

Step 1

Discover the importance of diverse forest ecosystems

BASIC ACTIVITY - Create a forest ecosystem and observe factors that impact it

Classroom Activity:

- Students will create a tropical rain forest ecosystem and observe factors that impact it
- Students will create and describe a new animal adapted to live in a specific forest ecosystem

Objectives:

Students will be able to:

- distinguish between different kinds of forests
- identify the different layers of a forest
- discuss use and conflicts that exist over use of forested lands
- apply knowledge of specific animal and plant needs in a tropical rain forest
- recognize that altering a forest environment affects all living things and interrelationships in that environment
- demonstrate understanding of a forest ecosystem by creating an animal and describing its adaptations to live in one of three forest ecosystems

Time Recommended:

- 60 - 90 minutes

Materials Needed:

- Photocopied map, worksheets, and rubric on pages 13-18
- Scissors
- Tape or Fun-Tac®
- Pencil and paper

National Science Standards Correlation:

- Develop understanding of populations, resources, and ecosystems
- Develop understanding of diversity and adaptations of organisms

National Geography Standards Correlation:

- Understand the characteristics and spatial distribution of ecosystems on Earth's surface
- Understand how human actions modify the physical environment

Assess Prior Knowledge

Ask students to quickly draw a picture of a tree. (Allow no more than 10 seconds.) Have students hold up their tree sketches and make comparisons. Ask students what they would add to the sketch if they had time to draw a forest. (Responses may include: more trees, different kinds of trees, animals in trees, etc.) Encourage students to mentally identify the sounds, smells, sights, and feelings associated with forests. Record responses without comment on the board.

Divide students into small groups. Explain they are going to have a contest to see which team can list the most forest plants and animals in just three minutes. Students should use fairly specific plant and animal names. For example: list "oak" or "spruce" rather than just a "tree." After three minutes take turns asking each team to read items on their list. Record each new plant or animal mentioned on the board. Student responses will provide insight as to their understanding of forests as more than tree covered tracts of land.

Briefly review the basic concept of food chains. (Example on page 6). Explain that plants and animals in an ecosystem are linked by what they eat or what gives them energy. This food energy link is called a **food chain**. A food chain starts when a plant captures energy from the sun and turns it into a sugar food that helps the plant grow. Animals that eat plants are called **herbivores**. An herbivore eats a plant to get energy so it can move and grow. Ask students to identify an herbivore from the list on the board. Animals that eat other animals to get food energy are called **carnivores**. Ask students to identify a carnivore from the list on the board. Animals, like humans, that eat both plants and animals are called **omnivores**. Ask students to identify an omnivore from the list on the board. Also important in food chains are **decomposers**, which break down dead things and return the nutrients to the soil.

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Tell students they have one minute for each group to identify a forest food chain from the plants and animals listed on the board. Have groups share their forest food chain with the class. Based on student responses, determine if you need to change or broaden any perceptions about food chains and the role plants play in food chains before starting the instructional sequence.

Instructional Sequence:

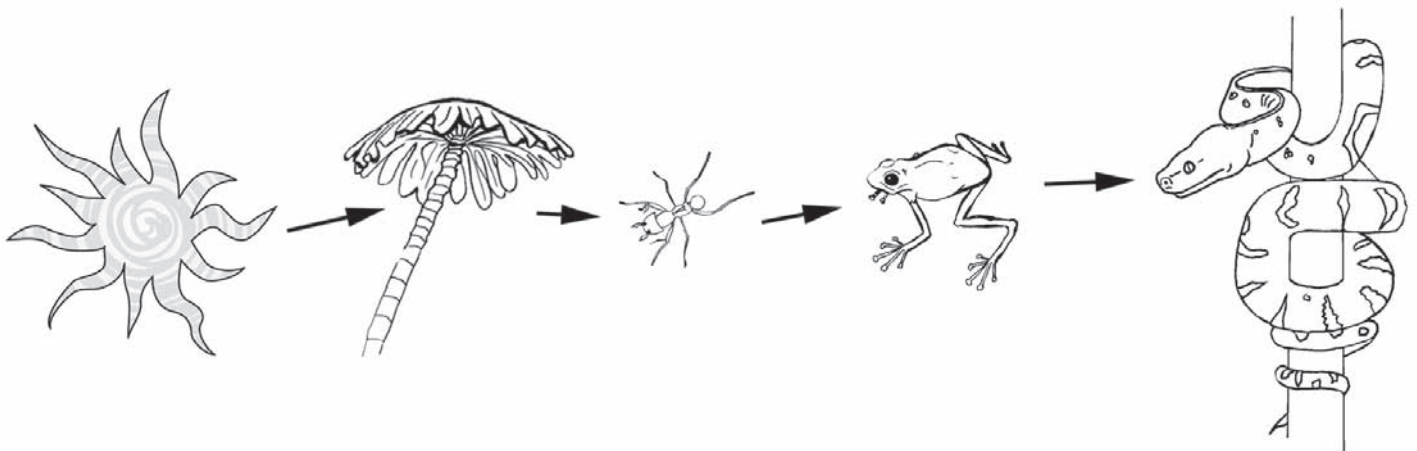
Concept #1: A forest is more than trees.

Building from student comments, lead students to understand that forests are more than just trees, they are diverse ecosystems that support many different plants and animals. *Ask students to name some ways that forest animals and plants interact.* (Examples might include: trees and other plants provide food and shelter for animals, animals bury seeds that may grow into plants, insects pollinate flowers, fungi and other decomposers break down dead material which enriches the soil so new plants can grow.)

Concept #2: Many different kinds of forests exist.

Ask students if all forests are the same. Responses will vary. Explain to students that, while all forests have much in common, different kinds of forests exist. Different kinds of forests have different kinds of trees. Hand out copies of the **Vocabulary/Rubric** and **World Forests Map** (pages 13 & 14).

Food Chain Example



The arrows in the food chain show the direction of energy flow

Concept #1: A forest is more than trees.

Concept #2: Many different kinds of forests exist.

Concept #3: Every forest contains a variety of habitats that support diverse, interdependent communities of plants and animals.

Concept #4: A forest provides many benefits.

Concept #5: Altering a forest environment affects all living things and interrelationships in an ecosystem.

Briefly remind students that trees are divided into two main types – broadleaf trees and conifers.

Broadleaf trees have thin and flat leaves that are usually shed annually (deciduous). Broadleaf trees bear a variety of fruit and flowers.



Broadleaf

Conifers are cone-bearing trees. Most are evergreen. Conifers have needle-shaped or scale-like leaves.



Conifer

Select students to read the descriptions of the different forest types on the **World Forests Map** (page 14).

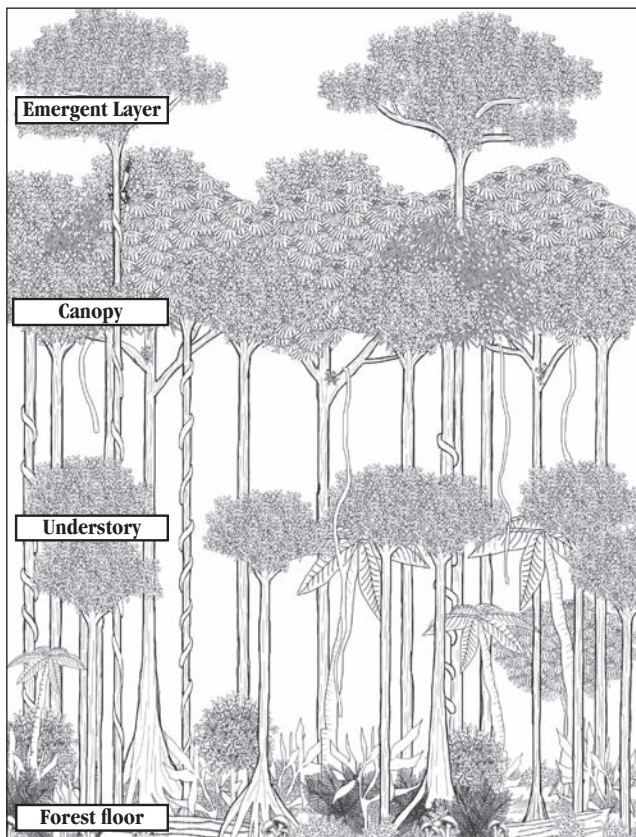
- **Boreal forests** (taiga) are located in cold regions of the world. The growing season is short; winters are long. Conditions are tough and a tree must be hardy to survive. Boreal forests are mostly coniferous forests. The characteristic pyramidal (triangular) shape of conifers helps the tree resist damage by heavy snow. Few understory plants grow in boreal forests. Animal life must be adapted for the cold.
- **Temperate forests** are located in areas with moderate average temperatures that change with the seasons. These forest areas have less severe winters and have precipitation usually spread evenly throughout the year. Temperate forests often have a mix of broadleaf (deciduous) trees and conifers. Understory plants are common. Animal life is fairly diverse. A typical temperate forest in the United States may contain from 5-12 different types of trees.
- **Tropical forests** are generally found near the equator, between the Tropic of Cancer and the Tropic of Capricorn. Temperatures are warm year-round. Long periods of daylight and lots of rain let

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plants grow quickly and animal life flourish. Tropical forests can be further divided into subgroups based on the amount of seasonal rainfall. Add a few details on subgroups from information below.

- **Tropical seasonal forests** have a dry season and a wet season and can have either evergreen or deciduous trees.
- **Tropical rain forests** receive constant and abundant precipitation – over 100 inches of rain per year. Tropical rain forest trees are mostly broadleaf trees that lose their leaves gradually and remain green year round (evergreen). Understory plants compete for light. A typical rain forest may have over 300 different types of trees. Tropical rain forests make up only 2% of the earth’s surface, but support over half of the world’s plants and animals!

Have students refer back to their quick-sketch tree. Ask: *Does your tree look more like a conifer or broad-leaf tree? In what type of forests would you be most likely to find a tree like the one you drew?*



Looking at the **World Forests Map**, ask students the following questions:

What kind of forest is closest to your community?
(Note: Only naturally occurring forests are shown on the map. If your region does not show any forests, explain that many communities have planted “urban forests” to bring the benefits of trees to their cities and towns. Ask students to think about the types of trees that grow best in their area in determining the type of forest closest to them.)

By looking at the forest regions, what factors do you think influence where certain forests will grow?
Answers could include: type of soil, proximity to water, elevation, climate (amount of moisture and temperature range), and biotic factors such as disease or presence of pollinators.

Direct students attention back to the location of Tropical Forests. Tell students that **tropical rain forests** cover only 2% of the earth’s surface, but are home to over half the world’s plants and animals. There is more diversity in tropical rain forests than anywhere else on earth!

Hand out the **Tropical Rain Forest Worksheet** and **Rain Forest Information Sheets A & B** (pages 15-17) to each student. Explain to the students that they are going to create a tropical rain forest ecosystem.

Concept #3: Every forest contains a variety of habitats that support diverse, interdependent communities of plants and animals.

Review the layers of the forest with your students as they look at the **Tropical Rain Forest Worksheet**. A forest is made up of many layers. Starting at the bottom and working up, the main forest layers are:

- **Forest floor** layer is comprised of decomposing leaves, animal droppings, dead trees, and animals, which all decay on the forest floor and create new soil and provide nutrients for the plants. Growing out of the forest floor are ferns, grasses, mushrooms, and tree seedlings.
- **Understory** layer is made up of bushes, shrubs and young trees that have adapted to living in the shade of the canopy.

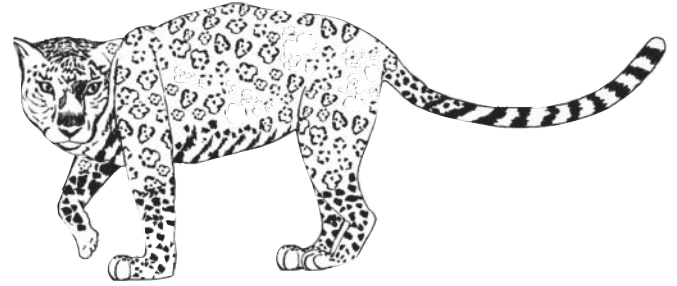
- **Canopy** is formed by the mass of intertwined branches, twigs, and leaves of the tall, mature trees. The crowns of the dominant trees receive most of the sunlight. This is where most of the tree's food is produced. The canopy forms a shady, protective umbrella over the rest of the forest. Much of the forest life exists in the canopy.
- **An emergent layer** exists in tropical rain forests and is composed of a few scattered trees that tower over the canopy.

Explain that in any forest ecosystem, each layer in the forest offers a different habitat site for forest inhabitants. Each layer has its own climate, based on differences in light, temperature, humidity, and wind. Each layer provides a home and food for specific plants and animals.

Have students look at the **Rain Forest Information Sheets**. Explain that these sheets show just a few of the millions of different kinds of trees, plants, and animals that exist in tropical rain forests. In a tropical rain forest ecosystem, each forest layer is home to unique plants and animals, many not found anywhere else in the world. Thousands of insects may live in each tree.

Ask students to look at the information sheets and find an animal whose "rain forest habitat" includes the emergent layer. (Harpy eagle) The emergent layer can be over 200 feet high. Emergent trees are exposed to full sun and strong winds. Only a few of the rain forest animals make their home in the emergent layer.

Ask students to name an animal or plant that lives in the canopy. (Spider monkey, sloth, etc.) The rain forest canopy is the most diverse place on Earth. Hundreds of thousands of plants and animals call the rain forest canopy home. Many never touch the ground during their lifetime. The canopy is a rich food source of fruits, flowers, leaves, and berries. Thick, woody vines called **lianas** are found in the canopy. These vines can be as big around as a person. Epiphytes, such as orchids, mosses, and bromeliads, are plants that grow without soil right on the canopy trees. **Bromeliads** have a cup-like shape that catches rainwater. Insects lay their eggs and get food from the water-holding bromeliad. Poison-arrow frogs carry their tadpoles piggyback to a bromeliad and deposit them in the plant "pool" where they feed on algae and mosquito larvae.



Tree frogs stay close to bromeliads to catch insects. Snakes are nearby to capture frogs, birds arrive to eat the snakes... and the food chain continues.

Ask students to find an animal or plant that lives or grows in the understory. (Jaguar, coffee tree, etc.) Small palms, young canopy trees, and woody shrubs grow in the rain forest understory. They often have huge leaves to try to catch what little sun filters through from the canopy. Trees grow slowly until a canopy tree dies and falls, then the young trees take advantage of the shaft of sun and grow rapidly toward the sky. Many animals live here, including snakes, frogs, parakeets, jaguars, and the largest concentration of insects.

What animals live on the forest floor? (Tapir, capybara, etc.) Only 2% of the sunlight reaches the rain forest floor. The forest floor is covered with ferns, mushrooms, fungi, and a layer of rotting plant material (leaf litter) that has fallen from the layers above. The air is still and the humidity is very high with temperatures between 80-85 degrees year round. In these conditions, the forest litter and dead trees on the floor decompose very rapidly releasing nutrients into the rain forest's shallow soil. A leaf that might take one year to decompose in a temperate forest will disappear in just six weeks on the rain forest floor! Many trees have wide buttress roots for support as well as other shallow roots that let the tree absorb many of the soil nutrients as quickly as possible before they are washed away by the rain. Large mammals, such as tapirs, forage for roots and tubers. Termites, cockroaches, beetles, centipedes, millipedes, and earthworms, along with the fungi, use the organic litter as a source of food.

Concept #4: A forest provides many benefits.

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Background information: Forests are great providers. They are a source of energy, influence water quality, preserve soil, absorb carbon dioxide, and create oxygen. Forests provide shelter and food for a variety of living things, they provide raw materials for many of the products used by humans, and they offer opportunities for recreation.

Not only is the tropical rain forest home to millions of plants and animals, many products we use in our everyday lives come from the rain forest. Bananas, avocados, pineapples, pepper, ginger, vanilla, shade-grown coffee, and cashews are all rain forest products. Chicle, used in chewing gum, comes from a tropical tree. Chocolate, from the cacao seed, is also native to the tropical rain forest and oil from the cacao seed is used in suntan lotions, cosmetics, and soaps. Latex, from the rubber tree, is used in making flexible tires for heavy equipment.

About one-fourth of all the medicines we use come from rain forest plants. The rosy periwinkle contains a chemical that fights leukemia (blood cancer). Curare, from a tropical vine, is used as an anesthetic and to relax muscles for surgery. More than 2,100 varieties of rain forest tropical plants possess cancer-fighting properties... and there may be many that have not even been discovered yet.

Discussion: *Ask students how many like chocolate? Vanilla? Pineapples? Cashews? Gum? Who has a family member that drinks coffee?* Explain that all these products come from the rain forest.

Ask how many have ever had to take medicine when they were sick or know someone with cancer? Point out the rosy periwinkle on the **Rain Forest Information Sheets**. Explain that one out of every four medicines we use comes from rain forest plants. The rosy periwinkle contains a chemical that helps people with a blood cancer called leukemia.

Share some additional background information on forest benefits with students, as time permits.

Concept #5: Altering a forest environment affects all living things and interrelationships in an ecosystem.

Background information: When tropical rain forest products like fruits, spices, cacao, rubber, and plants for medicines are harvested, little or no damage is done to the rain forest. However other practices do affect rain forests. "Slash and burn" agriculture, cattle ranching, mining, and logging have all contributed to the loss of millions of acres of tropical rainforest. Animals and native people alike lose their homes when rain forests are cut down.

In "slash and burn" agriculture large areas of tropical rain forest are burned and cleared to grow crops. Burning huge areas of rain forest releases carbon dioxide, causing changes in wind currents and rainfall around the world. Many scientists believe burning the rain forest adds to the greenhouse effect and contributes to global warming. Without the rain forest to soak up rain and release it slowly, floods and droughts become more common. The delicate soil becomes eroded and barren. After two or three years, the soil is so depleted of nutrients it will neither produce a crop nor grow back to rain forest. Farmers and ranchers move on to clear other sections of rain forest.

Discussion: *Explain that as the world's population grows, the number of people living near the rain forests is increasing. The demand for farmland and other natural resources is also increasing. Rain forests are being cut and burned... the impacts of which affect land, water, animals, and native people. Include additional background information in the discussion.*

Following discussion of the five key concepts, make sure students are comfortable finding information on the **Rain Forest Information Sheets** then begin the activity.

Rain forest facts to share with the class:

- Many songbirds from the United States fly south to spend the winter in tropical rain forests. Burning rain forests destroys the birds' winter habitat meaning fewer birds will survive to return in the spring.
- 17,000 species become extinct every year in the world's tropical rainforests.

The Activity: Create a forest ecosystem and observe factors that impact it

Explain that each student will now create a section of tropical rain forest that, when combined as a class, will form a tropical rain forest ecosystem. Pass out the ***Plants and Animals of the Rain Forest - Cutout Sheet*** (page 18) to each student as well as pieces of Fun Tak® or tape.

(NOTE: A minimum of twelve sections of rain forest are needed for this activity. In a classroom of less than 12 students, have each student create two sections of rain forest.)

Remind students that it takes many more plants and plant eaters at the bottom of the food chain to support a few animals at the top of the food chain.

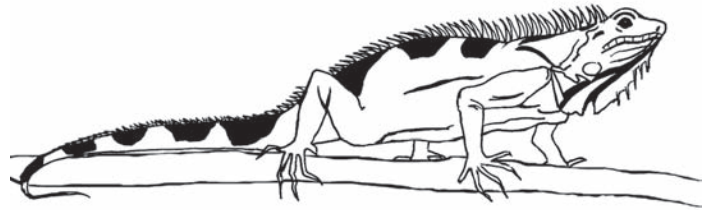
Students should each select from their cutout sheet:

- 2 large carnivores
- 3 small carnivores or omnivores
- 6 herbivores
- 3 special rain forest plants.

Explain each image represents a population of that plant or animal that a section of rain forest can comfortably support.

As students make their selections, they should refer back to the ***Rain Forest Information Sheets***. This will help them place their plants and animals in the correct forest layer and determine if the animal they are placing in the rain forest has a food source in that area. Remind them that some animals need a specific food source to survive. For example, the 3-toed sloth must have a trumpet tree available for its primary food source. A student may put in a trumpet tree without a sloth, but cannot have a sloth without a trumpet tree. (Quetzal needs wild avocado.)

Allow students 10 minutes to select and place their plants and animals in the correct forest layer on the ***Tropical Rain Forest Worksheet***. (If using tape, remind students to roll the tape and place their selections in lightly so they will be able to move them later.) While students are working, list all 24 plants and animals from the ***Information Sheets*** on the board and label a separate section of the board “Extinct or Endangered Species.”



When students have completed their rain forest section, conduct a forest inventory. Read the name of each plant/animal listed on the board and ask students to raise their hand if they have that animal or plant in their section. Record the number of each response on the board. If a plant or animal is not used in any rain forest section, list it in the “Extinct or Endangered Species” section on the board.

With a small class, put the completed rain forest sections side by side in three or four rows on the board or on a table where students can gather. With a larger class, have students remain at their desks and simply visualize that the desks represent the entire area of the rain forest ecosystem.

Explain to students that farmers burn and clear rain forest for growing crops. Select a student to represent a farmer and have the student remove his/her section of rain forest. Remind students when trees in a section of rain forest are removed, the animals can move to try to find new homes, but the plants cannot and they die with that section of forest.

The student whose section was removed must now try to find a home for his/her animals. The student must pass animals from his/her section of rain forest to students whose rain forest sections were adjacent to the section just removed. If the adjacent section does not already have that animal in its forest, then the animal may be placed there. If the animal already exists in that section of forest, the animal must be passed on to another adjacent rain forest section and so on until there is space and food for it to survive.

Remind students that if the animals need a certain plant as food (example: 3-toed sloth needs the trumpet tree) the new rain forest section must have that plant available in order for the animal to survive.

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If no section of rain forest can take a particular animal, that animal dies and the picture is taped or tacked on the board by the animal name. (The student whose section of rain forest was removed may become the record keeper at the board.)

Remind students that it is the layer of decaying material on the rain forest floor that is rich in nutrients, not the soil itself. When people clear rain forest land for farming they are only able to grow crops for a year or two before the soil runs out of nutrients. This land can no longer be used for farming and it is too depleted of nutrients to grow back to rain forest. Farmers are forced to clear more rain forest land to make a living. Clear another section of rain forest land. Repeat procedure as before.

Tell students another impact on tropical rain forests is ranchers who slash and burn the forest to get land on which to pasture cattle. Remove one or two sections of rain forest. (Do this in two areas of the classroom to get all students involved.) Repeat the hunt for habitat space as before.

Continue removing rain forest sections until the effect of clearing the rain forest has impacted every student's rain forest section in one way or another. Conduct a second forest inventory and record the numbers on the board next to the starting numbers and discuss results. Look at how many populations of animals were lost.

Ask:

Did any populations become extinct?

What animals were in the most danger and why?

What effect did cutting rain forest trees have on the plants and animals in this ecosystem?

How would loss of rain forest affect our lives?

Ask students if they think the soil is the same in all

other forests. (Clarify that other types of forests usually have richer soil that will support regrowth of new trees after clearing. Properly managed, most forests are renewable, providing fresh air, clean water, habitat for wildlife, and countless forest products. However, if new trees or ground cover are not planted where a forest area has been cleared, soil is in danger of erosion.)

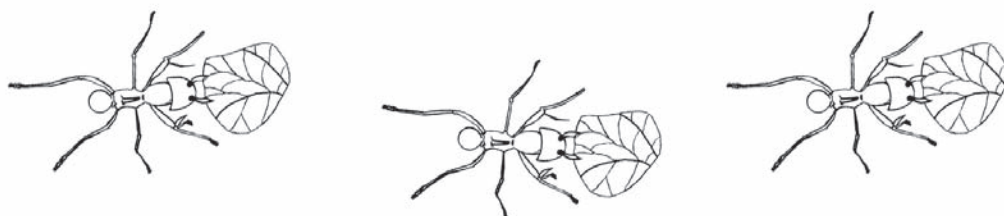
Explain that conflict exists over use of tropical rain forest land: choices include pasture for cattle or forest habitat for many animals; short term food production for hungry people or long term availability of medicines and renewable rain forest products. Eco-tourism, expanded markets for sustainable rain forest products, and increased research in medicinal uses of rain forest plants are just some of the things people are working on to try to preserve rain forest land and provide native people with income to support their families. Choices are tough and people have differing viewpoints about use of this forested land. *Ask students: What choices would you make?*

Assessment:

Ask students to imagine they are a forest explorer who has just discovered a new plant or animal species. They should name their new species, draw a picture of it, and describe in a written paragraph what it eats, what kind of forest it lives in, what level/layer of the forest it lives in, what other animals might eat it, and include any other special adaptations or characteristics that help it survive its forest environment. Refer students to the Rubric.

Alternative Assessment: Students draw a new forest creature and show by illustration or describe orally the details outlined in the assessment above.

Additional Suggested Reading: The Great Kapok Tree



Vocabulary

Boreal forests – mostly conifer forests located in cold regions of the world.

Broadleaf – trees that bear fruit and flowers; with leaves that are flat, thin, and usually shed annually.

Bromeliad – a cup-like rain forest plant; grows without soil.

Canopy – a top forest layer made up of intertwined branches, twigs, and leaves of tall trees, which form a shady “umbrella” over the rest of the forest.

Carnivores - animals that eat other animals.

Conifer – trees that bear cones and have needle-like or scale-like leaves. Most lose their leaves gradually and are evergreen.

Deciduous – trees that lose their leaves in the fall.

Decomposers – organisms that break down dead things and return the nutrients to the soil.

Emergent layer – tall forest layer found in tropical rain forests made up of a few scattered trees that tower over the canopy.

Evergreen - trees with leaves that remain alive and on the tree through the winter into the next growing season.

Food chain – the way plants and animals in an ecosystem are connected by what they eat or what gives them energy.

Forest floor – bottom forest layer comprised of low ground plants, decomposing leaves, rotting logs, animal droppings, etc.

Herbivores - animals that eat only plants.

Liana - a thick woody vine found in rain forests.

Omnivores - animals that eat both plants and animals.

Temperate forests – are located in areas of the world with moderate average temperatures and less severe winters. Often have a mix of conifer and broadleaf trees.

Tropical forests - forests generally found near the equator where temperatures are warm year-round. Includes tropical rain forests and tropical seasonal forests.

Tropical rain forest – tropical forest with constant sun and rain year-round; contains mostly broadleaf trees that keep their leaves through the year.

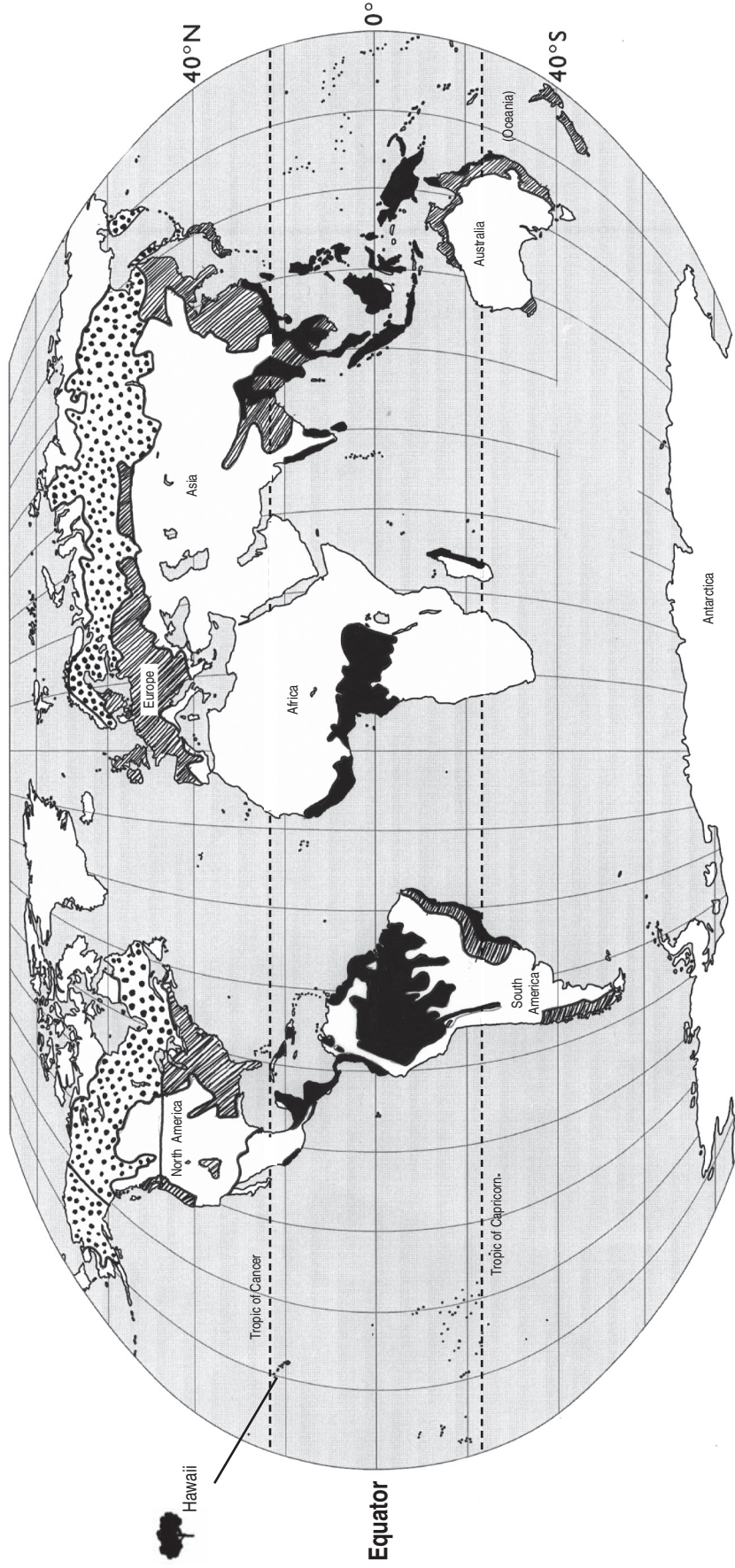
Tropical seasonal forest – tropical forest with a dry season and a wet season; can have either evergreen or deciduous trees.

Understory – forest layer made up of bushes, shrubs, and young trees that have adapted to living in shade of taller trees.

RUBRIC - How high can you grow?

Forest Floor	Understory	Canopy	Emergent Tree Tops
<p><input type="checkbox"/> You do not participate in class discussion or the rain forest ecosystem activity. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> Less than 8 of the animals or plants are placed in the correct layer of the forest on the Tropical Rain Forest Worksheet. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> You are a “novice” forest explorer. You “discovered” (created and named) a new forest plant or animal but described less than 3 of the 5 important points below, which was not enough information to help ensure its survival.</p> <ol style="list-style-type: none"> 1. what it eats 2. what kind of forest it lives in 3. what level/layer of the forest it lives in 4. what other animals might eat it 5. other special adaptations or characteristics of your new species <p>(Worth one half of your total score)</p>	<p><input type="checkbox"/> You participate a little in class discussion and the rain forest ecosystem activity. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> 8-11 of the animals or plants are placed in the correct layer of the forest on the Tropical Rain Forest Worksheet. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> You are an “apprentice” forest explorer. You “discovered” (created and named) a new forest plant or animal and helped ensure its survival by describing 3 or 4 of the 5 important points below:</p> <ol style="list-style-type: none"> 1. what it eats 2. what kind of forest it lives in 3. what level/layer of the forest it lives in 4. what other animals might eat it 5. other special adaptations or characteristics of your new species <p>(Worth one half of your total score)</p>	<p><input type="checkbox"/> You participate actively in class discussion and the rain forest ecosystem activity. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> 12-13 of the animals or plants are placed in the correct layer of the forest on the Tropical Rain Forest Worksheet. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> You are a “skilled” forest explorer. You “discovered” (created and named) a new forest plant or animal and helped ensure its survival by clearly describing 4 or 5 of the 5 important points below:</p> <ol style="list-style-type: none"> 1. what it eats 2. what kind of forest it lives in 3. what level/layer of the forest it lives in 4. what other animals might eat it 5. other special adaptations or characteristics of your new species <p>(Worth one half of your total score)</p>	<p><input type="checkbox"/> You participate actively in class discussion and the rain forest ecosystem activity. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> 14 animals or plants are placed in the correct layer of the forest on the Tropical Rain Forest Worksheet. (Worth 1/4 of your total score)</p> <p><input type="checkbox"/> You are an “expert” forest explorer. You “discovered” (created and named) a new forest plant or animal and helped ensure its survival by clearly describing all 5 of the important points below:</p> <ol style="list-style-type: none"> 1. what it eats 2. what kind of forest it lives in 3. what level/layer of the forest it lives in 4. what other animals might eat it 5. other special adaptations or characteristics of your new species <p>(Worth one half of your total score)</p>

World Forests Map



 **Boreal Forest** 

Boreal forests (taiga) are located in cold regions of the world. The growing season is short; winters are long. Conditions are tough and a tree must be hardy to survive. Boreal forests are mostly coniferous forests. The characteristic pyramidal (triangular) shape of conifers helps the tree resist damage by heavy snow. Few understory plants grow in boreal forests. Animal life must be adapted for the cold.

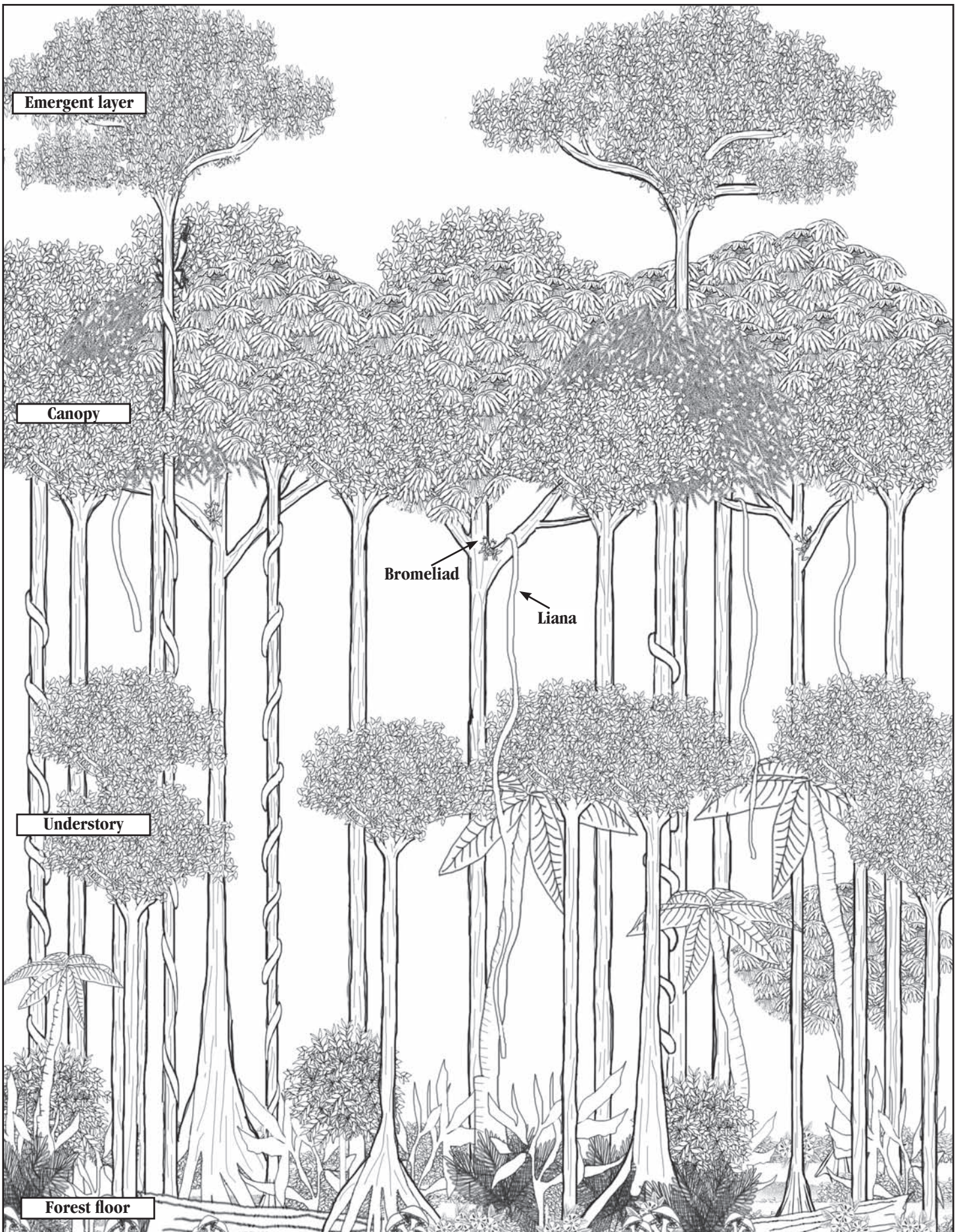
 **Temperate Forest** 

Temperate forests are located in areas with moderate average temperatures that change with the seasons. These forests areas have less severe winters and have precipitation usually spread evenly throughout the year. Temperate forests often have a mix of broadleaf (deciduous) trees and conifers. Understory plants are common. Animal life is fairly diverse. A typical temperate forest in the United States may contain from 5-12 different types of trees.

 **Tropical Forest** 

Tropical forests are generally found near the equator, between the Tropic of Cancer and the Tropic of Capricorn. Temperatures are warm year-round. Long periods of daylight and lots of rain lets plants grow quickly and animal life flourish. Tropical forests can be further subdivided into subgroups based on the amount of seasonal rainfall. Subgroups are **tropical season forests** and **tropical rain forests**, the most diverse ecosystems on earth.

Tropical Rain Forest Worksheet



Rain Forest Information Sheet — Side A

Harpy Eagle (bird, carnivore)

Rain forest habitat: Canopy & emergent layer

Diet: Small snakes, frogs, monkeys, sloth

Interesting facts: The Harpy is the largest eagle in the world. It nests high in the tree tops, swooping down from above to capture its prey.



Jaguar (mammal, carnivore)

Rain forest habitat: Understory & floor

Diet: Capybara, tapir, small mammals, sloth

Interesting facts: It's the largest cat in North America, an agile climber and an excellent swimmer. It is hunted for its fur.



Anaconda (reptile, carnivore)

Rain forest habitat: Understory & floor

Diet: Fish, caiman, capybara, birds

Interesting facts: Anacondas can grow to 30 ft. in length and weigh over 250 lbs. They squeeze their prey so it can't breathe, then eat it whole. Often found in or along streams.



Bird-eating Spider (arachnid, carnivore)

Rain forest habitat: Canopy & understory

Diet: Small birds, frogs and insects

Interesting facts: Often called tarantula, this spider measures 10" across. They do not spin webs, but pounce on prey.



Rain Forest Iguana (reptile, omnivore)

Rain forest habitat: Canopy & understory

Diet: Insects, leaves and fruit

Interesting facts: Iguanas blend in perfectly with their habitat. Natives hunt them for their meat that tastes like chicken.



Tree Frog (amphibian, carnivore)

Rain forest habitat: Canopy

Diet: Insects

Interesting facts: "Suction cup" like feet help frogs cling to leaves. Some hide by camouflage, poison frogs are brightly colored to warn off predators.



Bat (mammal, can be carnivore or herbivore)

Rain forest habitat: Canopy & understory

Diet: Fruit, nectar; many bats eat insects

Interesting facts: Sometimes called flying fox, bats are some of the most important pollinators of the rain forest. They fly at night using echolocation.

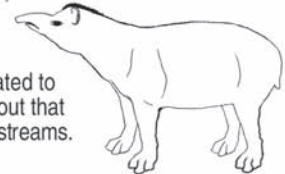


Tapir (mammal, herbivore)

Rain forest habitat: Forest floor

Diet: Marsh plants and grasses

Interesting facts: A shy animal related to the rhinoceros, it has a trunk-like snout that helps it browse for food. It lives near streams. Numbers reduced due to hunting.

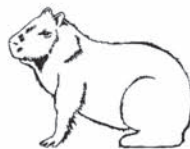


Capybara (mammal, herbivore)

Rain forest habitat: Forest floor

Diet: Marsh plants

Interesting facts: The capybara is the world's largest rodent. It has webbed feet that help it swim in rain forest streams and ponds.



Morpho Butterfly (insect, herbivore)

Rain forest habitat: Canopy & understory

Diet: Nectar

Interesting facts: Recognized by its large size and fluorescent blue upper wing color, the Morpho blends into the forest when its wings are closed.



Hummingbird (bird, herbivore)

Rain forest habitat: Canopy

Diet: Nectar from rain forest flowers

Interesting facts: These birds are pollinators of rain forest flowers with beaks specially adapted to fit into the heart of the flower. They are the only bird that can fly backwards.



Three-toed Sloth (mammal, herbivore)

Rain forest habitat: Canopy

Diet: Trumpet tree (cecropia) leaves

Interesting facts: Hangs upside down in the treetops. It moves so slowly, moss grows on its back which helps camouflage it from predators.

It depends almost entirely on cecropia trees.



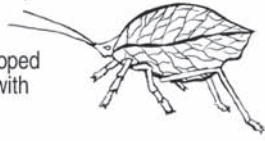
Rain Forest Information Sheet — Side B

Katydid (insect, herbivore)

Rain forest habitat: Canopy, understory and floor

Diet: Leaves

Interesting facts: Katydids have developed colors that help them blend perfectly with their surroundings to survive.

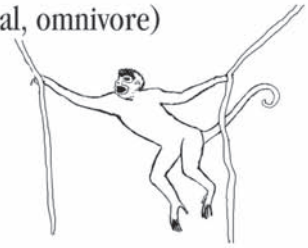


Spider Monkey (mammal, omnivore)

Rain forest habitat: Canopy

Diet: Mostly fruit

Interesting facts: The spider monkey swings through the rain forest canopy using its tail like an extra hand.



Resplendent Quetzal (bird, herbivore)

Rain forest habitat: Canopy

Diet: Wild avocado

Interesting facts: This shy bird has beautiful feathers which has caused it to almost be hunted to extinction.

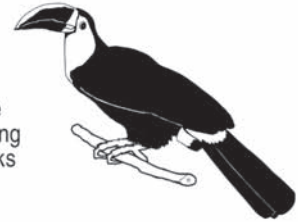


Toucan (bird, herbivore)

Rain forest habitat: Canopy

Diet: Fruit

Interesting facts: Despite its huge size, the toucan's colorful bill is strong and lightweight. They use their beaks to toss food to each other.



Scarlet Macaw (bird, herbivore)

Rain forest habitat: Canopy

Diet: Seeds, fruits and nuts

Interesting facts: These brightly colored birds live in social groups. Their sharp curved beaks crack the toughest nuts and help them climb trees.

Numbers reduced due to hunting.



Leaf-cutting Ant (insect, herbivore)

Rain forest habitat: Floor & understory

Diet: Fungus grown on decaying leaves

Interesting facts: These ants cut and carry leaves five times their size back to the nest. They grow a fungus on the leaves for food.



Rosy Periwinkle (plant)

Rain forest habitat: Forest floor plant (Madagascar)

Plant use: Food for insects, medicine

Interesting facts: Contains chemicals that can be used to treat leukemia, a cancer of the blood.



Cacao Tree (plant)

Rain forest habitat: Understory tree

Plant use: Chocolate, lotions, and soap

Interesting facts: The pods contain fatty seeds that are used to make cocoa, chocolate, sun tan lotion, and soaps.



Trumpet Tree or Cecropia (plant)

Rain forest habitat: Canopy tree

Plant use: Food of 3-toed sloth

Interesting facts: The cecropia tree is the main food source for the 3-toed sloth and food for many other rain forest animals.

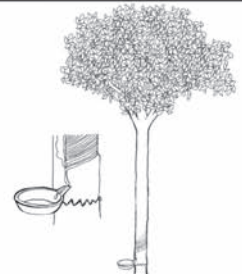


Rubber Tree (plant)

Rain forest habitat: Canopy tree

Plant use: Rubber

Interesting facts: Rubber is used to make flexible tires, rubber cement, and rubber bands. Harvesting rubber does not harm the tree.



Wild Avocado (plant)

Rain forest habitat: Canopy tree

Plant use: Fruit; food of Quetzal

Interesting facts: The wild avocado depends on the Resplendent Quetzal to disperse its seeds and the Quetzal depends on the wild avocado for its food.

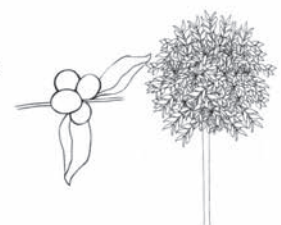


Coffee Tree (plant)

Rain forest habitat: Understory tree

Plant use: Coffee

Interesting facts: Coffee grown in the shade of rain forests has a rich flavor. Shade grown coffee protects rain forest land.



Plants & Animals of Rain Forest - Cutout Sheet

DIRECTIONS: Create a section of tropical rain forest with plants and animals that could live there. Be sure each animal you select has a food source (plant or animal) that it needs to survive. (Example: if you put a carnivore in your forest, you must have at least one of the animals it eats in the forest, too. If you select the 3-toed sloth or the Quetzal, be sure to include the particular plant each one eats.) Use your Rain Forest Information Sheets for reference.

✓ From this page - select and cut out:

- 2 large carnivores
- 3 small carnivores or omnivores
- 6 herbivores
- 3 special plants

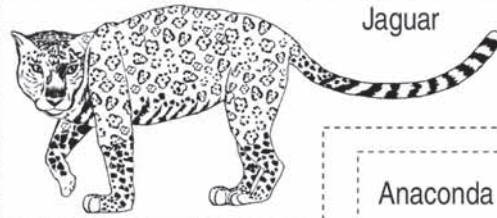
Make sure you have an appropriate food source for the animals you select.

✓ Place (lightly tape) your selected animals and plants onto the **Tropical Rain Forest Worksheet** in the correct layer of the forest in which they live.

Each picture on this page represents a population of a particular plant or animal that could live in a tropical rain forest. These images represent just a few of the millions of plants and animals that exist in a tropical rain forest ecosystem.

LARGE CARNIVORES

(Choose 2)



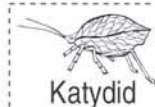
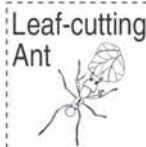
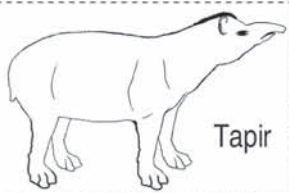
SMALL CARNIVORES & OMNIVORES

(Choose 3)



HERBIVORES

(Choose 6)



Resplendent Quetzal



Three-toed Sloth



Capybara



Coffee Tree



Cacao Tree



Trumpet Tree or Cecropia



Wild Avocado



Rosy Periwinkle



Rubber Tree



SPECIAL PLANTS

(Choose 3)

Step 1

EXTENSION ACTIVITY - Familiar Forests

Objectives:

Students will be able to:

- describe a forest in their area
- name several forest products
- describe how a forest changes over time
- recognize different factors that impact their local or state forest

Time Recommended:

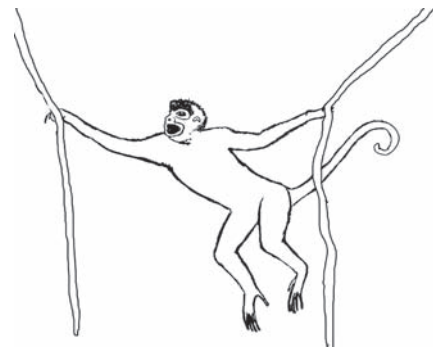
- Two to four 50-60 minute class periods

Materials Needed:

- Tree field guides and reference books. Tree information can also be found at arborday.org/regionaltrees.
- Information obtained from newspapers, public library, local county agent or state forester about regional forest use and/or issues related to local forest management
- World Forests Map (page 14) – one per student
- Pencil and paper

National Science Standards Correlation:

- Students should develop an understanding of populations, resources, and environments.



permit, schedule a field trip to a nearby forest area. Have students record how many different kinds of trees they can find. Students need not identify trees by species name, just recognize the amount of tree diversity by looking at clues like seeds, leaves, and bark. *Ask: Are the trees broadleaf or conifers... deciduous or evergreen?* If very few trees are nearby, print off images of regional trees from one of the suggested Web sites on page 20 and look for tree diversity in those images.

Remind students that trees are the basic building blocks of a forest. The greater the diversity of trees in a forest, the greater the diversity of animal life that will be found there as well. Encourage students to look for diversity of forest wildlife as well.

Return to the classroom. Divide students into groups to research your local or state forest. Each group should work to prepare a short report on a different aspect of the area forest. Encourage students to include artwork or pictures from the Internet. Group research topics could include:

- **Regional Forest Animals** - What animals live in the regional forest? What do these animals eat? What layer of the forest do they live in?
- **Regional Forest Trees** – What kinds of trees and plants are common to the area forest?
- **Regional Forest History** – How old is the regional forest? Has there been forest succession, changing the forest over time? If so, how has it changed?
- **Regional Forest Products** – Do people use the regional forest for lumber or other tree products?
- **Regional Forest Recreation** – What kind of recreational opportunities are available in nearby forested areas (camping, fishing, hiking, etc.)? Create a map to reflect those opportunities.

Instructional Sequence:

Pass out the **World Forests Map**. Tell students they have learned about tropical rain forests, but it is also important to learn about forests close to home. Ask students to identify the forest region closest to them. Only naturally occurring forests are shown on the map. If your region does not show any forests, explain that many communities have planted “urban forests” to bring the benefits of trees to their cities and towns.

Ask students to help create a list of forest benefits. Record responses on the board. The list might include: produce oxygen, prevent erosion, clean the air, filter water, create beauty, provide food and habitat for wildlife, and provide thousands of products we use everyday.

Take students outside to look at trees around the school or in the community. If time and distance

- **Regional Forest Issues** – Are there any conflicts or local issues related to use of the forested land? Is there a forest management program established to care for the forest? If so, describe it.

Allow students one class period to work on their reports. Have students make their forest presentations during the next class period. Allow time for questions and class discussion.

Forests have multiple uses and sometimes conflicts develop over how a forest is used. Through careful planning, a forest can be managed in ways that support many different needs. Tree planting is an important part of forest preservation.

Allow students an opportunity to role-play. Divide students into teams of four. Assign each student in the team a role.

- **Lumber Company President:** responsible for many jobs in the community. The lumber company harvests trees to produce paper.
- **Natural Resources Manager:** responsible for protecting the diversity of plants in the forest and protecting the area natural resources, like soil.
- **Recreation Director:** responsible for creating or maintaining outdoor recreational opportunities for people in the community and tourists who visit the area.

- **Mayor:** responsible for maintaining a healthy community, which includes preservation of jobs and responsible community development.

Explain to students that there is a large section of forest near their fictional community. As citizens of the community, they must come up with a workable plan to manage their nearby forest. Everyone in the group must be involved. Students should discuss what might happen if the community starts to grow. What would happen if large amounts of forest were cleared for housing development? What changes might happen in the forest if large numbers of tourists come through? Have groups think of conservation solutions that would help care for forests. Can celebrating Arbor Day and planting trees help preserve forests? Allow students 20 minutes to work in their groups to develop a forest management plan. Have students present their plan to the class.

Assessment:

Assessment should be based on the information presented in student reports and presentations. Allow time for students to add information to their reports if they desire, and then have students put the reports together into a Local Forest Information Booklet to go in the classroom library.

Tree Information Web Sites

National Arbor Day Foundation: information on regional trees available at www.arborday.org/regionaltrees AND www.arborday.org/trees/treeguide
 U.S. Department of Agriculture Plant Database: www.plants.usda.gov/
 United States Forest Service: www.fs.fed.us/
 University of Georgia collaboration: www.discoverlife.org/nh/
 National Wildlife Federation: <http://enature.com/fieldguides/>
 Center for Plant Conservation: www.centerforplantconservation.org/ASP/CPC_PlantLinks.asp#90

Tree Reference Books

Field Guide to Trees and Shrubs by George Petrides (Houghton Mifflin) 1972
National Audubon Society Field Guide to North American Trees: Eastern Region and Western Region by Elbert Luther Little (Alfred Knopf) 2000
The Complete Trees of North America by Thomas Elias (Van Nostrand Reinhold) 1980
Trees of North America by C. Frank Brockman (Golden Press) 1986
Western Trees by George and Olivia Petrides (Houghton Mifflin) 1992
What Tree Is That? A Guide to the more common trees found in the Eastern/Central and Western United States (The National Arbor Day Foundation) 1999