



LESSON 2

What Makes a Forest?

BIG IDEAS

- Forests are ecosystems characterized by a dominance of tree cover and they contain a variety of other organisms (e.g., other plants, animals). (Subconcept 1)
- Forests differ in composition (species within a forest) and structure (layers in a forest). These are both affected by biotic (e.g., animals, plants, humans) and abiotic (e.g., soil, moisture, sunlight, climate) factors. (Subconcept 2)

OBJECTIVES

Upon completion of this lesson, students will be able to:

- Define the term “ecosystem.”
- Identify forests as ecosystems with trees as the dominant plant.
- Identify the structural layers within a forest.

SUBJECT AREAS

Language Arts, Science

LESSON/ACTIVITY TIME

- Total Lesson Time: 85 minutes
- Time Breakdown:
 - Introduction.....20 minutes
 - Activity 125 minutes
 - Activity 225 minutes
 - Conclusion.....15 minutes

TEACHING SITE

Classroom

FIELD ENHANCEMENT CONNECTIONS

This lesson ties closely with Field Enhancement 2, *Studying Forest Layers*.

NUTSHELL

In this lesson, students learn about earth systems and what makes a forest ecosystem. Students choose animals and plants they think can be part of a forest ecosystem. They also learn about forest layers by acting out and discussing each layer.

BACKGROUND INFORMATION FROM INDIVIDUALS TO BIOMES

The systems on Earth can be divided into a number of levels. The smallest division is an **individual**. An individual is simply one living thing. A person, a dog, a bear, or a tree are all individuals.

A group of individuals of the same species is called a **population**. A pack of wolves, a stand of aspen trees, or a class of students are all populations.

A group of plants, animals, and other living things living and interacting with each other is called a **community**. A tree, the squirrel that climbs it, the person that rakes the leaves, and the insects that live on the tree are a community. A school with students, teachers, class pets, and plants is a community too.

When we add nonliving things such as soil, air, water, and sunlight, to a community, we get an **ecosystem**. An ecosystem is living organisms interacting with one another and with the nonliving things that make up their environment. Ecosystems can be of any size. An ecosystem can be a pond, prairie, forest, or just a drop of water, as long as there are living and nonliving things interacting. Even things like buildings and cars are nonliving things that can be part of an ecosystem. That means that our cities are ecosystems too.

An ecosystem that covers a whole region of Earth and has distinct seasonal climatic differences, vegetation, and animals is called a **biome**. There are many biomes on Earth.



MATERIALS LIST

FOR EACH STUDENT

- Copy of Student Page  1, *Earth System Puzzle*
- Crayons or colored pencils
- Drawing paper (8.5" X 11")
- Copy of Student Page  3, *Ecosystem Parts Game Score Card*
- Copy of Student Page  6, *Forest Layers Concrete Poem*

FOR EVERY 3 STUDENTS

- Copy of Student Pages  2A-B, *Ecosystem Parts Game Dice*

FOR EVERY 5 STUDENTS

- Set of cards made from Student Page  4, *Forest Layers Cards*
- One envelope labeled "Forest Layers"
- Copy of Student Page  5, *Forest Layers Details*

FOR THE TEACHER

- Copy of Teacher Key  1, *Earth System Puzzle Key*
- Chalk/marker board
- Overhead transparency of Teacher Page  1, *Forest Layers*
- Scissors
- Scotch tape

TEACHER PREPARATION

- Make overhead transparency of Teacher Page  1, *Forest Layers*.
- Assemble ecosystem parts dice from Student Pages  2A-B, *Ecosystem Parts Game Dice* (or have students make them as part of the activity). Use cardstock or glue paper to wooden cubes.
- Copy and cut apart Student Page  4, *Forest Layers Cards* and label envelopes "Forest Layers." Put one set of cards into each envelope for each group of five students.
- Copy one Student Page  5, *Forest Layers Details*, for each group of five students. On each copy mark a different layer with a star. This will be the layer each group will act out in Activity 2.

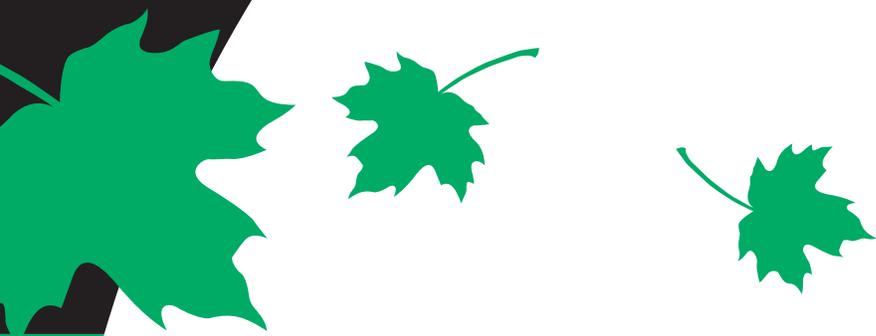
Tropical forest, desert, temperate forest, ocean, and tundra are examples of biomes. Wisconsin's forest biome is the temperate forest.

The Earth is a **biosphere**. All of the land, air, and water that contain living things make up a biosphere.

FORESTS AS ECOSYSTEMS

Forests are ecosystems in which the dominant vegetation is trees. Forests around the world vary in the types of trees, other plants, and animals that live in them. These variations are due to **abiotic** factors such as soil type, moisture,

sunlight, and climate. Examples include the hot and rainy tropical rainforests, the temperate deciduous forests that change with the seasons, and the northern boreal forest, or taiga, which survives in cold temperatures. Depending on your view, Wisconsin's forest ecosystem is one large forest, or many smaller forests. We can even include the urban forests in our cities and towns as forest ecosystems. They include **biotic** (people, squirrels, birds, trees, shrubs, flowers, and grass) and abiotic (sun, water, soil, buildings, and even cars) things interacting with each other.



VOCABULARY

Abiotic: Refers to nonliving things.

Biome: A regional ecosystem characterized by distinct seasonal climatic differences, vegetation, and animals.

Biosphere: The air, land, and water on Earth's surface that contain living organisms.

Biotic: Refers to living things.

Community: A group of plants and animals living and interacting with one another in a given area.

Ecosystem: An area that contains organisms (e.g., plants, animals, bacteria) interacting with one another and their nonliving environment. Ecosystems can be of any size (e.g., forest, meadow, log).

Forb Layer: Layer of the understory containing non-woody plants.

Individual: One living thing.

Litter Layer: Surface layer of the forest floor composed of leaves, twigs, needles, etc., with minimal decomposition.

Overstory: The uppermost trees in a forest.

Population: A group of individuals of the same species in an area.

Shrub Layer: Layer of the understory containing woody plants with multiple stems.

Understory: Forest vegetation present under the overstory, which can include trees, shrubs, and forbs.

LAYERS OF A FOREST

A mature forest is made up of structural layers.

- The **overstory** is made up of the crowns of the uppermost trees in the forest.
- The **understory** is made up of the crowns of shorter forest trees and includes:
 - The **shrub layer**, made up of woody plants with multiple stems.
 - The **forb layer**, made up of non-woody plants.
- The **litter layer** includes the leaves, branches, and other debris that have fallen onto the forest floor.

These layers add another dimension to forest ecosystems. There are many possible combinations of layers, which lead to a wide variety of forest ecosystems. A forest without a substantial forb layer will not have as many small ground-dwelling animals such as mice and rabbits. Certain birds survive in the overstory and rarely come into the lower layers. This means that the different layer combinations offer a wider opportunity for biodiversity. Understanding what layers exist in a given forest and what the benefits and drawbacks are to the different structures helps us understand how forests function.

PROCEDURE INTRODUCTION

1. Tell students they will be putting together a puzzle about Earth. Hand out Student Page  1, *Earth System Puzzle*, and have students cut out the puzzle pieces.
2. Tell students they will first need to match the pictures to the appropriate definition. When the pictures and descriptions have been matched, they will put them in order from the smallest to the largest. (*Individual, population, community, ecosystem, biome, biosphere.*) (See Teacher Key  1, *Earth System Puzzle Key.*)

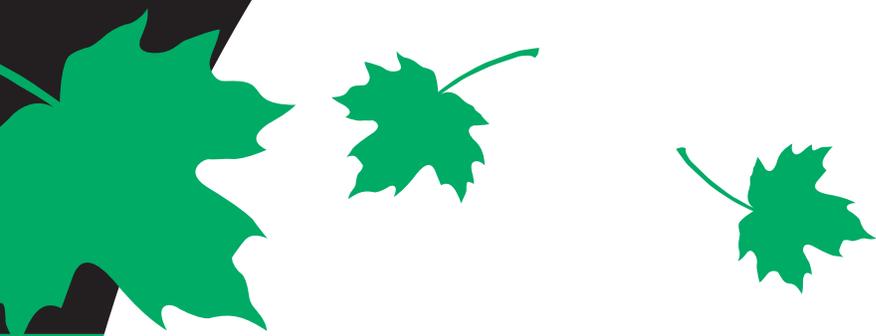


3. When they have completed their puzzles, point out the ecosystem description. Tell students that they are going to learn more about ecosystems next.

OPTION: Have several students work in a group to put the puzzle together.

ACTIVITY 1

1. Ask students to remember the definition of ecosystem from the introduction. (*An area that contains organisms [e.g., plants, animals, bacteria] interacting with one another and their nonliving environment. Ecosystems can be of any size [forest, meadow, log].*) Write the definition on the board. Stress the importance of living and nonliving things interacting together. Tell students that an ecosystem can be of any size as long as it meets those criteria.
 2. Ask students to think about the definition of ecosystem and list some examples of ecosystems on the board. (*Wetland, pond, desert, lake, field, ocean, forest, prairie, log.*) If students don't list forests, remind them that forests of all sizes are ecosystems too. Ask what the main difference between a forest ecosystem and one of the other ecosystems is. (*Trees grow in forest ecosystems, but not necessarily in all the others.*) Tell students that forests are ecosystems that are dominated by trees.
 3. Divide students into groups of three. Give each group a set of *Ecosystem Parts Game Dice*. (One plant, one animal, one abiotic.) **NOTE:** If you have not made the dice ahead of time, have students make them now.
 4. Explain the rules of the game.
 - a. Each student is trying to collect parts to make a forest ecosystem. They collect those parts by rolling dice, and keeping track of the ecosystem parts they have collected by marking them on Student Page **3**, *Ecosystem Parts Game Score Card*.
 - b. Students take turns rolling the dice. Each student will roll all three dice at once.
 - c. If they choose to keep what is on the dice as part of a forest ecosystem, they write the name of that item in the appropriate box on their score card.
 - d. If they choose not to keep the things they rolled on one or more of the dice, they may roll those dice again. (For instance, if in the first roll they rolled a tree, sun, and whale, they should keep the tree and sun and roll again to try to get an animal that lives in a forest ecosystem.) If they get parts on the second roll that fit into the forest ecosystem, they record them on the score card. If not, their turn is over and they mark that column with an "x."
 - e. Play will continue for four rounds. At the end of four rounds, the student(s) with three plants (at least two must be trees), three animals, three abiotic parts (at least one sun and one water) have a forest ecosystem. (**NOTE:** Animals and plants must be forest ecosystem related. The cactus, cattails, zebra, bison, and whale do not count.) If no one has these minimums, continue with another round until the criteria are met.
5. Discuss the ecosystem parts that were on the dice. Discuss why we asked them to find two trees. (*A forest ecosystem is identified by the fact that trees dominate the ecosystem.*) Discuss and list other things that they might list as parts of a forest ecosystem. (*Birds, bears, people, ferns, lichens, soil, rocks, etc.*) Ask students if all of their forest ecosystems were the same. (*Probably no. Some may have had three trees, some may have had different forest animals.*) Just as in the forests of Wisconsin, their ecosystems varied.



ACTIVITY 2

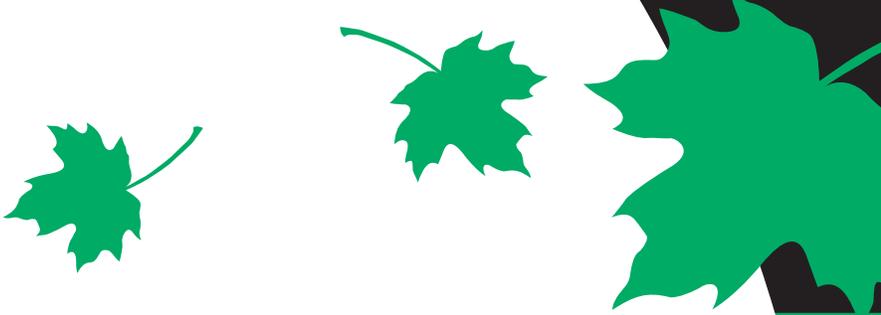
1. Discuss that forests have layers. (*Overstory, understory, shrub, forb, litter.*) The layers are made up of different plants that have different characteristics. Explain that the students are going to receive descriptions of a forest layer and will be acting out and describing the layer to the other students in their group.
2. Divide students into groups of five. Give each group a Forest Layer envelope you prepared earlier.
3. Instruct each student in each group to take out one card. The card they draw will give the name of a layer of the forest. Each student should decide how he or she will act out that layer. For instance, the overstory may be represented by stretching arms upward; the litter layer may be represented by lying flat on the floor.
4. Once students read their cards and decide what to do, they should take turns demonstrating for their own group what action they are doing. They should also describe the layer that it represents in their own words. When the groups have gone through their descriptions the whole group should act out their layers and become a forest.
5. Explain to students that now each group will be acting out one of the layers. Hand out Student Page  5, *Forest Layers Details*. (You need to mark a different layer on each group's sheet before you hand them out.

The other groups should not know which group is being assigned which layer.) Have students decide how they will act out their layer for the rest of the class in charades fashion. The class should guess which layer they are acting out. **NOTE:** If students do not know any of the plants and animals listed, allow them to use books and other resources to research their layer before moving on.

6. After each group has had an opportunity to act out their layer, display the Teacher Page  1, *Forest Layers* overhead transparency. Discuss the layers the students have just learned about as a class. Explain that different layers provide habitat for different animals. Discuss that since there are many different combinations of layers possible, there are also many possibilities for different forest ecosystems.

CONCLUSION

Hand out Student Page  6, *Forest Layers Concrete Poem*. Explain to students that they will be writing a concrete poem. A concrete poem is written in a shape that represents something they are writing about. They should write a poem about each of the forest layers inside the appropriate layer on the worksheet. When everyone has written their concrete poems, have students share their poems with the class.



CAREERS

The career profile in this lesson is about Alan Haney, Ecologist, UW-Stevens Point. Career Profile 4B.E is found on page 40. Use this profile to enhance the lesson and/or use it with the special careers lesson on page 148.

SUMMATIVE ASSESSMENT

Have students write a paragraph and draw a picture discussing the similarities and differences between a forest ecosystem and another ecosystem, such as a prairie or wetland.

REFERENCES

Bush, M. B. (1997). Ecology of a Changing Planet. Upper Saddle River, NJ: Prentice Hall.

Cunningham, W. P., Woodworth Saigo, B. (2001). Environmental Science: A Global Concern. Madison: McGraw-Hill Higher Education.

Stiling, P. D. (1996). Ecology Theories and Applications. Upper Saddle River, NJ: Prentice Hall.

RECOMMENDED RESOURCES

●●● WEBSITES ●●●

Mighty Trees

www.mightytrees.com/science/foreststrat.html

This southeastern site has an interactive illustration of the layers of a forest with explanations.

MBGNet

<http://mbgnet.mobot.org/>

This website from the Missouri Botanical Gardens is designed for kids. It gives information about the temperate forest biome, including explanations about the animals that live there and the weather conditions that make it unique. Other biomes of the world are also included.

●●● BOOKS ●●●

One Day in the Woods by Jean Craighead George. (New York: Harper Collins Publishers, 1988.)

In this illustrated book, a girl climbs a tree and observes the things around her. It examines forest layers, habitat, birds, animals, insects, and forest characteristics.

Temperate Deciduous Forest by April Pulley Sayre. (New York: Twenty-First Century Books, 1994.)

This book looks at temperate forest biomes and the plants and animals in them. It talks about communities, people and forests, and the abiotic factors that influence them.

ALAN, ECOLOGIST

Meet Alan Haney. Alan is a Forest Ecologist. He has two jobs that are related. As an ecologist, Alan studies forest communities. He looks at how all the things in a forest relate to each other. He also is a Professor of Forestry at the University of Wisconsin-Stevens Point, so he teaches college students about forests. Sometimes he teaches other adults about forests too. Foresters can use what Alan learns to make decisions about forests.

Alan went to college for nine years to earn a PhD. He has taught, done research, and managed forests for 35 years. Alan has worked in six different states. Even before he went to college and worked at different jobs, Alan was learning about the outdoors. He grew up on a farm and learned how plants and animals rely on the environment around them. Alan is a member of different organizations that focus on forests and birds.

Alan says that his favorite part of his job is, "Sharing my love of forests with others and being outside, especially in the woods."

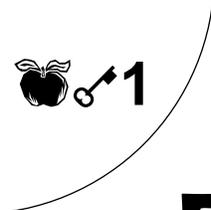
If you would like to be a forest ecologist like Alan, he says you should study science and mathematics. He also says you should take every chance you can to get into forests with groups of people who like the same things you do.



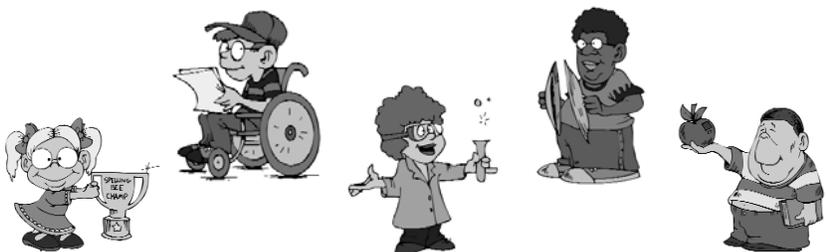
Alan studies many forested areas, including this one that was damaged in a windstorm.

EARTH SYSTEM PUZZLE

<p>COMMUNITY: A group of plants and animals living and interacting with one another in a given area.</p>	
<p>BIOSPHERE: The air, land, and water on Earth's surface that contain living organisms.</p>	
<p>INDIVIDUAL: One living thing.</p>	
<p>ECOSYSTEM: An area that contains living and nonliving organisms interacting with each other.</p>	
<p>BIOME: A regional ecosystem characterized by distinct seasonal climatic differences, vegetation, and animals.</p>	
<p>POPULATION: A group of individuals of the same species in an area.</p>	

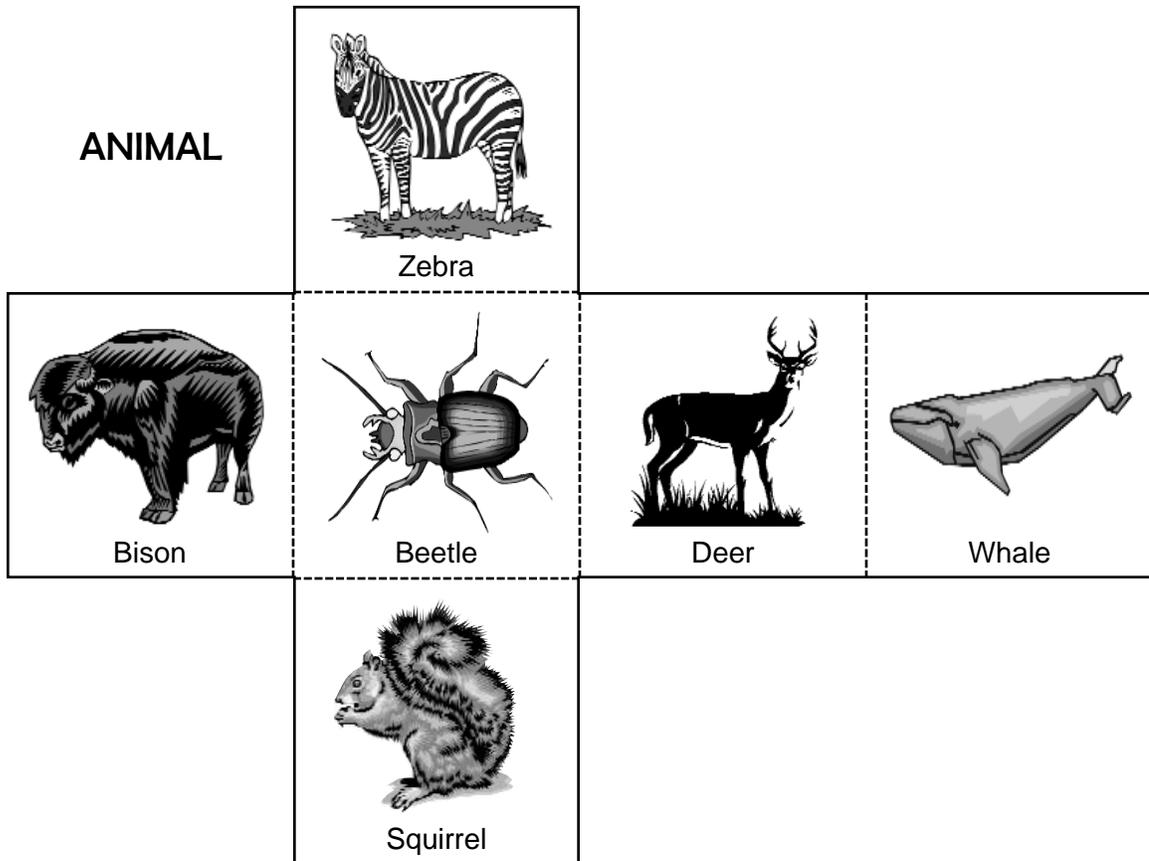
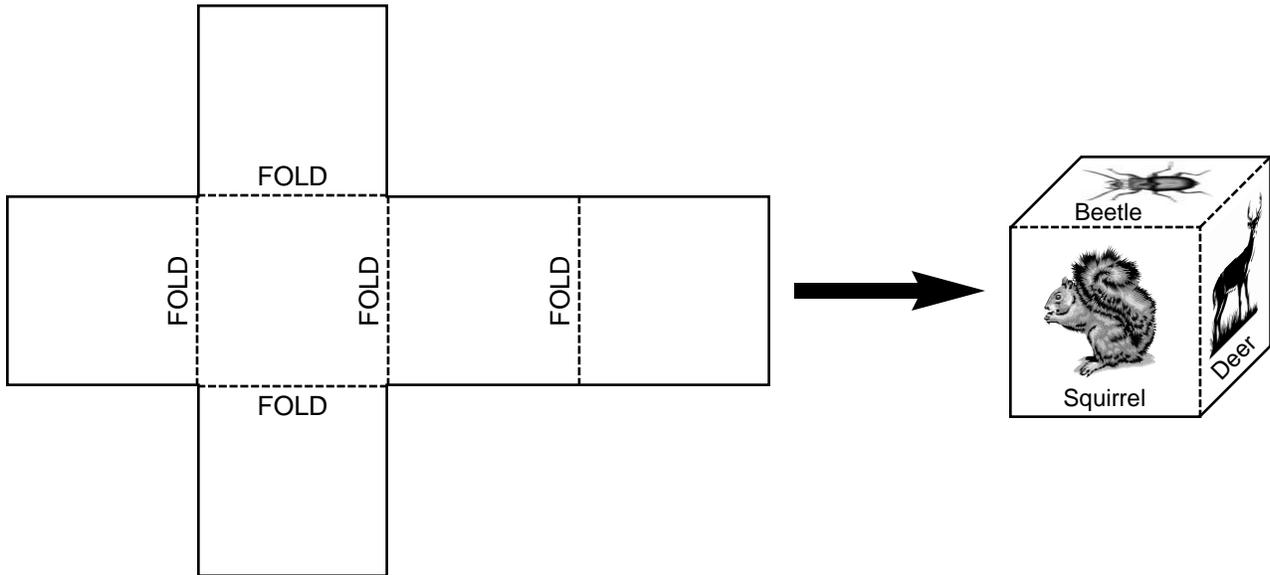


EARTH SYSTEM PUZZLE KEY

<p>BIOSPHERE: The air, land, and water on Earth's surface that contain living organisms.</p>	
<p>BIOME: A regional ecosystem characterized by distinct seasonal climatic differences, vegetation, and animals.</p>	
<p>ECOSYSTEM: An area that contains living and nonliving organisms interacting with each other.</p>	
<p>COMMUNITY: A group of plants and animals living and interacting with one another in a given area.</p>	
<p>POPULATION: A group of individuals of the same species in an area.</p>	
<p>INDIVIDUAL: One living thing.</p>	

ECOSYSTEM PARTS GAME DICE

Copy and cut out all three dice patterns.
 Fold along the dotted lines and tape edges together to create a cube as shown.



ECOSYSTEM PARTS GAME DICE

PLANT



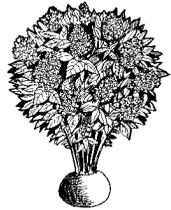
Violet



Conifer Tree



Cactus



Shrub



Cattails



Deciduous Tree



Dead Logs

ABIOTIC



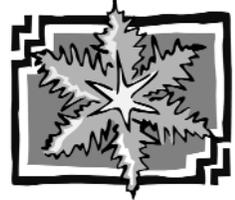
Water



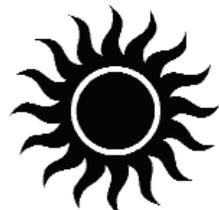
River



Temperature



Snow



Sunlight

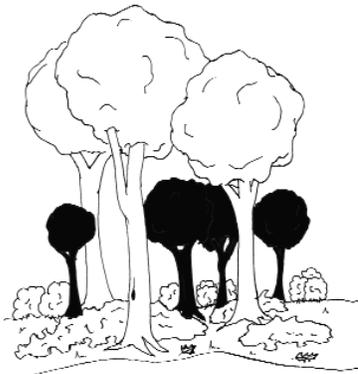
ECOSYSTEM PARTS GAME SCORE CARD

ROUND NUMBER	PLANT	ANIMAL	ABIOTIC	<p>In order to have a forest ecosystem you must get:</p> <ul style="list-style-type: none"> • At least three plants that live in a forest (two must be trees) • At least three animals that live in a forest • At least three abiotic parts (at least one sun and one water)
1				
2				
3				
4				
5				
6				
7				
8				

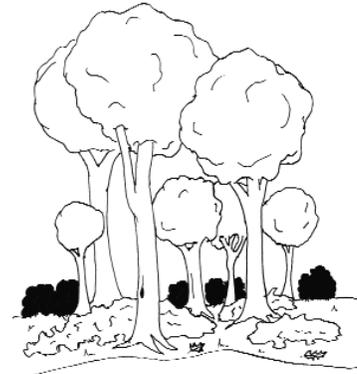
FOREST LAYERS CARDS



Overstory: The tallest trees in a forest.



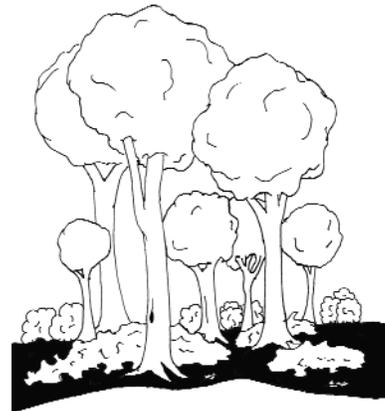
Understory: Includes young trees that haven't yet reached the overstory. It also includes the shrub and forb layers.



Shrub: Part of the understory containing woody plants with multiple stems (shrubs).



Forb: Part of the understory containing non-woody plants like flowers and ferns.



Litter: Surface layer of the forest floor made of leaves, twigs, needles, etc.

FOREST LAYERS DETAILS



OVERSTORY: The tallest trees in a forest.

Plants that grow in this layer are: white pine, red pine, sugar maple, red maple, white ash, red oak, white oak, trembling aspen.

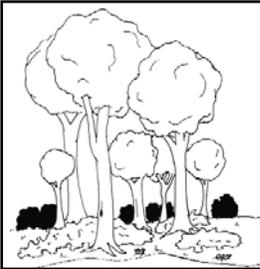
Animals that live in this layer are: blue jays, owls, orioles, hawks, woodpeckers, eagles, squirrels, crows, turkeys, porcupines.



UNDERSTORY: Includes young trees that haven't yet reached the overstory. It also includes the shrub and forb layers.

Plants that grow in this layer are: choke cherry, pin cherry, serviceberry, eastern red cedar, ironwood, and musclewood.

Animals that live in this layer are: blue jays, owls, orioles, squirrels, woodpeckers, crows, turkeys, porcupines.



SHRUB: Part of the understory containing woody plants with multiple stems (shrubs).

Plants that grow in this layer are: raspberry, maple-leaved viburnum, dogwood, witch hazel.

Animals that live in this layer are: squirrels, deer, robins, chickadees, warblers, sparrows, finches, cardinals, mourning doves, grosbeaks.



FORB: Part of the understory containing non-woody plants like flowers and ferns.

Plants that grow in this layer are: bracken fern, wild columbine, lady slipper, violet.

Animals that live in this layer are: chipmunks, snakes, toads, mice, moles, grouse, turkeys, rabbits, insects, turtles, spiders.



LITTER: Surface layer of the forest floor made of leaves, twigs, needles, etc.

Things you will find growing in this layer are: moss, fungus.

Animals that live in this layer are: worms, beetles, ants, centipedes, pill bugs.

FOREST LAYERS



OVERSTORY: The tallest trees in a forest.



UNDERSTORY: Includes young trees that haven't yet reached the overstory. It also includes the shrub and forb layers.



SHRUB: Part of the understory containing woody plants with multiple stems (shrubs).



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FOREST LAYERS CONCRETE POEM

