

Lesson 2

Forests

1. Objectives

1. To learn about the layers of the forest and the types of plants and animals that live in each layer.
2. To learn the benefits of forests to the environment and humans.
3. To learn about the parts of trees and their functions.
4. To understand the way that forests help to reduce the impacts of climate change.

2. Outcomes - I will be able to

1. Name the three main layers of the forest.
2. Identify one type of plant and animal that lives in each layer.
3. List three ways trees help the environment and humans.
4. Name the three main parts of trees and explain their functions.

Older students

1. Describe the process of photosynthesis.
2. Explain that carbon dioxide is a greenhouse gas and how it contributes to climate change.
3. Explain how forests are carbon reservoirs and reduce the negative impacts of climate change.

3. Standards Addressed

PA Academic Standards for Science and Technology (2002)

3.1 Unifying Themes

3.1.4A Know that natural and human-made objects are made up of parts.

- Identify and describe what parts make up a system.

3.1.4C. Illustrate patterns that regularly occur and reoccur in nature.

- Identify observable patterns (e.g., growth patterns in plants, crystal shapes in minerals, climate, structural patterns in bird feathers).

3.3 Biological Sciences

3.3.4A. Know the similarities and differences of living things.

- Identify life processes of living things (e.g., growth, digestion, react to environment).
- Describe basic needs of plants and animals.

3.3.4B. Know that living things are made up of parts that have specific functions.

- Determine how different parts of a living thing work together to make the organism function.

PA Academic Standards for Environment and Ecology (2002)

4.2 Renewable and Nonrenewable Resources

4.2.4A Identify the needs of people

- Identify plants, animals, water, air, minerals and fossil fuels as natural resources.
- Identify how the environment provides for the needs of people.

4.2.4B Identify products made from natural resources

- Identify products made from trees.

4.3 Environmental Health

4.3.4C Understand the elements of natural systems are interdependent

- Identify some of the organisms that live together in an ecosystem.

4.6 Ecosystems and Their Interactions

4.6.4A Understand that living things are dependent on nonliving things in the environment for survival.

- Describe how animals interact with plants to meet their needs for shelter.

4.8.4A Identify the biological requirements of humans

- Identify several ways that people use natural resources

4.8.4D Know the importance of natural resources in daily life.

- Identify items used in daily life that come from natural resources.

Lesson 2 Continued

Machinery, Pollution and the Carbon Cycle

1. Objectives - To learn

1. about the process of photosynthesis.
2. about the process of respiration.
3. about how photosynthesis and respiration are interrelated in the carbon cycle.
4. the difference between renewable and nonrenewable energy sources.
5. about how humans can have a negative impact on the carbon cycle.
6. how changes in the carbon cycle can increase the impacts of climate change.
7. how humans can reduce climate change.

2. Outcomes - I will be able to

1. Name the main steps in the process of photosynthesis.
2. Name the main steps in the process of respiration.
3. Trace the steps in the carbon cycle.
4. Explain the reason fossil fuels are nonrenewable resources and wind and solar power are renewable resources.
5. Identify two ways humans have a negative impact on the carbon cycle.
6. Explain how an increase in carbon dioxide in the atmosphere causes climate change.
7. Explain how air pollution can make human diseases worse.
8. Discuss how humans can take action to reduce the impacts of climate change.

3. Standards Addressed

PA Academic Standards for Science and Technology (2002)

3.1 Unifying Themes

3.1.4A Know that natural and human-made objects are made up of parts.

- Identify and describe what parts make up a system.
- Identify system parts that are natural and human-made (e.g., ball point pen, simple electrical circuits, plant anatomy).

PA Academic Standards for Environment and Ecology (2002)

4.2 Renewable and Nonrenewable Resources

4.2.4A Identify the needs of people

- Identify plants, animals, water, air, minerals and fossil fuels as natural resources.
- Explain air, water and nutrient cycles.
- Identify how the environment provides for the needs of people

4.2.4C Know that some natural resources have limited life spans.

- Identify renewable and nonrenewable resources used in the local community.
- Identify various means of conserving natural resources.

4.3 Environmental Health

4.3.4A Know that plants, animals and humans are dependent on air and water.

- Know that all living things need air and water to survive.
- Identify different areas where health can be affected by air, water or land pollution.
- Identify actions that can prevent or reduce waste pollution.

4.3.4B Identify how human actions affect environmental health.

- Identify pollutants.
- Identify sources of pollution.
- Describe how people can reduce pollution.

4.6 Ecosystems and Their Interactions

4.6.4B Understand the concept of cycles

- Explain the carbon dioxide/oxygen cycle (photosynthesis).

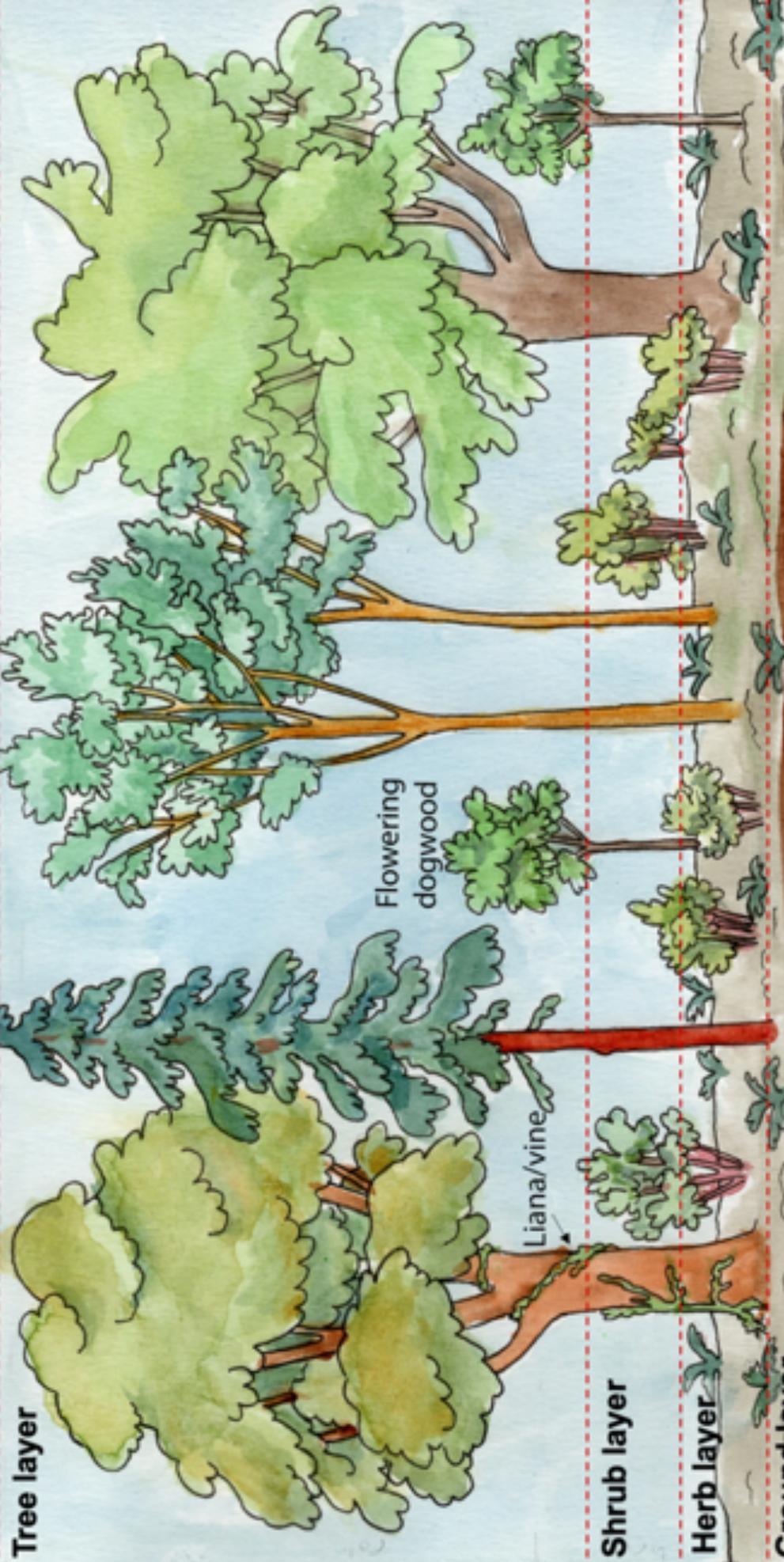
American beech

Trembling aspen

Eastern hemlock

Sugar maple

Tree layer



Flowering dogwood

Liana/vine

Shrub layer

Herb layer

Ground layer

The Forest

Teacher's Guide

Background Information

We live in a temperate climate which means we don't consistently experience extreme heat or cold because of our location between the north pole and the equator. Thus, we have a change of seasons throughout the year with a moderate amount of precipitation. This supports the temperate deciduous forested areas around us.

The temperate deciduous forest has the following layers:

1. Ground layer consists of very small plants that hold the soil in place such as mosses.
2. Herb and shrub layers consist of small plants such as ferns.
3. Tree layer has 2 levels: the understory (young trees) and the canopy (tall, mature trees).



Ground Layer



Shrub Layer



Understory and Canopy Layers

Forests provide many services for us.

1. Food – edible plants, fruits, nuts
2. Homes (habitats) for animals – owls, deer, squirrels, etc.
3. Tree roots hold the soil in place and prevent erosion (movement of soil).
4. Trees are a carbon reservoir. In the process of photosynthesis, they take in carbon dioxide and release oxygen. This helps to reduce climate change and filter the air. The more CO₂ in our atmosphere, the more the temperature increases which can cause an imbalance in our climate.
5. Medicines – Plants such as rosy periwinkle produces medicines to treat leukemia and cinchona trees provide quinine, which is an important medicine for treating malaria.
6. We get timber from trees to produce wood products.
7. Recreation and aesthetics – We can visit natural forests to walk on trails, ride bikes, observe animals, go on nature tours, etc.

The Forest

Teacher's Guide

Activities

1. Remove the layer labels from the forest diagram (provided). Make copies of the forest diagram for each student or groups of students. Place the names on the board and have the students fill them in while describing them.
2. Look around your classroom and identify anything that could have been made from trees. Can you think of anything else you have at home made of wood?
3. Draw a tree and label its parts. Can you explain what each part does for the plant?

Leaves – photosynthesis

Trunk and branches – move water and nutrients from the roots to the leaves and move food from the leaves to the branches and roots

Roots - take up water and nutrients from the soil

4. If you have a forest on your school property or nearby, take a walk to identify the layers and notice the types of plants and animals that live there.

Discussion questions

1. Ask the students if they have ever visited a forest area. Can they describe what they saw? Plants? Animals?
2. How many forest benefits can they name?
3. What do plants in the forest need to live?

Water, sunlight, nutrients from soil, space

4. What is the importance of soil?

Soil provides a substance to anchor the plant and roots to take up water and nutrients.

5. Why do you think specific plants live in certain layers?

Plants can survive with various levels of the items mentioned above. For example, the plants that live on the forest floor require little sunlight. Those in the canopy require a lot.

Older students

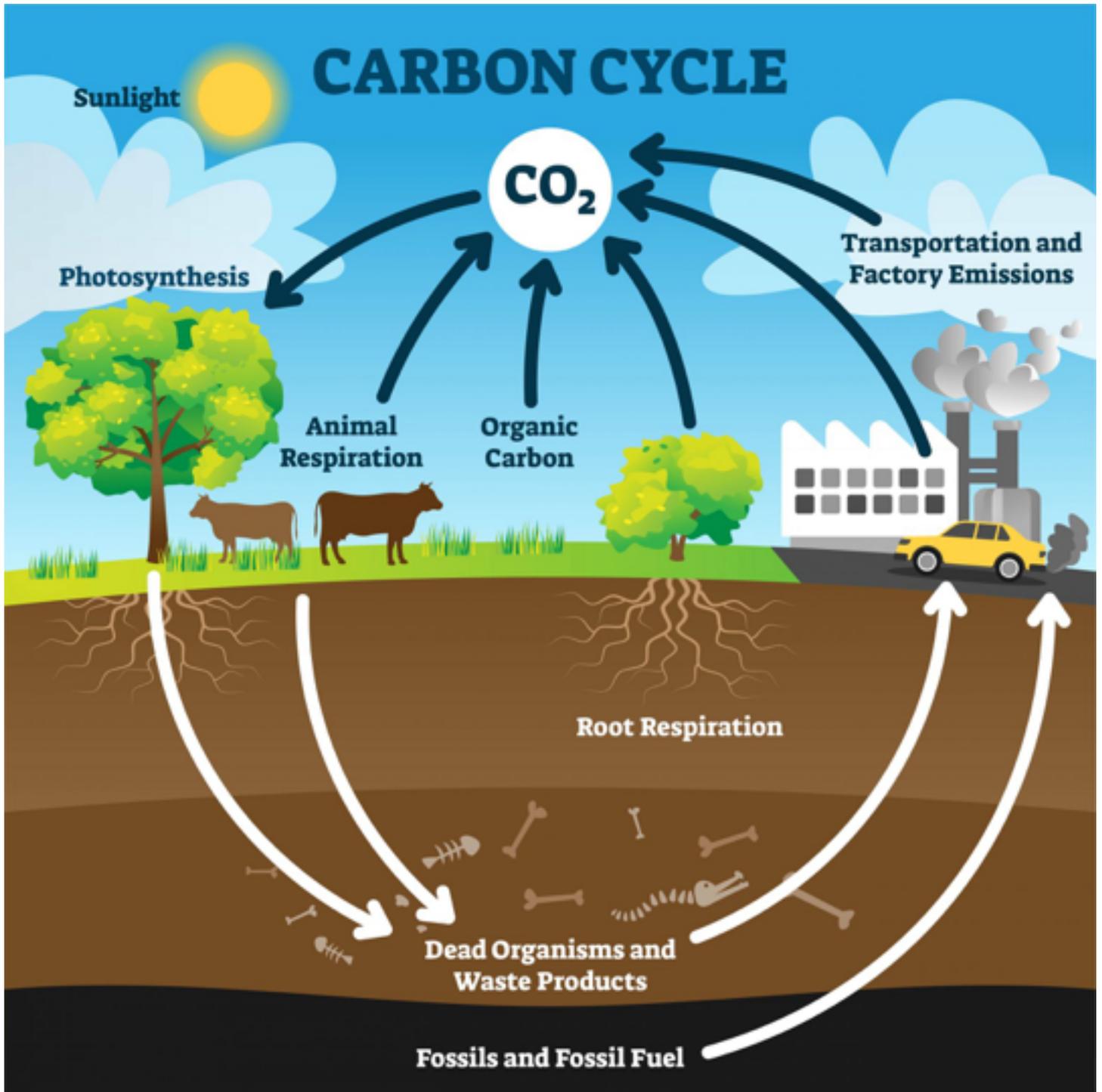
1. Can they describe the process of photosynthesis?

Plants take in carbon dioxide and with the energy from the sun, they make food. They release oxygen as a waste product.

2. How does photosynthesis help reduce climate change?

When carbon dioxide levels increase, usually from burning fossil fuels like coal, oil and natural gas, it heats up the atmosphere. That increase in temperature causes the melting of glaciers, sea levels to rise and an increase in stormy weather. Plants take in carbon dioxide during photosynthesis which helps to reduce the effects of climate change.

CARBON CYCLE



The Carbon Cycle

Teacher's Guide

Background Information

The carbon cycle shows how carbon moves through areas on the earth in different forms. It consists of two main processes.

1. Photosynthesis occurs when plants take in CO_2 (carbon dioxide) from the atmosphere to make food in the presence of sunlight and release oxygen as a waste product.
2. Respiration occurs when animals take in oxygen and while breaking down food in their bodies, they release CO_2 as a waste product. That is why we say humans breathe in oxygen and breathe out carbon dioxide. Plants and animals die and their bodies are decayed in the soil.

Humans have a negative impact on the carbon cycle in the following ways.

1. We remove fossil fuels (coal, oil and natural gas) that were created millions of years ago by mining and drilling underground.
2. When we burn coal in electric power plants, burn natural gas to power manufacturing processes and heat our homes and use gasoline to drive cars, it adds CO_2 to the atmosphere.
3. Carbon dioxide is a "greenhouse gas". That means it acts like a greenhouse and increases the temperature on the surface of the earth.
4. The increased temperature causes ice to melt raising sea levels, increased frequency and severity of storms, droughts, floods, fires, etc. We are experiencing these events currently.

The activities mentioned above can put other pollutants into the air such as mercury, ozone and small particles. These can exacerbate human respiratory problems. Some people suffer from asthma, emphysema and lung cancer.

Activities

1. Remove the arrows from the carbon cycle diagram (provided). Make copies of the diagram for each student or groups of students. Have the students fill in the arrows in while describing the processes.

Discussion questions

1. Have you ever seen smoke coming from a smokestack, chimney or tailpipe on a car? You can actually see pollutants going into the air.
2. Do you know anyone who has trouble with their breathing? How do you think the quality of the air around them affects them?
3. How can we reduce air pollution? What can you do?

Reducing the amount of electricity we use can decrease the amount of coal that is burned to produce it.

4. What about green energy: wind turbines, solar panels? How does that help?

The Carbon Cycle

Teacher's Guide

5. What about electric cars? Don't they use electricity? How are they better for the environment than gasoline engines

Electric cars do use a small amount of energy that has a much lower negative impact than burning gasoline. If the electricity used to power electric cars is produced from green energy (solar panels and wind turbines) instead of burning coal, that would be even better.

6. What else can you do to have a positive impact on the environment?

Reduce the amount of resources you use (plastics) and the waste you produce. Plant a garden. Walk or ride your bike to go somewhere.