Lesson Summary

This activity helps students explore the connections between and among living and nonliving components of a healthy natural forest ecosystem. Students discover that biota are intimately connected with abiotic components of the environment and that there are various interdependent relationships between living organisms as they feed upon, shelter among, and compete with each other. They learn how to define an ecosystem using a forest as an example. They also learn that a healthy ecosystem functions because of the presence, strength, and quality of interrelationships among biota and their environments.

The activity makes use of nature exploration and observation to introduce students to these forest elements. Students go on a scavenger hunt in the forest, and later in the classroom they compare notes and observations to come up with a definition of a forest ecosystem. Students then enact an ecosystem using sounds, motions, and facts about forest elements. They later discuss the relationships observed between organisms and their environment and the quality of the forest as a result of these connections.

Background

The Elements of an Ecosystem

Florida holds many diverse and unique ecosystems. Each ecosystem is a physical area incorporating living organisms, nonliving features such as rocks, soil, and dead organic matter, and the natural cycles of water, carbon, and nutrients. Ecosystem function is determined by the interplay between the three elements—the biotic, the abiotic, and the nutrient cycles that transfer nutrients between the two.

Ecosystems are characterized by their biota and it is sometimes seems that the biotic elements are the most important. However, abiotic features of an environment lay the foundation on which biota flourish—topography, local climate, soil characteristics, and water availability favor specific organisms adapted to thrive in particular environments. Likewise the processes responsible for cycling air, water, and other nutrients within the ecosystem also determines the composition and quality of biotic features found there.
Trophic Levels in an Ecosystem

Although the species of organisms may differ from location to location, most forests are home to many of the same categories of living things. Nearly all forests contain canopy trees, understory trees and shrubs, groundcover plant species, insects, birds, mammals, fungi, and microbial decomposers. Each category of organism performs an indispensable function in the forest. In essence, each category occupies a niche in the ecosystem and exchanges or provides vital resources that all other components of the ecosystem depend upon. For example, trees form the base of the food web in a forest ecosystem.

As a result, trophic levels, or production and consumption levels, are an important concept in a forest ecosystem. Organisms occupying each trophic level provide food and energy for those at higher levels. Primary producers include plants, which make their own food through photosynthesis, and some bacteria, which use chemical synthesis. Trees are the most important, and most visible, primary producers in a forest (see Extension to PLT Activity 42: Sunlight and Shades of Green [page 52] for more on this concept).

Primary consumers are organisms that eat primary producers to make energy. Those that feed on plants are also called herbivores (see Extension to PLT Activity 25: Birds and Worms [page 22] for more on this concept). Secondary consumers are organisms that typically eat other consumers. Some examples include bobcats, owls, praying mantises, rats, and snakes. They may be carnivores, eating only other animals, or omnivores, eating a combination of plant, animal, and fungal matter.

Finally, decomposers are organisms that eat dead or decaying organisms. In a forest, as with most ecosystems, decomposers can be some of the most numerous of organisms—numbering in the trillions. But decomposers often go unnoticed. Most of them, such as bacteria and fungi, are microscopic. Many of them live secretive lives—carrion beetles, bark beetles, fly maggots, and earthworms may be found within a decomposing animal, underground, or within leaf litter or logs. Yet decomposers unquestionably perform one of the most important roles in the ecosystem, that of releasing nutrients locked up in plant and animal matter and cycling it back into the ecosystem (see Extension to PLT Activity 24: Nature’s Recyclers [page 20] for more on this concept).

Each trophic level helps to support the food web in a forest ecosystem. If all of the organisms within a trophic level are extirpated, the food web is drastically changed and may become unbalanced. Therefore, the interdependence of organisms within each trophic level is important to maintain a healthy forest ecosystem. If only one element is removed, however, the forest may continue unphased. A healthy forest is resilient and can withstand some degree of change (see Extension to PLT Activity 45: Web of Life [page 16] for more on this concept).

Ecosystem health: A function of biotic relationships

Trophic levels illustrate consumption relationships, but an ecosystem’s biota interact in many other ways. Some of the most commonly illustrated symbiotic relationships between organisms are competition, parasitism, mutualism, and commensalism (see Extension to PLT Activity 26: Dynamic Duos [page 43] for examples of the latter three such relationships in Florida). These relationships may not always relate to the obtaining of food, and may focus on other needs, such as a place to live, type of shelter, or an aid to reproduction. The strength and complexity of these connections between organisms often reflects the general health of the ecosystem as well.

Competition is a relationship in which two or more organisms in the same environment vie for the same resources. In this type of relationship, both organisms are negatively impacted. For example, when two trees are planted close to one another, they may compete for sunlight, water, and nutrients. Therefore, each tree obtains fewer resources than if they were farther apart.

Parasitism is a relationship in which one organism gains from the relationship while the other is negatively affected. Mistletoe, for example, is a tree parasite that steals nutrients and water from its hosts, giving nothing in return.

Mutualism is a relationship in which both organisms involved benefit from the interaction. During pollination, for example, hawk moths and hummingbirds obtain a sugary, energy-rich meal of nectar from flowers while becoming pollen couriers aiding in the plant’s reproduction.
Getting Ready

- Read the Background, Doing the Activity, and Student Page sections to familiarize yourself with the material.
- Prepare the supplies outlined in the Materials section.
  - For each student:
    - 1 notebook or journal.
    - 1 writing utensil.

Finally, commensalism is a relationship in which one organism benefits while the other is unaffected. An orchid growing on a tall cypress tree is a perfect example of commensalism. The orchid is an epiphyte, using another plant as an anchor upon which to grow. From its high vantage point on the cypress, it can access sunlight as well as water and nutrients trickling off branches in the canopy. The cypress tree is not harmed in this relationship but does not gain any benefit either.

In addition to these symbiotic relationships, many others exist. Although only one relationship was illustrated for each of the previous examples, a single organism typically maintains many symbiotic relationships with surrounding biota. The complexity of these relationships demonstrates the intricacy of a healthy, self-sustaining ecosystem. The health of a forest is not dependent on the success of an individual organism. Individual plants, mammals, birds, and insects are constantly sprouting, growing, migrating, or dying in the forest. They each belong to a larger population that may shrink or swell depending on seasonal variations in nutrient availability, predation pressure, and other such factors. Losing one individual animal or plant that is part of a larger population will not affect the forest ecosystem as a whole—it happens every day! However, a significant change in a population can cause an effect. A population is dependent on and can impact the overall health of the forest ecosystem in a variety of ways.

For example, if a disease-causing fungus enters a forest and kills off all the oak trees, this might result in a cascading series of effects—the organisms that feed on the acorns from the oak trees might starve, change what they eat, or migrate to other forests; other tree species would fill the niche left by the oak trees; epiphytes, insects, and fungi dependent upon oaks for their survival would have lost a habitat, and if these organisms preferentially inhabited oaks, they could decline. To understand forest health is to recognize the various interconnections between species and their environment, and to learn how to anticipate the consequences, good and bad, of changes made to an ecosystem.

Doing the Activity

Part A: Scavenger Hunt in the Forest
30 minutes

Take it outside.

1. Take students to a wooded area near your school. Students should bring notebooks and writing instruments. Tell students they will be going on a forest scavenger hunt. During this hunt, ask students to search the area for evidence of five animals, five plants, and three nonliving things, and make notes or sketches about each—what it is, where it was found, what it looks like, why it caught their eye. If they think any of the items on their list might have some relationship to something else on the list, ask them to make a note of that as well—for instance, if they make put down “soil” and “maple tree” then one connection between the two would be that the tree grows in the soil.

Traces of an animal in the area, such as prints, feathers, or feeding marks on leaves and twigs, may be used as evidence. Samples of plants, such as seeds, pieces of bark, or fallen leaves, may be collected in some natural areas and forbidden in others—draw students’ attention to park rules about collecting. Forewarn students not to touch poison ivy, poison oak, and any other stinging, thorny, or toxic plants in the area. It may be advisable to provide gloves and plastic bags to students keen on collecting samples to take back to class, but notes and sketches should be sufficient. Students may pair up while searching, but each should make independent notes and sketches.
2. When you return to the classroom, pair up students (not the same pairs as in the forest) and ask each pair to share and exchange their observations and notes. Distribute large sheets of newsprint and markers and ask them to work together to come up with an answer to the question, “What makes up an ecosystem?” They should diagram what they think an ecosystem looks like, either listing or drawing ecosystem elements. Below their diagram, ask them to write their definition or description of an ecosystem.

Encourage students to include living and nonliving components in their definition. Have them use their scavenger hunt notes, but also suggest that they can record additional things they noticed in the forest.

3. When students are finished, collect the diagrams and tape them to the classroom walls. Allow students to walk around and examine each other’s work. After students have had a chance to see what their classmates have come up with, ask each pair to explain their diagram and definition to the class.

4. Discuss with students what makes an ecosystem, based on everyone’s notes and observations. Write down key terms or components on the board. Once the class has come to an agreement on a definition of an ecosystem, write it on the board. Explain that forests are ecosystems made up of interacting biotic and abiotic elements.

Although students were asked to find plants, animals, and nonliving things in the forest, these categories do not include all that one might find in an ecosystem. Ask if any students observed toadstools or mushrooms, the fruiting structures of some fungi. Most fungi are invisible most of the time, but forests are full of them! What else might students not have noticed? You may start a discussion on the overlooked or invisible components of a forest ecosystem—bacteria, fungi, nematodes, pollen and fungal spores in the air, nutrients in the soil, and so on.

Part B: Acting Out a Forest
60 minutes

5. Distribute the forest ecosystem component cards. Explain that each student will represent a component in a 100-acre forest in Florida.

Have students form a circle. They will be sharing the information on their card with the rest of the class, first by reading the card aloud, then acting out the role with sounds or motions. Each card is numbered from 1 to 32. Ask students to come into the circle in order starting from number 1. Each student, as they enter the circle, may interact with any of the previously introduced components. Encourage students to make descriptive noises and motions, moving, hiding among, and engaging with other members within the circle.

6. After everyone has read and acted out a card, ask students to share their thoughts about the different relationships they’ve seen between living and nonliving components of forests.

7. As a class, try to improve on the original class definition of an ecosystem. Use this discussion to introduce some important concepts of forest ecosystems using the Background section as a guide. For instance, point out the importance of the connections between biota, abiotic components, and nutrient cycles. Also address various relationships between biota, such as herbivory or commensalism.

8. Work as a class to categorize the forest ecosystem components. It may be helpful to ask each student to write the name of their component on a sticky note. Clearly define parts of the chalk board for nonliving and each living trophic level (primary producers, primary consumers, secondary consumers, decomposers) and challenge students to place their ecosystem component sticky note under the correct category.

9. Ask students to identify the types of interactions exhibited in the forest ecosystem. Use this as an opportunity to reapply the concepts of parasitism, mutualism, competition, and so on. Explain that these interactions occur in other ecosystems as well. Ask students to brainstorm what species would perform each role in other ecosystems, such as a lake, a grassland, or a desert.

10. Discuss the concept of ecosystem health. What do students think are the important components of a healthy forest ecosystem? Can a forest do without one of these components?

Healthy forests include living organisms and nonliving components that interact with each other. The components of an ecosystem are dependent upon each other, so if an entire component disappears, others will have to compensate. They may need to find new sources of shelter, nutrients, or water. Generalist species that can use a variety of resources may not be affected much by changes to the ecosystem. Specialist species that rely upon a single source of nutrients or a specific habitat may die out as well, adding to the cascade of ecosystem changes (see Extension to PLT Activity 45: Web of Life [page 16] for more on this concept).
11. Discuss with students the importance of scale in a forest. Will the forest miss an animal if it dies? Will the forest miss a population of animals if they all die out? Is there a difference between the death of one tree in a forest, perhaps because it could not obtain enough water due to competition, or an entire stand of trees dying because of drought? Does it matter if the drought is natural or caused by people draining water from the area?

Be sure that students understand the difference between an individual organism dying versus an entire population, or a pocket of an ecosystem experiencing a dip in nutrient availability versus the entire forest losing a nutrient source. The magnitude of the impact and its consequences is very different in each case—ecosystems are constantly experiencing micro-scale changes in nutrient levels and organisms, but it is the broad-scale fluxes, such as the disappearance of an entire species, that can have significant consequences.

12. Ask students to look at the board where the ecosystem component sticky notes are posted. Instruct students to draw a picture showing the relationship between five of the living organisms and two nonliving components from the forest ecosystem using pictures, labels, and connecting arrows. Challenge the students to write a paragraph elaborating on the system they just illustrated. The following questions may guide students as they write their paragraphs:

- Describe each component as living or nonliving, common or rare.
- If living, does this component have a large population?
- If nonliving, is this component found everywhere, or only in some places?
- What kind of living organism is it—a primary producer, primary consumer, secondary consumer, or decomposer?
- What type of nonliving component is it? How do the living organisms depend on this nonliving component?
- How are the elements of the forest connected to each other?
- Are there any elements of the forest connected to each other element?

Assessment

Using students’ answers to various steps in Doing the Activity, check that they can do the following:

- Make observations of living and nonliving forest elements. 
  Seen in students’ notebook entries in step 1.
- Analyze observations to define a forest ecosystem.
  Seen in students’ diagrams in step 2.
  Note that this is not an individual assessment.

- Describe five living and two nonliving components of forest ecosystems.
  Answered in students’ responses to step 12.
- Identify two connections between living and nonliving components of a forest ecosystem.
  Seen in students’ diagrams from step 12.

Extension Ideas

- Watch a movie about an ecosystem not yet explored. Ask students to identify relationships between living and nonliving elements in the film. You can ask students to research some of the organisms and make their own component cards for the ecosystem in the movie.
- Ask each student to research more information about their ecosystem component cards, and prepare a short presentation to the class. Encourage students to be creative and share interesting facts with the class about their research topic.

Resources and References

- The University of Florida’s SFRC Extension website for educators includes pictures of the organisms introduced in this activity. You may wish to combine these pictures with the ecosystem component cards in the Student Page section. Visit [http://sfrc.ufl.edu/extension/ee/foresthealth.html](http://sfrc.ufl.edu/extension/ee/foresthealth.html)
- UF IFAS Extension’s Solutions for Your Life includes information on various Florida ecosystems in ‘Ecosystems & Species.’ Visit [http://solutionsforyourlife.ufl.edu/environment/ecosystems_and_species.html](http://solutionsforyourlife.ufl.edu/environment/ecosystems_and_species.html)
### Instructions

Make copies and cut out the thirty-two ecosystem components on the following pages. Each student should receive one card. If you have more students than cards, allow some students to share a card, or make a few extra copies.

#### 1. Sun
I am the sun. I shine light into the forest, helping plants produce food through photosynthesis. This food helps the plants grow leaves, fruits, seeds, and nuts, which are important food sources for the insects, birds, and mammals that call this forest home.

#### 3. Eastern fox squirrel
I represent one of several species of squirrels, and one of 40 eastern fox squirrels in this forest. I am dark grey or black with white markings across my eyes and tail tip. I eat fruits, nuts, and seeds. I bury acorns in hiding places but sometimes forget about them. These forgotten acorns can sprout into new oaks. I love pine cones. I eat them like you eat corn on the cob!

#### 5. Live oak seedling
I represent one of hundreds of live oak seedlings growing in this forest. Mammals and birds spread acorns from older live oak trees around the forest. I like sunlight and moist areas. I wait in the shade for one of the older trees to die and fall over. Then I might grow up into the canopy where the old tree once stood.

#### 7. Lightning
I am the discharge of electricity from a thundercloud. I hit forests during storms, usually in the summer months. I send a bolt of electricity down through the atmosphere toward the Earth’s surface. If I hit a tree, I can crack its trunk, set it on fire, or damage its phloem, preventing it from carrying food and water to and from its leaves and roots. I can cause a tree to die.

#### 2. Live oak
I represent one of many species of oak and one of 60 live oak trees in this forest. I can reach heights of 85 feet tall. My large branches stretch out from my trunk and grow low to the ground. I prefer moist woods or coastal sandy soils. I produce hundreds of sweet, tasty acorns that deer and squirrels love to eat.

#### 4. Slash pine
I represent one of hundreds of pine trees that grow into the forest canopy. I am a tall tree that enjoys wet soils and swampy areas. I can grow up to 115 feet tall and like lots of sunlight. Eastern fox squirrels love to eat the seeds from my pinecones. The fox squirrels actually help spread my seeds through this forest.

#### 6. White-tailed deer
I represent one of many species of mammals and one of 7 white-tailed deer living in this forest. I eat acorns and fruits from plants such as live oaks and sparkleberry. In the winter I eat twigs and branches. I can run very fast and travel many miles throughout the forest, so I must eat a lot to give me energy. Some people hunt me for food and sport.

#### 8. Decaying log
I was once a huge tree that got hit by lightning five years ago. My phloem was damaged and I died. My body provided a home and food to southern pine beetles. When my roots rotted, I fell to the ground, making a new home for many insects, worms, fungi, and nematodes. These creatures break down my wood and add nutrients to the soil for new trees to grow. I am now one of 25 logs still visible on the ground in this forest.
<table>
<thead>
<tr>
<th>9. Earthworm</th>
<th>10. Soil</th>
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<tbody>
<tr>
<td>I am one of millions of earthworms in the soil of this forest. I am a decomposer, eating plant debris such as dead leaves and twigs. As I digest food, I break it down and mix it with secretions from my intestine before releasing it into the soil. This adds important nutrients to the soil, which helps plants and trees to grow. Birds dig around in the soil and enjoy me as a yummy snack!</td>
<td>I am found under the leaf litter layer of the forest floor. I am made of rock and sand minerals, and the remains of dead plants and animals that have been eaten by insects and earthworms. Although I am not alive, I contain nutrients that help plants grow. I also provide habitat for many species of insects and reptiles, and decomposers such as earthworms, fungi, and bacteria.</td>
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<tbody>
<tr>
<td>I am a species of microscopic roundworm. My relatives cover the planet in many different environments, but I prefer the soil in this forest. Here, I am one of hundreds of millions—nematodes usually outnumber plant and animal species in every ecosystem, and many of us can be quite destructive! I burrow into roots using a piercing mouthpart, damaging them and making it harder for plants to take in nutrients. I also feed on other microscopic organisms such as bacteria and fungi.</td>
<td>I am one of millions of fungi found in the forest. I have a net-like body of threads that I can send through soil to grow into roots and tree stumps. When I grow under the bark of trees I produce thickened nets of hairs that glow in the dark! When I grow in a sick or injured tree, I can cause it to rot and die. I make honey-colored mushrooms that release tiny, seed-like spores for reproduction. Eastern fox squirrels like to munch on my mushrooms.</td>
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<tr>
<td>I am one of millions of southern pine beetles in this forest. I tunnel into sick and dying pine trees and feed on their phloem. I carry a fungus that can grow through wood. The fungus blocks the transport of water and nutrients in a tree, killing it in the process. By killing old, sick, or dying trees, I make room for new ones to grow. I reproduce and spread through a forest quickly. Woodpeckers and even some insects love to eat me!</td>
<td>I represent one of 10 pileated woodpeckers in this forest. I am one of the largest woodpeckers in North America. I have a loud, repetitive, drumming call, “kuk, kuk, kuk.” I peck at trees with my large beak and dig big, rectangular holes in tree bark to find insects. These holes attract other birds that come to feast on insects for dinner. I excavate holes for nests in large, tall dead trees and branches.</td>
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<tr>
<th>15. Spanish moss</th>
<th>16. Pine warbler</th>
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<tr>
<td>I am one of thousands of Spanish moss plants found in the forest. But did you know that I’m not really a moss? In fact, I’m related to the pineapple. I grow on oaks, but I do not steal nutrients from them. I make my own food through photosynthesis. Scales on my leafy strands absorb water and nutrients. I produce seeds that are spread by birds and wind. Many birds use me for nesting material because my leaves are like tangled wool, and very comfy.</td>
<td>I am one of 50 pine warblers found in this forest. I have a bright yellow belly and white lines on my wings. I live in pine forests and search along branches and under tree bark to for insects to eat. I use Spanish moss to build my nest high in the tree canopy.</td>
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### 17. Wind
I am the wind. I travel through the branches, leaves, and stems of plants in the forest. I carry pollen and seeds from plants throughout the forest to new places where they can grow. When I am a very strong wind, I can cause trees or plants to blow over and die. These dead plants decompose and become part of the soil.

### 18. Japanese climbing fern
I am one of thousands of non-native, invasive Japanese climbing fern plants in this forest. I am from Asia, and I am making myself at home here in Florida! I grow rapidly over shrubs and trees, shading out the sun. Although my leaves and vines die in a freeze, I can re-sprout in the spring. The wind carries seed-like spores from my leaves.

### 19. Wild grape
Also known as “muscadine grape,” I am one of many vine species and one of hundreds of wild grape plants in this forest. I grow on the ground, in shrubs, and up into trees—my vines can be 100 feet long! My grapes are eaten by white-tailed deer and birds. When animals eat my fruit, they spread my seeds, letting them sprout throughout the forest.

### 20. Standing dead tree
I am one of 15 standing dead trees, also called “snags,” in the forest. I provide important habitat for many animals—especially insects, lizards, and woodpeckers. Birds like the red-shouldered hawk use me as a hunting perch. As I slowly fall apart, I provide food for decomposers. This returns nutrients to the soil below me, helping other plants grow.

### 21. Red-shouldered hawk
I represent one of several species of raptors and one of 4 red-shouldered hawks that hunt in this forest. My call, “kee-aah,” can be heard echoing in the forest. I perch high in the canopy and swoop down to the forest floor to catch prey. My favorite foods are small mammals such as squirrels and mice, small birds, lizards, and frogs.

### 22. Southern black racer
I am one of several snake species found in this forest. I am slim and shiny, ranging from 2 to 5 feet long. I am not venomous, but I am fast—that is why I am called “racer.” I slither on the ground and up trees for prey such as insects, small reptiles, amphibians, and small mammals. I help control rodent and insect populations.

### 23. Southeastern pocket gopher
I am one of 7 pocket gophers in this forest. I eat plant roots, and carry the food in the “pockets” of my cheek pouches. I live underground in deep, sandy soil, and I dig tunnels up to 145 feet long. Many reptiles and amphibians, including the mole skink, live in my tunnels. As I make tunnels I push sand and soil to the surface, providing nutrients to plants. You may sometimes see the sand piles I make along roads and paths.

### 24. Mole skink
I am one of hundreds of skinks found in this forest. I am a small, skinny, brown lizard with an orange-red tail. I am called a mole skink because, like moles, I burrow in the ground. Unlike other lizards, I do not climb trees. I am very secretive and rarely seen because I like to hide under logs and leaf litter. I feed on small insects and spiders. Yikes, the black racer snake likes to eat me!
25. Sparkleberry
I am one of many understory plant species and one of hundreds of sparkleberry plants in this forest. I grow to about 12 feet tall. In the spring, I make white flowers with nectar that attracts pollinating honey bees. In the summer, I produce dark purple berries that animals enjoy eating. When animals digest my berries, the seeds pass through their systems and can sprout into young trees.

26. Honey bee
I am one of millions of honey bees in this forest. My family lives in a colony. My mother, the queen bee, has more than 30,000 daughter worker bees, and a few thousand sons! My sisters and I collect flower nectar to make honey. The flowers we visit dust our bodies with pollen which brushes off onto the next flowers we visit, pollinating them so they can produce seeds.

27. Blazing star
I am one of thousands of wildflowers in this forest. I grow in sunny spots where there is an opening in the forest canopy. I have a tall stem and in the late summer and fall, I produce beautiful, feathery pink or purple flowers. My seeds are a favorite food of many songbirds, and these birds and the wind disperse my seeds throughout the forest. The monarch butterfly enjoys drinking the nectar from my flowers.

28. Monarch butterfly
I am one of 50 monarchs found in this forest. My big wings are striped orange and black and I use them to migrate to Mexico in the winter. My wing colors are a warning—if a bird eats one of my family, it’ll never touch another orange-and-black flying insect again to avoid the bitter taste! I drink nectar from flowering plants and lay eggs on the undersides of leaves. Caterpillars hatch from these eggs and munch on the leaves. Mature caterpillars form chrysalises and emerge as beautiful adults like me.

29. Oak tussock moth caterpillar
In the spring, I am one of millions of caterpillars that hatch from eggs in this forest. I have two antennae-like hair stalks on my head and a fluffy tail. If I’m picked up, I can hurt you. I develop a stinging toxin in my hairs so birds will leave me alone. I eat with many other caterpillars and together we can eat all of the leaves from an oak tree! After I feed for several weeks, I spin a cocoon and change from a caterpillar to a moth.

30. Mistletoe
I am one of several parasitic plant species and one of hundreds of mistletoe plants in this forest. Birds and mammals enjoy eating my fruit. The seeds within my fruits are very sticky and easily transported through the forest by animals and rain. When a seed lands on a tree, it grows a rootlike structure into the tree’s phloem and xylem. Although I can use photosynthesis to make food, I use this rootlike structure to steal nutrients and water from a tree. This is quite a nuisance to the tree—the more mistletoes it has on it, the less food it gets for itself.

31. Rain cloud
I am a cloud that rains on the forest. My rainwater sustains all life here. It goes deep into the soil, and also into streams and ponds that are a part of the forest. The streams and ponds provide a source of water and habitat for many insect, reptile, bird, and mammal species. The water in the soil is essential for plants to grow.

32. Resurrection fern
I am one of many types of air plants and one of hundreds of resurrection ferns that grow on tree branches in this forest. I attach myself to large live oaks and get nutrients and water as they trickle down the tree’s bark. When there is not enough water, I curl up and turn brown. When it rains I uncurl, turn green, and resurrect! Many insects use my leaves and stems as a home.
### Instructions

Make copies and cut out the thirty two ecosystem components on the following pages. Each student should receive one card. If you have more students than cards, allow some students to share a card, or make a few extra copies.

<table>
<thead>
<tr>
<th>1. Sun</th>
<th>2. Live oak</th>
</tr>
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<tbody>
<tr>
<td>I am the sun. I shine light into the forest, helping plants produce food through photosynthesis. This food helps the plants grow leaves, fruits, seeds, and nuts, which are important food sources for the insects, birds, and mammals that call this forest home.</td>
<td>I represent one of many species of oak and one of 60 live oak trees in this forest. I can reach heights of 85 feet tall. My large branches stretch out from my trunk and grow low to the ground. I prefer moist woods or coastal sandy soils. I produce hundreds of sweet, tasty acorns that deer and squirrels love to eat.</td>
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<th>3. Eastern fox squirrel</th>
<th>4. Slash pine</th>
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<td>I represent one of several species of squirrels, and one of 40 eastern fox squirrels in this forest. I am dark grey or black with white markings across my eyes and tail tip. I eat fruits, nuts, and seeds. I bury acorns in hiding places but sometimes forget about them. These forgotten acorns can sprout into new oaks. I love pine cones. I eat them like you eat corn on the cob!</td>
<td>I represent one of hundreds of pine trees that grow into the forest canopy. I am a tall tree that enjoys wet soils and swampy areas. I can grow up to 115 feet tall and like lots of sunlight. Eastern fox squirrels love to eat the seeds from my pinecones. The fox squirrels actually help spread my seeds through this forest.</td>
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<thead>
<tr>
<th>5. Live oak seedling</th>
<th>6. White-tailed deer</th>
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<tr>
<td>I represent one of hundreds of live oak seedlings growing in this forest. Mammals and birds spread acorns from older live oak trees around the forest. I like sunlight and moist areas. I wait in the shade for one of the older trees to die and fall over. Then I might grow up into the canopy where the old tree once stood.</td>
<td>I represent one of many species of mammals and one of 7 white-tailed deer living in this forest. I eat acorns and fruits from plants such as live oaks and sparkleberry. In the winter I eat twigs and branches. I can run very fast and travel many miles throughout the forest, so I must eat a lot to give me energy. Some people hunt me for food and sport.</td>
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<thead>
<tr>
<th>7. Lightning</th>
<th>8. Decaying log</th>
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<tbody>
<tr>
<td>I am the discharge of electricity from a thundercloud. I hit forests during storms, usually in the summer months. I send a bolt of electricity down through the atmosphere toward the Earth’s surface. If I hit a tree, I can crack its trunk, set it on fire, or damage its phloem, preventing it from carrying food and water to and from its leaves and roots. I can cause a tree to die.</td>
<td>I was once a huge tree that got hit by lightning five years ago. My phloem was damaged and I died. My body provided a home and food to southern pine beetles. When my roots rotted, I fell to the ground, making a new home for many insects, worms, fungi, and nematodes. These creatures break down my wood and add nutrients to the soil for new trees to grow. I am now one of 25 logs still visible on the ground in this forest.</td>
</tr>
</tbody>
</table>
### 9. Earthworm
I am one of millions of earthworms in the soil of this forest. I am a decomposer, eating plant debris such as dead leaves and twigs. As I digest food, I break it down and mix it with secretions from my intestine before releasing it into the soil. This adds important nutrients to the soil, which helps plants and trees to grow. Birds dig around in the soil and enjoy me as a yummy snack!

### 10. Soil
I am found under the leaf litter layer of the forest floor. I am made of rock and sand minerals, and the remains of dead plants and animals that have been eaten by insects and earthworms. Although I am not alive, I contain nutrients that help plants grow. I also provide habitat for many species of insects and reptiles, and decomposers such as earthworms, fungi, and bacteria.

### 11. Nematode
I am a species of microscopic roundworm. My relatives cover the planet in many different environments, but I prefer the soil in this forest. Here, I am one of hundreds of millions—nematodes usually outnumber plant and animal species in every ecosystem, and many of us can be quite destructive! I burrow into roots using a piercing mouthpart, damaging them and making it harder for plants to take in nutrients. I also feed on other microscopic organisms such as bacteria and fungi.

### 12. Honey mushroom
I am one of millions of fungi found in the forest. I have a net-like body of threads that I can send through soil to grow into roots and tree stumps. When I grow under the bark of trees I produce thickened nets of hairs that glow in the dark! When I grow in a sick or injured tree, I can cause it to rot and die. I make honey-colored mushrooms that release tiny, seed-like spores for reproduction. Eastern fox squirrels like to munch on my mushrooms.

### 13. Southern pine beetle
I am one of millions of southern pine beetles in this forest. I tunnel into sick and dying pine trees and feed on their phloem. I carry a fungus that can grow through wood. The fungus blocks the transport of water and nutrients in a tree, killing it in the process. By killing old, sick, or dying trees, I make room for new ones to grow. I reproduce and spread through a forest quickly. Woodpeckers and even some insects love to eat me!

### 14. Pileated woodpecker
I represent one of 10 pileated woodpeckers in this forest. I am one of the largest woodpeckers in North America. I have a loud, repetitive, drumming call, “kuk, kuk, kuk.” I peck at trees with my large beak and dig big, rectangular holes in tree bark to find insects. These holes attract other birds that come to feast on insects for dinner. I excavate holes for nests in large, tall dead trees and branches.

### 15. Spanish moss
I am one of thousands of Spanish moss plants found in the forest. But did you know that I’m not really a moss? In fact, I’m related to the pineapple. I grow on oaks, but I do not steal nutrients from them. I make my own food through photosynthesis. Scales on my leafy strands absorb water and nutrients. I produce seeds that are spread by birds and wind. Many birds use me for nesting material because my leaves are like tangled wool, and very comfy.

### 16. Pine warbler
I am one of 50 pine warblers found in this forest. I have a bright yellow belly and white lines on my wings. I live in pine forests and search along branches and under tree bark to for insects to eat. I use Spanish moss to build my nest high in the tree canopy.
<table>
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<tr>
<th>17. Wind</th>
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<tbody>
<tr>
<td>I am the wind. I travel through the branches, leaves, and stems of plants in the forest. I carry pollen and seeds from plants throughout the forest to new places where they can grow. When I am a very strong wind, I can cause trees or plants to blow over and die. These dead plants decompose and become part of the soil.</td>
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<tr>
<th>18. Japanese climbing fern</th>
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<tbody>
<tr>
<td>I am one of thousands of non-native, invasive Japanese climbing fern plants in this forest. I am from Asia, and I am making myself at home here in Florida! I grow rapidly over shrubs and trees, shading out the sun. Although my leaves and vines die in a freeze, I can re-sprout in the spring. The wind carries seed-like spores from my leaves.</td>
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<th>19. Wild grape</th>
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<tr>
<td>Also known as “muscadine grape,” I am one of many vine species and one of hundreds of wild grape plants in this forest. I grow on the ground, in shrubs, and up into trees—my vines can be 100 feet long! My grapes are eaten by white-tailed deer and birds. When animals eat my fruit, they spread my seeds, letting them sprout throughout the forest.</td>
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<th>20. Standing dead tree</th>
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<tbody>
<tr>
<td>I am one of 15 standing dead trees, also called “snags,” in the forest. I provide important habitat for many animals—especially insects, lizards, and woodpeckers. Birds like the red-shouldered hawk use me as a hunting perch. As I slowly fall apart, I provide food for decomposers. This returns nutrients to the soil below me, helping other plants grow.</td>
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<th>21. Red-shouldered hawk</th>
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<tr>
<td>I represent one of several species of raptors and one of 4 red-shouldered hawks that hunt in this forest. My call, “kee-aah,” can be heard echoing in the forest. I perch high in the canopy and swoop down to the forest floor to catch prey. My favorite foods are small mammals such as squirrels and mice, small birds, lizards, and frogs.</td>
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<tr>
<th>22. Southern black racer</th>
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<tr>
<td>I am one of several snake species found in this forest. I am slim and shiny, ranging from 2 to 5 feet long. I am not venomous, but I am fast—that is why I am called “racer.” I slither on the ground and up trees for prey such as insects, small reptiles, amphibians, and small mammals. I help control rodent and insect populations.</td>
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<th>23. Southeastern pocket gopher</th>
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<tr>
<td>I am one of 7 pocket gophers in this forest. I eat plant roots, and carry the food in the “pockets” of my cheek pouches. I live underground in deep, sandy soil, and I dig tunnels up to 145 feet long. Many reptiles and amphibians, including the mole skink, live in my tunnels. As I make tunnels I push sand and soil to the surface, providing nutrients to plants. You may sometimes see the sand piles I make along roads and paths.</td>
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<tr>
<th>24. Mole skink</th>
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<tr>
<td>I am one of hundreds of skinks found in this forest. I am a small, skinny, brown lizard with an orange-red tail. I am called a mole skink because, like moles, I burrow in the ground. Unlike other lizards, I do not climb trees. I am very secretive and rarely seen because I like to hide under logs and leaf litter. I feed on small insects and spiders. Yikes, the black racer snake likes to eat me!</td>
</tr>
</tbody>
</table>
25. Sparkleberry
I am one of many understory plant species and one of hundreds of sparkleberry plants in this forest. I grow to about 12 feet tall. In the spring, I make white flowers with nectar that attracts pollinating honey bees. In the summer, I produce dark purple berries that animals enjoy eating. When animals digest my berries, the seeds pass through their systems and can sprout into young trees.

26. Honey bee
I am one of millions of honey bees in this forest. My family lives in a colony. My mother, the queen bee, has more than 30,000 daughter worker bees, and a few thousand sons! My sisters and I collect flower nectar to make honey. The flowers we visit dust our bodies with pollen which brushes off onto the next flowers we visit, pollinating them so they can produce seeds.

27. Blazing star
I grow in sunny spots where there is an opening in the forest canopy. I have a tall stem and in the late summer and fall, I produce beautiful, feathery pink or purple flowers. My seeds are a favorite food of many songbirds, and these birds and the wind disperse my seeds throughout the forest. The monarch butterfly enjoys drinking the nectar from my flowers.

28. Monarch butterfly
I am one of 50 monarchs found in this forest. My big wings are striped orange and black and I use them to migrate to Mexico in the winter. My wing colors are a warning—if a bird eats one of my family, it’ll never touch another orange-and-black flying insect again to avoid the bitter taste! I drink nectar from flowering plants and lay eggs on the undersides of leaves. Caterpillars hatch from these eggs and munch on the leaves. Mature caterpillars form chrysalises and emerge as beautiful adults like me.

29. Oak tussock moth caterpillar
In the spring, I am one of millions of caterpillars that hatch from eggs in this forest. I have two antennae-like hair stalks on my head and a fluffy tail. If I’m picked up, I can hurt you. I develop a stinging toxin in my hairs so birds will leave me alone. I eat with many other caterpillars and together we can eat all of the leaves from an oak tree! After I feed for several weeks, I spin a cocoon and change from a caterpillar to a moth.

30. Mistletoe
I am one of several parasitic plant species and one of hundreds of mistletoe plants in this forest. Birds and mammals enjoy eating my fruit. The seeds within my fruits are very sticky and easily transported through the forest by animals and rain. When a seed lands on a tree, it grows a rootlike structure into the tree's phloem and xylem. Although I can use photosynthesis to make food, I use this rootlike structure to steal nutrients and water from a tree. This is quite a nuisance to the tree—the more mistletoes it has on it, the less food it gets for itself.

31. Rain cloud
I am a cloud that rains on the forest. My rainwater sustains all life here. It goes deep into the soil, and also into streams and ponds that are a part of the forest. The streams and ponds provide a source of water and habitat for many insect, reptile, bird, and mammal species. The water in the soil is essential for plants to grow.

32. Resurrection fern
I am one of many types of air plants and one of hundreds of resurrection ferns that grow on tree branches in this forest. I attach myself to large live oaks and get nutrients and water as they trickle down the tree’s bark. When there is not enough water, I curl up and turn brown. When it rains I uncurl, turn green, and resurrect! Many insects use my leaves and stems as a home.