.5B.1, **3.L.5B.2**
4th Grade: 4.S.1A.1, **4.S.1A.3**, **4.S.1A.6, 4.L.5A.1, 4.L.5B.2**
5th Grade: 5.S.1A.1, **5.S.1A.3**, **5.S.1A.6, 5.L.4A.1, 5.L.4B.1,** 5.L.4B.4

*** Bold standards are the main standards addressed in this activity**

South Carolina College- and Career-Ready Science Standards 2021

Third Grade Performance Expectations
3-LS3-2 Use evidence to support the explanation that traits can be influenced by the environment.
3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can thrive, struggle to survive, or fail to survive.

Fourth Grade Performance Expectations
4-LS1-1 Construct an argument that plants and animals have internal and external structures that function together in a system to support survival, growth, behavior, and reproduction.

Fifth Grade Performance Expectations
5-PS1-4 Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
5-PS3-1 Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
5-LS1-1 Support an argument with evidence that plants obtain materials they need for growth mainly from air and water.
5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

2014 Academic Standards and Performance Indicators for Science

Third Grade Performance Indicators
3.S.1A.1 Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs.
3.S.1A.3 Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
3.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
3.L.5A.2 Develop and use a food chain model to classify organisms as producers, consumers, and decomposers and to describe how organisms obtain energy.
3.L.5B.1 Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.
3.L.5B.2 Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).

Fourth Grade Performance Indicators
4.S.1A.1 Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs.
4.S.1A.3 Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
4.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

4.L.5A.1 Obtain and communicate information about the characteristics of plants and animals to develop models which classify plants as flowering or nonflowering and animals as vertebrate or invertebrate.
4.L.5B.2 Construct explanations for how structural adaptations (such as the types of roots, stems, or leaves; color of flowers; or seed dispersal) allow plants to survive and reproduce.

Fifth Grade Performance Indicators
5.S.1A.1 Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs.
5.S.1A.3 Plan and conduct controlled scientific investigations to answer questions, test hypotheses and predictions, and develop explanations: (1) formulate scientific questions and testable hypotheses, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.
5.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.
5.L.4A.1 Analyze and interpret data to summarize the abiotic factors (including quantity of light and water, range of temperature, salinity, and soil composition) of different terrestrial ecosystems and aquatic ecosystems.
5.L.4B.1 Analyze and interpret data to explain how organisms obtain their energy and classify an organisms as producers, consumers (including herbivore, carnivore, and omnivore), or decomposers (such as fungi and bacteria).
5.L.4B.4 Construct scientific arguments to explain how limiting factors (including food, water, space, and shelter) or a newly introduced organism can affect an ecosystem.

Cross Curricular Standards

South Carolina College and Career Standards for ELA
Writing (W) – 3-3.1, 4-3.1, 5-3.1
Communication (C) – 3-1.1, 3-1.2, 4-1.1, 4-1.2, 5-1.1, 5-1.2

Common Core ELA Standards
Speaking/Listening – 3.1, 3.2, 3.3, 3.4, 4.1, 4.3, 4.4, 5.1, 5.3
Language – 3.3, 4.3, 5.3

Background

Key Points
Key Points will give you the main information you should know to teach the activity.

- Plants are **producers** because they can make their own food energy and, therefore, do not have to consume other organisms.
- Plants produce food through **photosynthesis**. In the plant leaf, carbon dioxide, water and sunlight combine to form **glucose** (a simple sugar) and oxygen. The carbon dioxide and sunlight are absorbed by the plant's leaves. **Chlorophyll** is the green chemical compound in leaves that absorbs the sunlight. The water is absorbed out of the soil by the plant's roots. The glucose provides food energy that is used by the plant to perform life processes and is also stored for later use.
- Though not directly necessary for photosynthesis, plants also need nutrients to survive. Nutrients are necessary for the plant to produce the chemical compounds it needs to perform its life processes. Nutrients are absorbed out of the soil by the plant's roots.
- The food energy of plants is stored for future use in its roots and stems and is stored as seeds and fruits to aid seedlings in their growth and success. These roots, stems, seeds and fruits are eaten by animals for food energy.
- Because animals cannot make their own food, they depend on plants for food energy and for nutrients. Without plants, the animals in a wildlife community could not survive.

Detailed Information
Detailed Information gives more in-depth background to increase your own knowledge, in case you want to expand upon the activity or you are asked detailed questions by students.

South Carolina Aquarium

3-5 Plants are Producers Activity

Certain organisms can turn solar energy into food that is essential to any wildlife community. These organisms, known collectively as **producers**, which can make or produce their own food include algae, some microscopic organisms such as diatoms and certain dinoflagellates and bacteria, as well as all of the plants. Life could not exist on the planet if it were not for producers. All the food energy that animals depend on originally came from producers. The description of how food energy passes from one organism to another when each organism is eaten is known as a **food chain**. Without producers, a food chain could not exist, because there would be no energy to pass from one organism to another.

The energy in a food chain has to constantly be renewed. As energy is passed from one organism to another, it is being used by the organism and eventually is released back into the atmosphere. To keep energy flowing through food chains, it has to be replenished. Producers are the means by which energy is brought into the food chain. Plants use sunlight energy to convert carbon dioxide and water into oxygen and **carbohydrates** (sugars). The carbohydrates are the food energy. This process is known as **photosynthesis**. The chemical formula of photosynthesis is this:

$6\ CO_2 + 6\ H_20 + \text{solar energy} \rightarrow C_6H_{12}O_6 + 6\ O_2$
(Six molecules of carbon dioxide plus six molecules of water plus the energy of the sun will combine to form one molecule of **glucose** (a carbohydrate) and six molecules of oxygen)

The carbohydrates produced by the plant passes to an animal when the plant is eaten and then may pass to another animal when that animal is eaten. Eventually the energy in the food will be released into the atmosphere as heat. The energy cannot be recycled. For this reason, plants have to constantly produce new carbohydrates from sunlight in order to sustain life.

In plants, photosynthesis occurs in tiny structures in the leaves known as **chloroplasts**. Chloroplasts contain a pigment known as **chlorophyll**. The chlorophyll absorbs the sunlight that provides the energy for photosynthesis. All the wavelengths of the sunlight are absorbed, except the green wavelength. This is reflected back, and is what gives plants their green coloration. Chloroplasts are very tiny. A square millimeter of leaf will contain about 500,000 chloroplasts.

The carbon dioxide used in photosynthesis is brought into the plant through pores in the leaves known as **stomata**. Stomata are not constantly open, but can be opened and closed when necessary. This keeps the water in the plant from escaping as water vapor. When the stomata are closed, the leaf is watertight. The stomata only open when the plant has sufficient water resources. During dry seasons, many of the plant leaves will die because the stomata are not opening to allow carbon dioxide to enter.

Water is gathered in a plant by its roots. The cells of the roots have highly porous cell walls, and the water in the soils moves into the roots through the process of **osmosis**. Osmosis is the process by which water moves from areas of high concentration to areas of low concentration. When the soil has more water in it than the plant's roots, the water will begin to fill the empty space in the roots. Osmosis is more rapid when there is a lot of surface area for the water to cross, therefore the more surface area on the plant's roots, the more water the plant can absorb. For this reason, roots develop root hairs, little tubes that stick out from the roots to provide more surface area. To give an example of how much they add, a four month old rye plant contains approximately 14 billion root hairs. This gives the roots a surface area of over 401 square meters through which to absorb water.

When photosynthesis occurs, the light energy from the sun causes a chemical reaction in the plant. Powered by the sun, carbon dioxide and water combine to form the carbohydrate glucose, a very simple kind of sugar. Some of the light energy is converted into chemical energy and this gets captured in the glucose molecule. This energy can be used by the plant for growing, making new cells, repairing wounds to the plant and allowing all the cells of the plant to synthesize molecules and conduct other necessary chemical reactions.

Much of the glucose is converted into more complex starches, sugars and oils that are stored by the plant for future use. Most of this converted glucose is then stored in the roots or stems of the plant. These are then used by animals as a food source. Some examples of the plants that store energy in this manner are potatoes, carrots, celery, radishes and onions. Some of the food energy is also stored in seeds to give the plant embryo energy to feed off of as it begins to grow and develop. Some of it is stored in colorful, sweet fruit which covers the seeds and is attractive to animals to eat. When an animal eats a fruit, it will also ingest the seeds. These are

carried by the animal until they are dropped as waste in a new location. This aids the plant in seed dispersal. Fruits include apples, grapes, oranges and tomatoes.

When an animal eats a plant, some of the food energy from the plant is used by the animal for its life processes, some of it is stored in fat and muscle and what is not digested is lost as waste. When that animal is consumed, some of its energy will be passed on to the animal eating it. If that animal is eaten, some of the energy will pass on to its consumer. Because energy is constantly being used or lost through a food chain, the farther up a food chain one moves, less of the original energy produced by the plant is available. For this reason, there is a limit to the number of organisms a food chain can sustain.

While energy in a food chain has to constantly be renewed, the nutrients in a food chain can constantly be cycled and recycled. Energy has the capability of escaping earth's gravity, whereas nutrients cannot. Luckily for us, the lost energy can always be replaced by the constant burning of the sun. Luckily for us too, nutrients are constantly being recycled by decomposers in the soil.

Plants, and all living things, need nutrients to make the chemical compounds they need in order to survive. Plants acquire their nutrients from the soil. Minerals and nutrients in the soil will dissolve in the groundwater from which the plant roots receive their water. The same root hairs that draw in water, draw in the minerals and nutrients dissolved in the water. These nutrients, though not specifically used in photosynthesis, are necessary for the plant in order to live.

Along with energy, nutrients too are passed through a food chain. An animal that eats a plant, a **herbivore**, gets the nutrients from that plant. The nutrients will then be passed on to the animal that consumes the herbivore. When that animal dies, decomposers, such as bacteria and fungi, will break that animal's chemical compounds down into the original nutrients, and these nutrients will be returned to the soil. Then another plant can pick up these nutrient with its roots, and the cycle will begin all over again.

A wildlife community without plants is an impossibility. Without plants, the other organisms in the community could not get the food energy, nutrients and oxygen they need to survive. Because plants are producers and make these things, they make life possible for all of the other organisms on earth.

South Carolina Aquarium Spotlight Organism: Spartina Grass

A saltmarsh is one of the most productive habitats on earth. An acre of saltmarsh can produce from five to ten tons of plants per year. The average wheat field only produces one-and-a-half to five tons of plants an acre per year. The predominate plant in a saltmarsh is Spartina grass. Spartina grass helps provide the majority of the food energy, not just for the animals in the saltmarsh community, but for the animals in the ocean community as well.

Spartina grass can thrive in an environment, the saltmarsh, which most plants cannot survive. Because of this, Spartina grass grows abundantly in South Carolina saltmarshes and is of great importance as a producer of food energy from the sunlight. Though some organisms eat the Spartina grass directly, Spartina is most important to the community when it is broken down into detritus. Detritus are tiny pieces of organic material that have been broken down by decomposers. When decomposers, such as bacteria, break down Spartina grass, they release both food energy and nutrients into the water. This detritus helps to sustain the large animal community that lives in the coastal waters of South Carolina. Without the Spartina grass in the salt marshes, many of the fish, crustaceans and mollusks of South Carolina would not be able to survive.

Procedures

Materials

- 3 necklace signs made in advance (air, water, nutrients)
- Jiffy biscuit mix
- Brown sugar
- Optional: cinnamon mixed into the brown sugar
- Water

- An electric skillet
- Green food coloring
- Disposable cups
- Spoons (for measuring and mixing)
- 2 large bowls
- 1 pitcher
- Apples, peaches or other fruit grown in South Carolina
- A live plant
- Construction paper (brown, green and black)
- Journals
- Scissors
- Tape

Procedure

Part 1

1. (If there are no plants in the classroom, bring some in for this activity.) Have students observe the plants and think about how plants get the food they need to live. Do they eat other animals or plants? Explain the term "producer" and tell them that all plants are producers. Explain that like a cook making food, plants need certain ingredients to produce the food they need. Tell the students they will pretend to be plants and, like plants, will mix ingredients together to make their own food.

2. Have students think about plants in the classroom and discuss what plants need in order to survive. Discuss with the students how plants need air, water, nutrients and sunlight. Talk about the adaptations of plants that allow them to collect these things. Roots collect water and nutrients from the soil. Leaves collect air and sunlight. By collecting these four things, the plant has the ingredients it needs to make its own food.

3. Have three students come to the front of the classroom and designate one to be air, one to be water and one to be nutrients. These students will wear signs around their necks so that the class will remember what they represent. The rest of the students will pretend to be plants and will sit at their desks. Note: if you want all the students to be “plants” during this activity, you can act as the air, water and nutrients by setting up stations.

4. Give the students who are plants a disposable cup, a spoon and construction paper (brown and green) to cutout shapes to represent leaves and roots. Have them tape the construction paper leaves to the side of the cup and the construction paper roots to the bottom of the cup. Add a drop of green food coloring to each student’s cup to represent chlorophyll, and explain the importance of this green substance to allow plants to produce food. Tell the students that because they are plants, they are producers who need to make their own food, and thus must gather their ingredients to do so. They will gather these from the students representing air, nutrients and water. Give the student representing air a large plastic bowl containing Jiffy biscuit mix and a spoon. Give the student representing water a large pitcher containing water and a spoon. Give the student representing nutrients a large plastic bowl containing brown sugar and a spoon. (If you want to improve the end taste of the producer pancakes, mix a little cinnamon into the brown sugar before the activity begins.)

5. Have the air, water and nutrients students sit at the front of the classroom with the bowls. Tell the "plant" students they will be simulating how a plant makes its own food. They will bring their cup up to the front of the classroom to receive the "ingredients" they need. Each "plant" student will shake the leaves on their cups (the adaptation used to collect air) to indicate for the "air" student to spoon two spoonfuls of biscuit mix in their cup. Each "plant" student will shake the roots on their cup (the adaptation used to collect water) to indicate for the "water" student to spoon two spoonfuls of water in their cup. Each "plant" student will shake the roots on their cup (the adaptation used to collect nutrients) to indicate for the "nutrients" student to spoon two spoonfuls of brown sugar in the cup. The "plant" students will then stir these ingredients together with a spoon.

The teacher may want to write these directions on the board:

2 spoonfuls of air, 2 spoonfuls of nutrients and 2 spoonfuls of water.

If students are curious as to why these amounts are used, it does not correlate to actual amounts used by the plants (see Background Information). The measurements allow the students to produce something that they themselves can eat. Use teaspoons or tablespoons, depending on how much pancake batter you want.

6. After the "plant" students have acquired the air, nutrients and water, ask the students what the mixture is missing to make it a finished food product. The answer is heat. Heat is energy, and like cooks need heat to turn batter into pancakes, plants need the energy of the sun to turn those ingredients into food. Have the students drop their mixture on the electric skillet. Tell the students that the electric skillet represents the sun and the energy the sun gives off that is necessary for a plant to produce food.

7. Cook the batter like normal pancakes and have the students observe the producer pancakes as they cook. Tell the students that the bubbles in the pancakes represent oxygen escaping and that the steam being released represents lost water vapor, both products of photosynthesis. When the producer pancakes are done, allow the students to eat the pancakes. Tell the students that the food made by plants is sugar. Explain how the plant uses the food it makes to give it energy to perform its life functions. Explain some of the ways a plant stores its food energy. Give the students some fruit to eat so they can taste the sugar. Explain to the students that all of the energy in a food chain comes originally from the sun and can only be used by animals when it is converted into food by plants. Without producers, animals would not be able to survive.

Part 2

1. Students will observe actual plants to reinforce how producers acquire food. A plant (or 2 or 3 plants) with many leaves, such as a philodendron, should be placed next to a window. Students should tape black construction paper around certain leaves while leaving other leaves exposed to the light.

2. Based on the producer pancakes activity, students should predict what will happen to the leaves that are in direct sunlight as compared to the leaves that are covered by construction paper. How will having sunlight and having no sunlight affect the different leaves? Students will write their predictions in their journals.

3. Students will make observations in their journals of the plant leaves over the course of two weeks. Students will keep a record of when they water the plant and what general changes they have noticed occurring to the leaves.

4. At the end of two weeks of observations have students compare their observations with their original predictions. Do they match up? Discuss and then have them write their thoughts in their journals. If plants are producers, what is happening to the leaves that do not get sunlight? Have students discuss and write their ideas in their journals.

Experiment Variations

For advanced students or students in the fifth grade, explain more in depth the process of photosynthesis. The biscuit mix represents carbon dioxide and this mixes with water and then, through the energy of the sun, this is converted into sugar and oxygen. Mix with amounts that correspond to the amounts used in photosynthesis, six spoonfuls of biscuit mix to represent six molecules of carbon dioxide and six spoonfuls of water to represent six molecules of water. The sugar that is mixed in the bowl still represents nutrients, but explain that though nutrients are necessary for the survival of the plant, they are not actually used in the process of photosynthesis.

Follow-up Questions

- What would we eat if there were no plants to make food?
- If humans "make" food, are they producers? Is cooking the same thing as what a plant does to produce its own food?

Assessment

Students will draw and describe a garden that they will grow. Students will describe what they will grow, and describe how they will make sure that the plants get the things that they need to produce the food that will make big, healthy vegetables and fruits.

3-5 Plants are Producers Activity

Scoring rubric out of 100 points

Draw and describe a garden	**20 points**
Identify air as one of the things a plant needs to produce food	**20 points**
Identify water as one of the things a plant needs to produce food	**20 points**
Identify sunlight as one of the things a plant needs to produce food	**20 points**
Identify nutrients or soil as one of the things a plant needs to survive	**20 points**

Cross-Curricular Extensions

STEM Extension
Plants if grown if the wrong area can become invasive plants. These are plants that should be in an area and take up space and nutrients from the native plants. Have students research beach vitex or kudzo (2 invasive plants) and then come up with a plan to get rid of it.

Social Studies Extension
Students will research what plants are grown and eaten the most in South Carolina and compare these with the plants that are grown and eaten the most in the world. Why are some plants eaten more than others? Do they produce more food energy?

Math Extension
Tell students to pretend that they can measure the amount of food energy produced by a plant in gallons, as if it were gasoline in a car. Pretend that every time the energy was passed in the food chain from one organism to another, five gallons of energy were lost. How many animals could exist in the food chain if the plant produced ten gallons of energy? 20 gallons? 30 gallons? Have them calculate the energy that is lost and determine how many organisms can be supported based on the amount of energy produced by the plant. Ask them to consider if energy is lost in a real food chain and if there is enough energy in a real food chain for it to go forever.

Language Arts Extension
Have the students write a recipe for the photosynthesis process as if it were an entry in a cookbook. Have them write it in a clear descriptive fashion so that someone totally unfamiliar with photosynthesis could create their own glucose and oxygen by following the recipe.

Language Arts Extension
Have the students read the book *Weslandia* by Paul Fleischman. Have them write their own story about how they could use the plants in their backyard to build their own civilization.

Social Studies Extension
Create a garden plan that is representative of South Carolina's diverse plant life. Students can use resources such as field guides to choose plants that can be used in a distinctive garden. The rules are that:

- Each garden plan must have at least five different plants that represent both different geological regions of the state and different types of plants (trees, shrubs, wildflowers, aquatic plants, etc.).
- The students should list characteristics of the plants that help them survive in their environment.
- The garden plans can be written and/or illustrated, with each plant identified by common name and the region(s) of the state they grow in.

Third Grade Science Extension by Brad Burnham

Resources

Teacher Reference Books

Eyewitness Visual Dictionaries: The Visual Dictionary of Plants, DK Publishing, Inc., New York, 1992.
Using visually striking photographs and illustrations, this book identifies the various parts and structures of a variety of plants.

The National Audubon Society Field Guide to North American Wildflowers: Eastern Region, Alfred A. Knopf, Inc., New York 1979.

The National Audubon Society Field Guide to North American Trees: Eastern Region, Alfred A. Knopf, Inc., New York 1980.
The National Audubon Society Field Guides not only contain information to allow the user to identify specific plants, but also provide information on the habitat, range and life history of that plant. They also contain beautiful photographs.

Porcher, Richard D. *Wildflowers of the Carolina Lowcountry and Lower Pee Dee,* University of South Carolina Press, Columbia, SC, 1995.
Written by a biology professor at the Citadel, this book contains identification information as well as general information on the ecology and natural history of Lowcountry wildflowers. It contains beautiful photographs.

Raven, Peter H., Ray F. Evert and Susan E. Eichhorn. *Biology of Plants,* W.H. Freeman and Company, New York, 1999.
Though admittedly college textbooks are often a little too dry and complex, they are often the best resources for finding information on a particular subject. This college textbook is an excellent resource for anyone wanting to know more about the biology of plants.

Teal, John and Mildred. *Life and Death of the Salt Marsh,* Ballantine Books, New York, 1969.
An in-depth look at one of the most important and productive ecosystems in South Carolina, with chapters on spartina grass and the other marsh plants and their effect on the surrounding wildlife communities.

Teacher Reference Videos

Attenborough, Sir David. *The Private Lives of Plants* (Video series), Turner Home Entertainment, 1995.
Sir David Attenborough, who was responsible for the heralded *Trials of Life* video series, has put together this amazing documentary series that uses advanced camera techniques to show the life processes of plants. Though the entire series may be too advanced for elementary students, it is a wonderful resource for teachers.

Teacher Reference Websites

Botanical Society of America
http://www.botany.org/
Information on the society whose mission is to increase public awareness of botany. Includes links to kids' websites on plants

The South Carolina Native Plants Society
http://www.scnps.org/
Information on the society, on the native plants of South Carolina and on the issues related to native and exotic species. Contains links to related websites.

Student Reference Books

Eyewitness Books: Plant, Alfred A. Knopf, Inc, New York, 1988.

Eyewitness Books: Tree, Alfred A. Knopf, Inc, New York, 1988.
These very attractive books use photographs, illustrations and text to teach the readers about plants and trees. Contains everything from photographs that show how a seedling grows to photographs that show how fallen leaves decompose.

Kalman, Bobbie D. *How A Plant Grows,* Crabtree Publishing Company, 1996.
Text for students on plants that includes information on photosynthesis and the importance of plants to food chains. Includes experiments and activities.

The National Audubon First Field Guide: Trees, Scholastic, Inc, 1999.

The National Audubon First Field Guide: Wildflowers, Scholastic, Inc, 1998
These field guides for children use photographs and text to allow students to identify plants and to learn about their natural history. Also handy as references for teachers.

Zim, Herbert and Alexander Martin. *Trees: A Golden Guide*, Golden Press, New York, 1987.

Zim, Herbert and Alexander Martin. *Flowers: A Golden Guide*, Golden Press, New York, 1987.
These field guides for children use illustrations and text to allow students to identify plants and to learn about their natural history. Though not as attractive as the Audubon guides, they are good references for students and teachers.

Student Fiction Books

Fleischmann, Paul. *Weslandia*, Candlewick Press, Cambridge, Massachusetts, 1999.
This is a picture book, but it is one that can be appreciated by 3rd, 4th and 5th graders. It is the story of an unpopular boy who uses the plants growing in his backyard to create his own civilization. It is a very entertaining story and is effective for showing the dependence of humans on plants.

Giono, Jean. *The Man Who Planted Trees,* Chelsea Green Publishing, 1999.
This is the story of a man who decides to give back to the earth by planting trees in a barren landscape. Considered a classic of juvenile nature fiction.

Morrison, Gordon. *Oak Tree,* Houghton Mifflin Company, Boston, 2000.
The story of an oak tree, how it changes through the seasons and how different animals in the community make use of it. Each page contains natural history information on the various organisms mentioned.

Curricula

Aquatic Project WILD
Aquatic Project WILD is an interdisciplinary curriculum for K-12 teachers on aquatic wildlife and ecosystems. The activities cover a broad range of environmental and conservation topics.
For more information click on http://www.projectwild.org/ProjectWILDK-12AquaticcurriculumandActivityGuide.htm

Hunken, Jorie and the New England Wild Flower Society. *Botany For All Ages: Discovering Nature Through Activities For Children and Adults,* The Globe Pequot Press, Old Saybrook, Connecticut, 1993.
This is a collection of hands-on activities about plants.

Project WILD
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For more information click on: http://www.projectwild.org/