STATEN ISLAND ZOO Activity Packet

The Tropical Rainforest

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Funding for Activity Packets provided by:
- *SI Bank and Trust Community Foundation*
- *In memory of Norbert H. Leeseberg*

Acknowledgements

Thanks to the following people involved in the two - year development of the Teacher Guides and Student Activity Packets. These packets are a symbol of the Staten Island Zoological Society's dedication to provide science education to the children of the New York City and surrounding area.

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Introduction to the Teacher Activity Packets

Thank you for utilizing the Staten Island Zoo's Teacher Activity Packets.

The following Teacher Activity Packet is designed to enhance the learning experience for school classes visiting the Staten Island Zoo.

The Teacher Activity Packets contain activities for students in grades K-5. The activities provided have been coordinated to reinforce the scientific and conservation information given in the Zoo's formal school presentations. The activities are designed as preparation for a Zoo visit, but contain suggestions for post-visit projects and activities. Many of the activities are multidisciplinary. These activities may be used to teach a wide variety of subjects in addition to science including creative arts, language arts, social studies and mathematics, etc.

Science Standards

The Staten Island Zoo's Teacher Activity Packets incorporate New York City Performance Standards for elementary science and are coordinated with New York State Curriculum Frameworks for science. Designated standards covered in the Teacher Activity Packet include: life science concepts such as organism characteristics and life cycles, ecological relationships, the development of scientific thinking and investigation, scientific communication as well as tool and technology uses including information acquisition from print and non-print sources.

Conservation

The Staten Island Zoo recognizes the importance of conveying a firm, well-developed conservation message. Some activities in the Teacher Activity Packets introduce children to complex conservation issues such as habitat loss, endangered species protection and pollution reduction. Some activities are designed to help students make good environmental decisions that are within their control. Furthermore, the Teacher Activity Packets provide information on opportunities where students, as individuals or as a class, can directly participate in conservation activities.

Specific Topics Covered

The following is a list of available Teacher Activity Packets and a brief description of the topics covered:

Let's Be Sensible *Grades K-2*
The activities provided will help familiarize the student with the five senses used by humans and other animals. Students will learn how some animals have adapted special senses and sense organs that work differently or are stronger/weaker than our own. The importance of the placement of these organs is also emphasized.

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It's Alive! *Grades K-2.*
The concepts included in this Teacher Activity Packet emphasize the defining characteristics of living things: eating, breathing, growing and reproducing. The interaction between living and non-living habitat components is illustrated, as is the importance of preserving animal habitats.

Animal Adaptations *Grades 3-5*
This Teacher Activity Packet's activities are designed to familiarize children with the concept of adaptation as a physical property or a behavior that helps an animal survive in its natural habitat. The intimate relationship between the success of animal adaptations and the stability (i.e. conservation) of their habitats is illustrated.

The African Savannah *Grades K-2 and 3-5*
In this Teacher Activity Packet, children learn to identify the climate, vegetation and landscape of the African grasslands known as the savannah. Students will discover many of the animal species normally found in this region. Students are also introduced to the conservation problems of the African Savannah including animal poaching and habitat loss are also explored.

The Tropical Rainforest *Grades K-2 and 3-5*
Through the activities provided, children are introduced to the components of the rainforest. The actions familiarize students will examine the vegetation layers of the forest and some of the animal species associated with these layers. Emphasis is placed on the various human uses of tropical rainforests. The unique problems of deforestation are discussed including biodiversity loss and displacement of native peoples.

We're All Relatives *Grades K-2*
Students will be able to identify animals as vertebrate or invertebrate species. Students will be able to identify the five classes of vertebrate species and some of their distinguishing characteristics.

Incredible Invertebrates *Grades 3-5*
This Teacher Activity Packet introduces the vast world of invertebrate species. Arthropods are, by far, the most abundant and diverse group of invertebrates on earth. Students learn the defining features of arthropods including exoskeletons and segmented joints. The four major groups of arthropods (including insects) are covered in the packet. Students will recognize the importance of invertebrates to humans and ecosystems in general.

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We hope that you will continue to incorporate the Zoo and its educational resources into your lesson plans. We appreciate your feedback and encourage you to complete the questionnaire provided at the back of this booklet. You may mail the questionnaire to the Education Dept., The Staten Island Zoo, 614 Broadway Staten Island, NY 10310 or fax it to (718) 442-8492.

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Meeting the Needs of the NYC Teacher

Relationship to the New York City Performance Standards

The packet of activities and suggestions that follows has been designed to help make your class visit to the Zoo as valuable as possible for the students. The concepts and objectives outlined and the activities presented have been chosen to provide your students with a basic knowledge of tropical rainforests. The activities in this packet have been designed to coordinate with the expectations of the New York City Performance Standards for science and should help you meet the goals for student performance when appropriately utilized.

A number of strategies, often in hands-on format, are presented in different activities. Some are whole class activities, but most are designed for the students to work in cooperative groups or as individuals. The activities include a variety of components such as reading skills activities, creative arts, language, theater arts, health and history. Skills in observation, sequencing, comparison, classification and problem solving may be exercised in these activities. Art or craft work is integrated into many of the activities as well. Internet URLs (addresses) and suggestions for their use as references or for direct student use have been supplied.

New York City Performance Standards for elementary science addressed in the Tropical Rainforest activities include:

S2 Life Science Concepts
S2a Characteristics of Organisms, such as survival and environmental support; the relationship between structure and function; and variation in behavior.
S2b Life Cycles of Organisms, such as how inheritance and environment determine the characteristics of an organism; and that all plants and animals have life cycles.
S2c Organisms and Environment, such as the interdependence of animals and plants in an ecosystem; and populations and their effects on the environment.

S4 Scientific Connections and Applications
S4a Big ideas and unifying concepts, such as order and organization; models, form, and function; change and constancy; and cause and effect.
S4d Science as a human endeavor, such as communication, cooperation, and diverse input in scientific research; and the importance of reason, intellectual honesty and skepticism.

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S5 Scientific Thinking
S5a Asks questions about natural phenomena; objects and organisms; and events and discoveries.
S5b Uses concepts from Science Standards 1 to 4 to explain a variety of observations and phenomena.
S5c Uses evidence from reliable resources to construct explanations.
S5d Evaluates different points of view using relevant experiences, observations, and knowledge; and distinguishes between fact and opinion.
S5e Identifies problems; proposes and implements solutions, and evaluates the accuracy, design, and outcomes of investigations.
S5f Works individually and in teams to collect and share information and ideas.

S6 Scientific Tools and Technologies
S6a Uses technology and tools (such as rulers, computers, balances, thermometers, watches, magnifiers, and microscopes) to gather data and extend the senses.
S6c Acquires information from multiple sources, such as experimentation and print and non-print sources.

S7 Scientific Communication
S7a Represents data and results in multiple ways, such as numbers, tables, and graphs; drawings, diagrams, and artwork; and technical and creative writing.
S7b Uses facts to support conclusions.
S7d Critiques written and oral explanations and uses data to resolve disagreements.

S8 Scientific Investigation
S8a The student demonstrates scientific competence by completing an experiment, such as conducting a fair test.
S8b The student demonstrates scientific competence by completing a systematic observation, such as a field study.
S8c The student demonstrates scientific competence by completing a design, such as building a model or scientific apparatus.
S8d The student demonstrates scientific competence by completing non-experimental research using print and electronic information, such as journals, video and computers.

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Introduction to the Tropical Rainforest

Tropical rainforests are found in a narrow belt near the equator. Rainfall of over 100 inches per year and a consistently warm temperature range create conditions for lush plant growth and a wide variety of animal species. Rainforests contain at least half of the plant and animal species found on land.

Rainforests also produce a substantial amount of the world's free oxygen and play an important role in the global water cycle. Worldwide weather is influenced by the energy released into the atmosphere by warm water from the rainforests. As rainforests disappear, changes in our own climate are expected.

One typical square mile of rainforest contains more species of flowering plants, mammals, birds, reptiles, amphibians and butterflies than most industrialized countries. Animals of the rainforest include orangutans, chimpanzees, sloths, anacondas, iguanas and jaguars. Parrots, cockatiels, hissing cockroaches and giant walking stick insects are few others. Although these examples are familiar to most of us, only about one percent of the plant and animal species of rainforest have been studied.

Many foods, drugs and other products that we use daily originate in tropical rainforests. Other products of the rainforest include rattan, resins, latex, spices and flavorings, perfumes, gums, essential oils and wood products such as teak, sandalwood and mahogany. As the rainforests disappear, the diversity of life on this earth diminishes as does the quality of our own lives.

Destruction of the rainforests is due to a variety of reasons. Economic pressure from the lumber and beef industries are two of the main causes of rainforest destruction. Clear-cutting is used by commercial loggers to remove entire forests even though only a small percentage of the trees have commercial value. Beef cattle ranching is another reason the rainforests are disappearing. The increasing demand for cheap beef by fast-food restaurants in the United States and other countries is responsible for the clearing of rainforest land to be turned into pasture land. With all its nutrients in the top two inches of soil, rainforest soil is very poor. After only a few years the land is no longer valuable for grazing and ranchers must move on to a new site destroying more rainforest.

Large areas of rainforest are also being destroyed to build hydroelectric power plants. Often the trees aren't even removed

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before flooding the dam. By-products from the rotting forest cause massive fish kills, increase the growth of aquatic weeds and produce hydrogen sulfide and other toxic substances which impose serious health risks.

Tribal people living in rainforests for hundreds of years are often relocated to new areas and lose the way of life they know. As they disappear or become more Westernized, valuable knowledge of the local medicines as well as flora and fauna are lost.

The growing human population is another reason rainforests are being destroyed. More land is needed for farming to provide food and rainforests are being replaced by farms. People have also resorted to clearing rainforests for fuel, timber to construct homes and to grow food.

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Concepts, Objectives and Vocabulary for Grades K - 2

Concepts to be Developed

1. Every plant and animal needs a habitat; a place to live where it can get enough air, water, food, space and shelter.

2. Forests are wild places covered by trees.

3. Tropical places are warm all year long.

4. Rainforests are wet and humid all of the time.

5. The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else.

6. Humans are killing so many plants and animals in the forests that many will disappear forever.

7. We can help save wild plants and animals in the rainforest by helping to protect their homes through local actions.

Program Objectives

Upon completion of the program, students will be able to:

1. Identify the differences between tropical forests, rainforests and other forests.

2. Describe how plants and animals are dependent upon one another.

3. Explain how humans are disturbing the lives of plants and animals in the rainforest.

4. List four ways we can protect animals and plants in the rainforests and locally.

Vocabulary

Prior to visiting the Zoo, it is suggested that you familiarize the class with the following vocabulary terms:

Camouflage - coloration which matches the surroundings making it harder to see an animal

Endangered - present populations are too small to survive very long: may become extinct in the near future

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Equator - the imaginary line halfway between the north and south poles.

Extinct - no longer living: all members of the species are now dead

Forest - an area covered with trees

Habitat - a particular place an animal lives

Population - all members of a species in a given area

Rainforest - a forest that receives over 100 inches of rain each year

Tropical - the area around the equator where temperatures are always warm

Tropical Rainforest - an environment in which temperatures are always warm and it rains almost every day

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Concepts, Objectives and Vocabulary for Grades 3 - 5

Concepts to be Developed

1. Tropical rainforests are located near the equator, between the Tropic of Cancer and the Tropic of Capricorn. They have many trees and are warm and wet every day.

2. Tropical rainforests have different layers of growth. They are the emergent layer, the canopy, the understory and the forest floor.

3. Over one-half of all the plant and animal species on Earth find their habitats in the different layers of the tropical forest.

4. The interrelationships between plants, animals, people, and the environment are an important part of the rainforest.

5. Rainforests are being cleared at an alarming rate. This practice destroys plants and animal species, many of which are unknown to science.

6. Humans can help protect tropical rainforests as well as local habitats.

Program Objectives

Upon completion of the program, students will be able to:

1. Describe the components of a habitat.

2. Give a definition of a “Tropical Rainforest”.

3. Describe the four layers of a tropical rainforest and name an animal found in each layer.

4. Explain why tropical rainforests are being destroyed.

5. List four ways we can help conserve tropical rainforest as well as our local habitats.

Vocabulary

Deforestation - cutting down all the trees in an area.

Endangered - present populations are too small and may become extinct in the near future.

Environment - the living and non-living things around us.

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Equator - the imaginary line around the middle of the Earth halfway between the North and South poles.

Erosion - the removal of soil by running water or wind.

Evaporation - the process in which water absorbs heat and enters the air becoming vapor.

Extinct - all populations no longer exist.

Habitat - the particular type of place in which an animal lives.

Humidity - moisture (water vapor) in the air.

Rainforest - an environment in which temperatures are always warm and yearly rainfall is over 100 inches.

Species - all animals of one particular type that does not reproduce with other groups.

Temperate - an area where seasons change from warm to cold.

Tropical - the area around the equator where temperatures are always warm.

Tropic of Cancer - an imaginary line at 23.5 degrees north latitude - the northern boundary of the tropics.

Tropic of Capricorn - an imaginary line at 23.5 degrees south latitude - the southern boundary of the tropics.

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Pre-trip Activities: Grades K - 2
1. What is a Tropical Rainforest?

Concepts

Forests are wild places covered by trees. (see *Concepts to be Developed #2* on page 10) Tropical places are warm all year long. (*Concept #3*) Rainforests are wet and humid all of the time. (*Concept #4*) The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else. (*Concept #5*)

Background

Students may not be familiar with an environment that is constantly warm and wet. In this activity, the growth of rainforest plants is compared under different conditions. In one terrarium, the plants are kept at normal room temperature and humidity. In the other, rainforest conditions are created using a clear cover to trap heat and moisture around the plants.

Materials

1. Two containers for terrariums. These may be 10 gallon aquarium tanks or deep plastic containers - clear or opaque
2. Gravel
3. Sandy soil
4. A clear plastic cover or plastic wrap for one terrarium
5. Four or five pairs of the following house plants from the rainforest: anthurium, croton, dieffenbachia, dracaena, fiddle-leaf fig, mother-in-law's tongue, parlor Ivy, philodendron, schleffera, silver vase bromeliad, spathiphyllum, swiss cheese plant, and the zebra plant.

Preparation

1. Choose a brightly lit location that is not in direct sunlight and is large enough to place the finished terrariums side by side. It is easier to build the terrarium where it is to be kept rather than move it later.

2. Place about 1/2 to 1 inch of gravel into the bottom of both aquariums or containers. Add another 2 inches of sandy soil to each. Tape a thermometer to the side of both terrariums

3. Plant exactly the same types of plants in the same places in both terrariums. Water the plants thoroughly giving the same amount of water to both terrariums.

4. Cover the top one of the terrariums with a clear plastic cover or plastic wrap. Tape the edges down if necessary. Leave the other terrarium uncovered.

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Action

1. Observe both terrariums on a daily basis for one week. Compare the temperatures in the terraria. Which is warmer? Note the droplets of water condensing on the sides of the covered terrarium. If the students are not familiar with the water cycle, take this opportunity to introduce it to them. Explain that water evaporates from the soil, condenses to form droplets (like clouds) on the plastic top which then drip (like rain) back to the soil and plants.

2. Compare the environments in the two terrariums as a habitat for living things. Which would be a better place for a frog to live in?

3. After a few weeks, compare the growth and health of the plants in the two terrariums. Which environment do rainforest plants grow best in?

Follow-up

Discuss the water cycle in more detail emphasizing the role of the rainforest in maintaining a large reservoir of water in the plant tissues and soil.

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Pre-trip Activities: Grades K - 2

2. What Does a Tropical Rainforest Look Like?

Concepts

Forests are wild places covered by trees. (see *Concepts to be Developed #2* on page 10) Tropical places are warm all year long. (*Concept #3*) Rainforests are wet and humid all of the time. (*Concept #4*) The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else. (*Concept #5*)

Background

The tallest trees scattered throughout the rain forest are called emergents. There are usually a few of these 120 to 200 feet tall trees in any one area of rainforest land. Emergents usually have small leaves and slender trunks.

The trees found in the canopy are 60 to 110 feet tall. These trees create a canopy or a giant umbrella that covers the other remaining layers. There is ample sunlight and numerous varieties of flowers, fruits, nuts and spices are found here.

Small trees that grow to 15 feet are found in the understory. This layer is often hot and humid since heat and moisture are trapped beneath the canopy.

Mosses, herbs, fungi, seedlings and ferns grow on the forest floor. These plants are often only a few inches tall. Vegetation is sparse due to lack of sunlight. High temperature and high humidity cause rapid decomposition.

Along with the students, you will construct a miniature model of a rainforest to illustrate these four levels. The model will then be used to compare temperature differences between the top and bottom layers.

Materials

1. Cardboard tubes from paper towel roll
2. Straws
3. Modeling clay
4. A 4 square foot piece of heavy cardboard 2 feet on each side
5. Various types and shades of green paper
6. Glue
7. Two thermometers
8. A lamp

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Preparation

You may wish to paint the “stems” (towel rolls and straws) shades of brown before beginning to construct the model. In addition, students may wish to be more artistic than the simple directions provided. They should be particularly encouraged to build foliage that is more consistent with the descriptions given in the background above.

Action

1. Use the illustration of a rainforest in Pre-Visit Activity #8 as a guide. Build the emergent layer first. Four of these trees is enough. Space them randomly around the board. Use the cardboard tubes as the trunks of trees. Glue one end to the cardboard. Use the lighter green paper to design the foliage. Have students assist by crumpling up some paper and then glue it to the top and upper sides of the cardboard tubes.

2. Use straws for the trunks of the trees in the canopy layer. If necessary, cut the straws so that they are about 2 inches shorter than the tubes used for the emergent layer. Small clumps of modeling clay may be used as bases to support the straws. Use medium green shades of paper to make the foliage of the trees in the canopy layer.

3. The understory may be constructed of the darkest green paper. Crumpled pieces of paper may be glued directly to the cardboard base.

4. The surface of the cardboard itself is the forest floor. Twigs and pieces of bark may be scattered about to represent fallen branches and trees.

5. Place one thermometer on the top of the canopy layer. Tape it down if necessary. Place the other thermometer on the forest floor. Place the lamp in a position such that the bulb is about eight inches above the model. Record the temperatures of both thermometers before turning on the lamp. The temperatures should be about the same at the start.

6. Turn on the lamp for 30 minutes and compare the temperatures. Compare the light and temperature conditions in the canopy to the forest floor. Which gets more light? Which gets hotter?

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Follow-up

Using a treadle wheel or a tape measure, show the children the height of the trees that grow in the different layers. Use a long hallway or playground to actually measure these distances. Divide the class into four groups. Beginning from a wall, have the “emergent group” measure 200 feet in a straight line. When they have measured to this point they are to stand there. The “canopy group” must measure to a point 110 feet from the wall and stand at that location. The “understory group” only needs to measure 15 feet to find their position. The “forest floor group” can line up against the wall.

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Pre-trip Activities: Grades K - 2

3. What Lives in a Tropical Rainforest?

Concepts

Every plant and animal needs a habitat; a place to live where it can meet all of its special needs (air, water, food, space and shelter). (see *Concepts to be Developed #1* on page 10. Forests are wild places covered by trees. (*Concept #2*) Tropical places are warm all year long. (*Concept #3*) Rainforests are wet and humid all of the time. (*Concept #4*) The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else (*Concept #5*)

Background

The rainforest is one of the most diverse environments on Earth. From the shaded, moist forest floor to the tall emergent layer, the rainforest contains many habitats for different animals. Each of the layers in a rainforest provides different conditions and therefore serves as a habitat for different animals.

The animals of the rainforest are adapted to the particular conditions of the habitats that exist there. No other place is the same as a rainforest or the organisms that live there.

Materials

1. Rainforest layer model from the last activity
2. Copies of the "Rainforest adaptation" cards.

Action

1. Explain to students that every plant and animal needs a habitat, a place to live that will meet all of its special needs (air, water, food, space and shelter). Give some examples: a squirrel needs trees that produce acorns or nuts and places to build nests, its habitat is a forest; a shark needs salt water, its habitat is the ocean, etc.

2. Explain that the year round warmth and wetness are in the tropical rainforest allows special kinds of animals to live there that can live nowhere else. Give examples: the trees of the rainforest provide fruit and a home for monkeys while the forest floor provides a habitat for the capybara (a large rodent) and the lesser anteater.

3. Distribute the "rainforest animal" cards to the students.

4. Ask the class to decide where each animal belongs in the model constructed in the last activity. In determining the habitat of each animal, direct the class to use the clues given in the animal's description and to consider what the animal eats and where it finds shelter. As each animal's place is determined, have the students tape the animal card into its place on the model.

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Follow-up

The native populations of the rainforests (indigenous populations) are dwindling as the rainforests are diminishing. Many of these cultures have developed a knowledge of the plants, animals and natural medicines that would be vastly helpful to modern science. Unfortunately, their knowledge is lost as their cultures are lost. Students may learn more about the native populations of the rainforest at various Internet sites. Look for references to the Yanomani of the Amazon, the Penan of Borneo and the Yagua of Peru.

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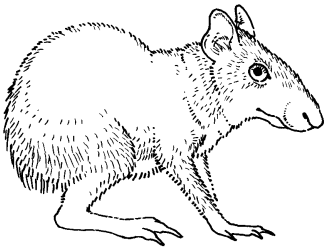
Tropical Rainforest Animal Cards

Agouti



Agoutis live mostly on fallen fruits and nuts on the ground and are built for running fast.

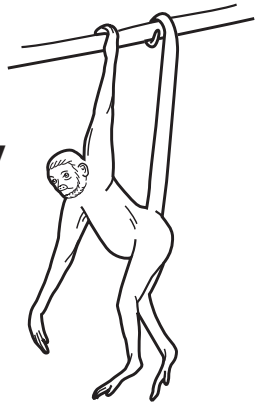
Ocelot

This medium-sized cat is a predator and hunts on the ground and in low trees.

Hoatzin

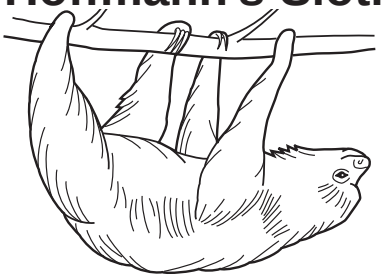
This large bird doesn't fly well, but it can climb small trees.

Spider Monkey



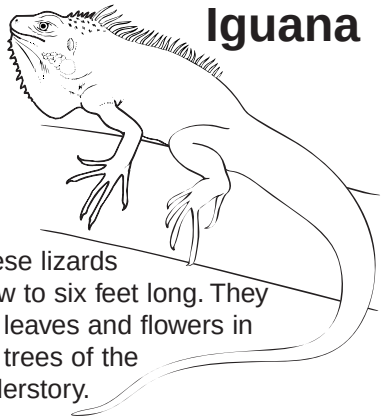
These slender monkeys have long tails they use to climb and hold food.

Hoffmann's Sloth



Leaves of the cecropia tree are a favorite food of the sloth. A sloth often stays in the tree for days.

Iguana



These lizards grow to six feet long. They eat leaves and flowers in the trees of the understory.

Kinkajou

This distant cousin of the raccoon rarely comes down to the ground.

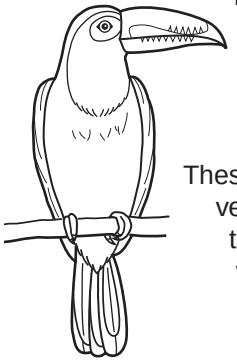
Boa Constrictor

This snake is an excellent climber, hunting for birds in trees as well as for rodents on the ground.

Harpy Eagle

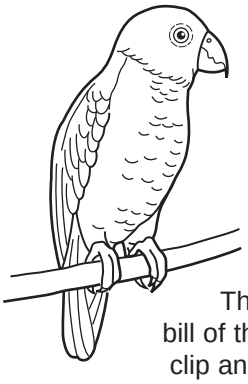
This high-flying bird is one of the few predators that hunt in the canopy layer.

Toucan



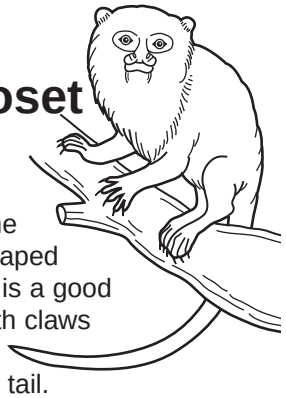
These birds have very large bills that are often very colorful.

Parrot



The large powerful bill of the parrot helps it clip and crush fruit and nuts in the highest trees.

Marmoset



A type of monkey, the squirrel-shaped marmoset is a good climber with claws and a grasping tail.

Pre-trip Activities: Grades 2 - K

4. Endangered Animals of the Tropical Rainforests

Concepts

The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else. (see *Concepts to be Developed #5* on page 10.) Humans are killing so many plants and animals in the forests that many will disappear forever. (*Concept #6*) We can help save wild plants and animals in the rainforest by helping to protect their homes through local actions. (*Concept #7*)

Background

As many as 35 species of living organisms may become extinct every day in the world's tropical rainforests. The main causes of rainforest destruction are logging, cattle ranching and overpopulation.

While some rainforest species have populations that number in the millions, other species consist of only a few thousand individuals. Living in small areas, most of these species are found nowhere else on earth. When their environment is destroyed, these species often die with it.

Most large mammals such as leopards and apes need large territories to roam. They have difficulty surviving in the smaller and fragmented habitats they are forced into as human activity closes in around them.

In this activity, children learn the names and some features of rainforest animals that are endangered.

Materials

1. "Endangered Animals" bingo cards
2. World map

Action

1. Define the terms endangered and habitat. Explain that many animals in the rainforest are in danger of extinction as their habitats are destroyed.

2. Pass out the "Endangered Animals" identification bingo cards. As you read out the clues, ask students to volunteer answers. When the correct response is given, all children may put a marker on that animal. When one or more children get four in a line, they may call "bingo."

3. Using a map of the world, locate the particular rainforests that each animal comes from.

4. Point out that all of these rainforests are being cut down for

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human uses. Ask the students to predict what happens to animals when they have no place to live. Destruction of their habitats is the main reason these animals are close to extinction.

Follow-up

Make flashcards for other endangered animals with the students. Students can make a flashcard with a picture of their animal on the front. The back of the card should have the following information:

(a) common and scientific name of animal
(b) where the animal lives
(c) what the animal eats
(d) a description of how the animal protects itself

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Endangered Animals
Clues for each animal

Surinam Toad - This strange looking amphibian has a very flat body. It lives entirely in water and doesn't hop very well like most of its cousins. The male carries the eggs on his back. (*South America*)

Asian Elephant - Its unusual trunk is the best sense organ for this large gray mammal. In addition to smelling, the trunk is used to eat, drink, bathe and lift heavy objects. (*Asia and* I*ndian subcontinent*)

Poison Arrow Frog - The skin of these amphibians releases a strong poison. Some of the South American natives use this poison on their arrows for hunting. (*South America*)

Cuscus - This gentle-looking animal has large eyes and a fuzzy appearance. It raises its young in a pouch, like a kangaroo. It lives in trees and has a tail that can be used to grab onto branches as well as "two-thumbed" hands for life in the canopy. (*Madagascar*)

Gorilla - This ground-living ape is active during the day. It is the largest of the apes. Males nest on the ground, females and young nest on a platform built less than ten feet from the ground. Although they usually walk on all fours, males sometimes stand on their hind legs and beat their chests. (*Africa*)

Jaguar - This large cat is bigger than its cousin the leopard. It has a large head with powerful jaws. The coat is often yellowish-brown, but ranges from white to entirely black. (*South America*)

Okapi - This animal is a cousin of the giraffe. Its short, sleek hair is generally reddish brown or black with stripes on the legs and flanks. Okapi's faces are cream colored. The white on the lower legs makes it look as if the animal is wearing white socks. Males have two small hair-covered horns. (*Africa*)

Reticulated (Royal) Python - This snake is tied with the anaconda for the title of the world's longest snake. It can grow to be over 30 feet long. It is an excellent swimmer and climber. It is not venomous. It kills by wrapping itself around the body of its prey and suffocating it. (*Southest Asia*)

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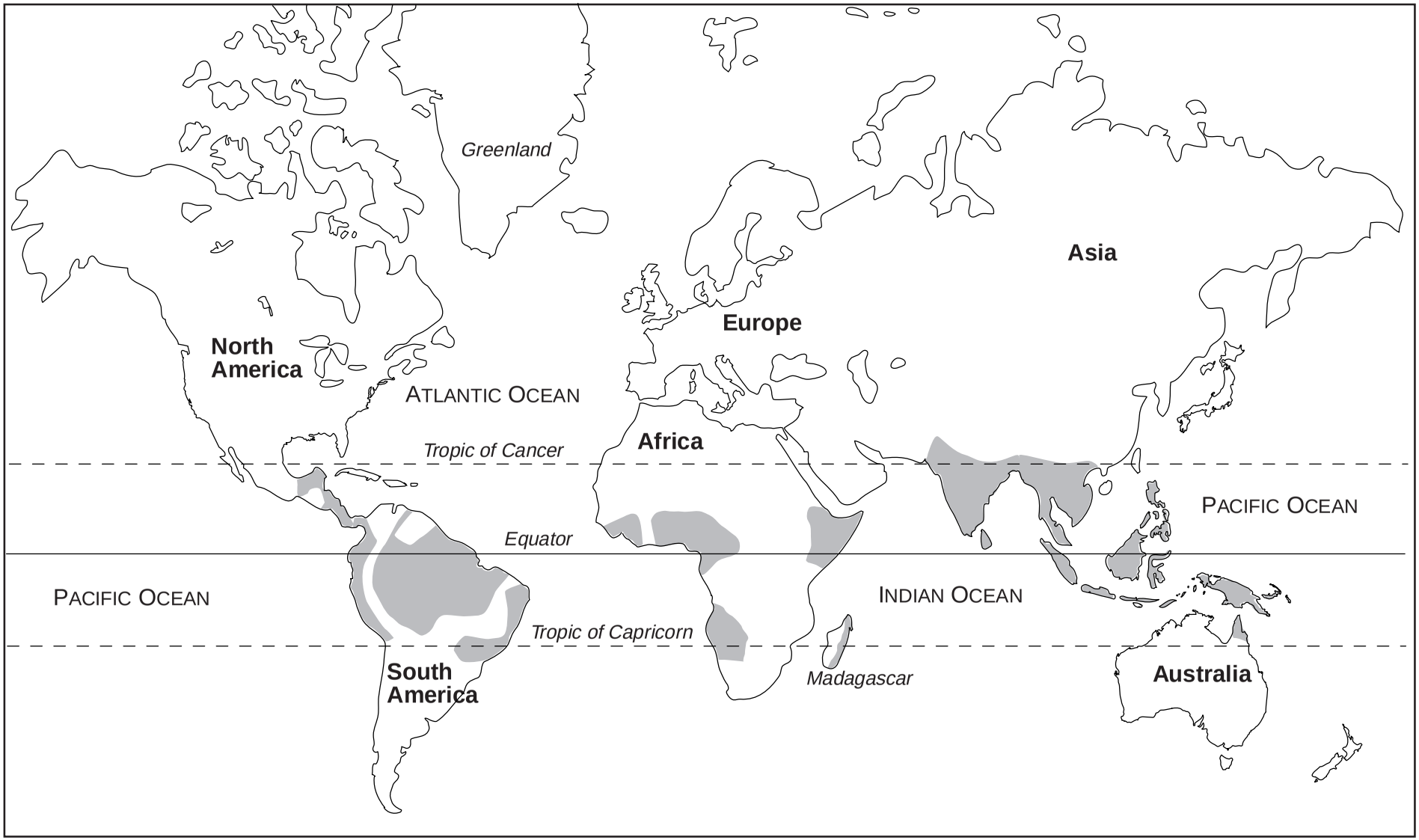
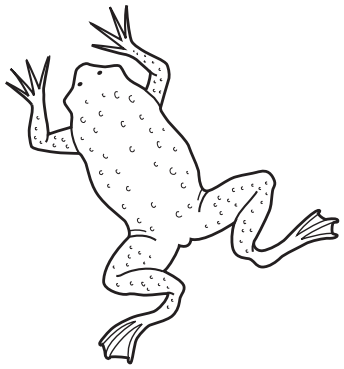
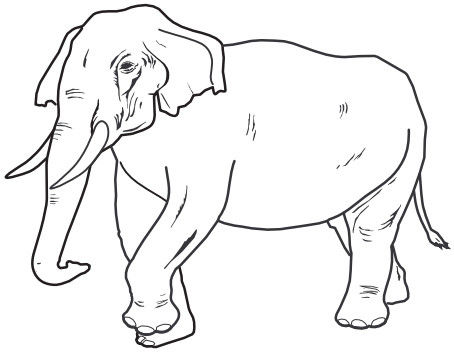
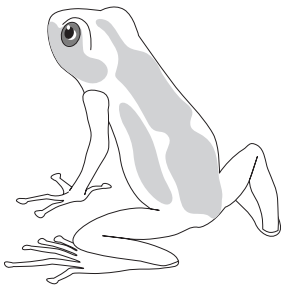
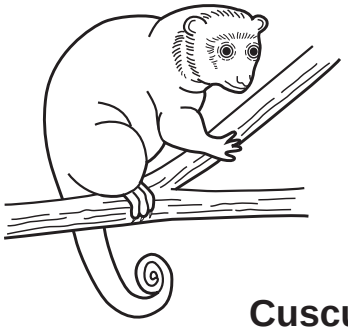
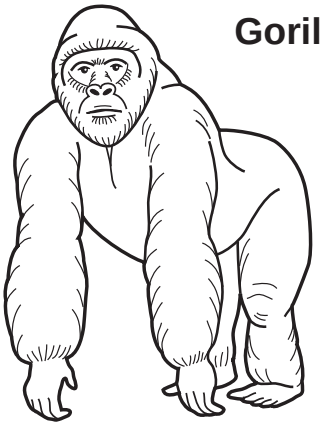
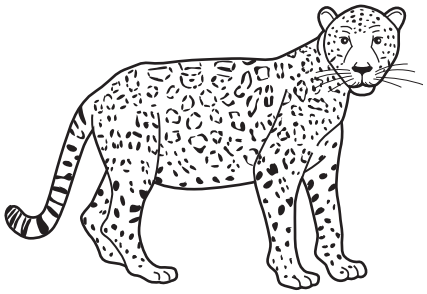
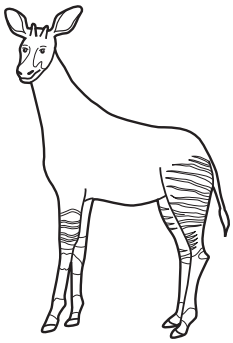
World Map of Tropical Rainforests



Endangered Animals
Bingo cards

Surinam Toad 	 Asian Elephant	 Poison Arrow Frog
 Cuscus	Gorilla 	 Jaguar
 Okapi	FREE SPACE	 Reticulated Python

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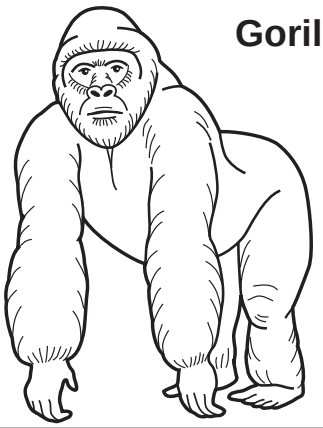
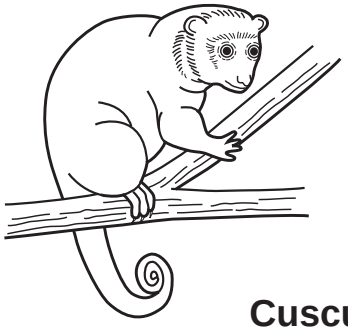
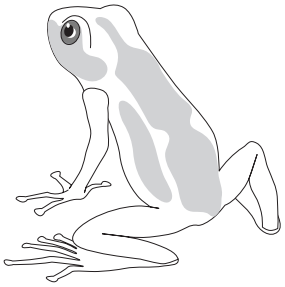
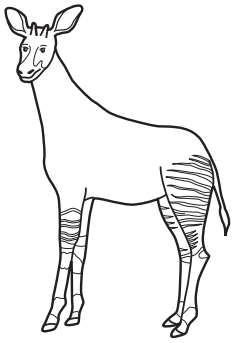
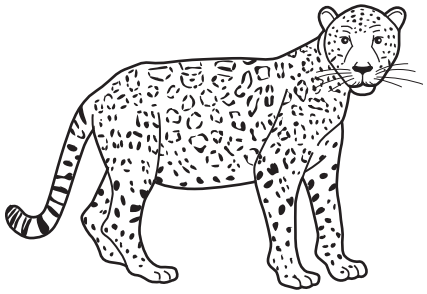
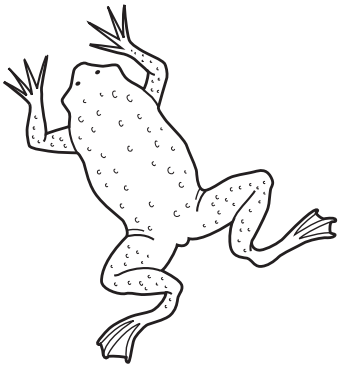
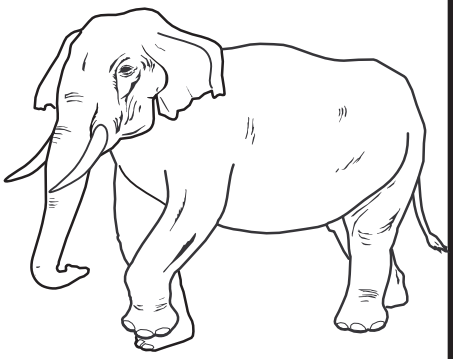
 Gorilla	 Reticulated Python	 Cuscus
 Poison Arrow Frog	FREE SPACE	 Okapi
 Jaguar	Surinam Toad 	 Asian Elephant

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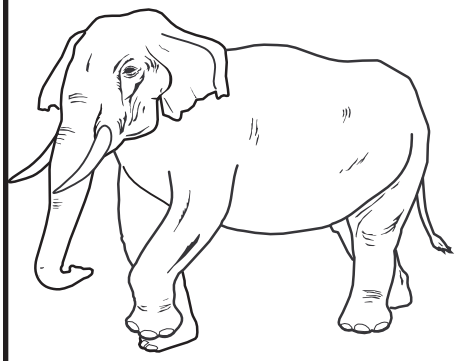
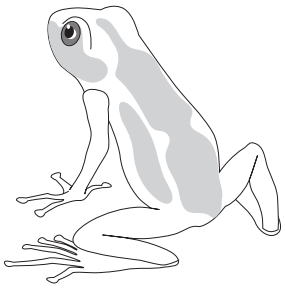
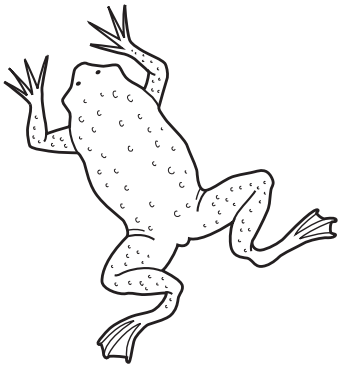
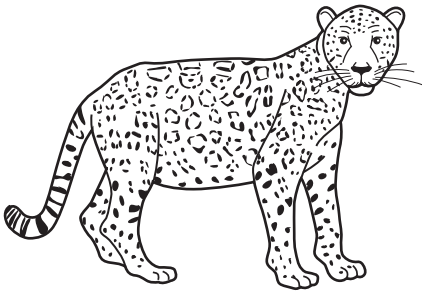
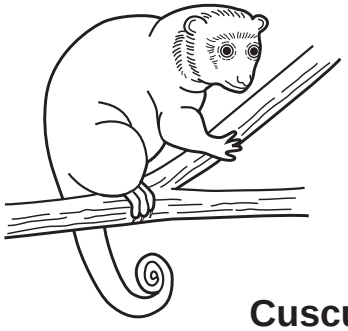
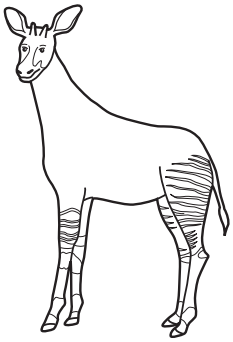
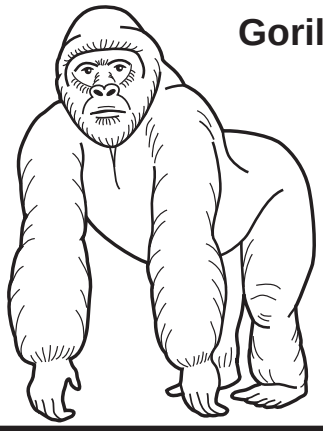
 **Asian Elephant**	 **Poison Arrow Frog**	FREE SPACE
Surinam Toad 	 **Jaguar**	 **Reticulated Python**
 **Cuscus**	 **Okapi**	**Gorilla** 

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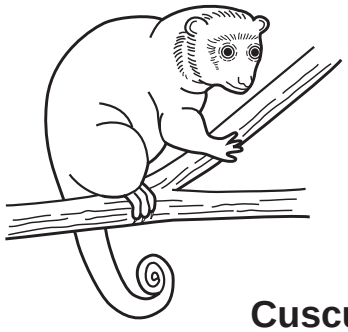
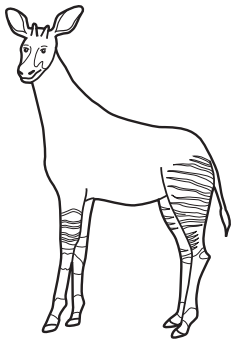
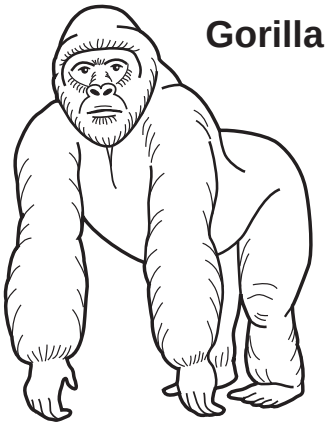
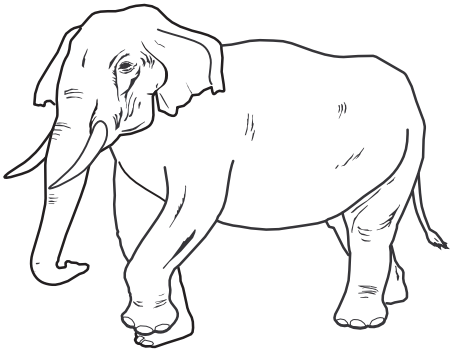
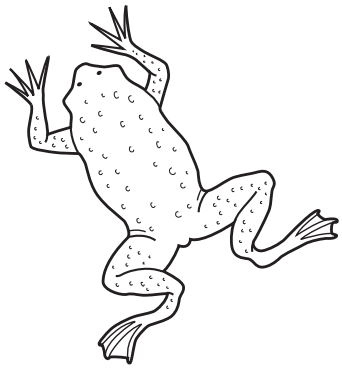
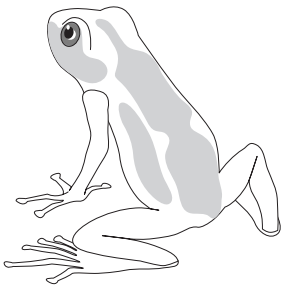
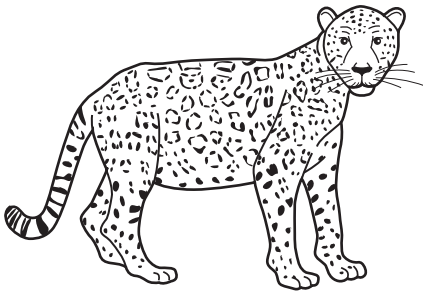
 Reticulated Python	 Cuscus	 Okapi
 Gorilla	 Asian Elephant	Surinam Toad 
 Poison Arrow Frog	 Jaguar	FREE SPACE

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Pre-trip Activities: Grades 2 - K
5. Tropical Rainforest Products

Concepts

Forests are wild places covered by trees. (see *Concepts to be Developed #2* on page 10.) Tropical places are warm all year long. (*Concept #3*) The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else. (*Concept #5*) We can help save wild plants and animals in the rainforest by helping to protect their homes through local actions. (*Concept #7*)

Background

Many familiar fruits, house plants, perfumes, spices, fibers and items made with wood come from the rainforest. In this activity, students explore and evaluate some of the ways that we use rainforest products on a daily basis.

Materials

"Rainforest Products" activity sheets for each student

Action

1. Name some familiar examples of rainforest products that students are likely to be familiar with. These might include fruits such as coconuts, bananas, lemons, limes, oranges, pineapples and tangerines. Foods and spices like cinnamon, ginger, chocolate and vanilla may also be included. Other items students may know might include bamboo (used in furniture and baskets) and house plants such as philodendron, zebra plant and the rubber tree plant.

2. Many other products in daily use originate from the rainforest. Woods such as teak, balsa, mahogany, rosewood and sandalwood are some examples that students may recognize. Explain that many familiar items such as doors and doorframes, windowsills, flooring, paneling, veneers, cabinets, dresser drawers, drawing boards, salad bowls, toys and patio furniture are made of these woods.

3. Distribute the "Rainforest Products" activity sheets. Ask students to look for examples of these rainforest products in their own homes for homework. As they find them, they should check them off on the activity sheets and bring them to class the next day.

4.On the following day, review the checklists with the students. Keep a tally of the class totals for each use. Have the class determine which rainforest products were most often found in the their homes. Other questions to explore might include: How many were used in total by the entire class? Which were the student's favorite rainforest products?

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5. Gathering some of these products can be done in ways which don't have to harm the rainforest or can be grown in ways which are ecologically consistent with the rainforest. Many of the foods, fruits and spices can be harvested by environmentally sound methods. Collecting other products, such as slow growing trees, results in destruction of the rainforests. Have the students identify how many of the products found in their homes fit into each of these categories?

6. Point out that by preserving habitats, we can help save the species that live there. By buying products that help preserve the rainforest, we can help save habitats. We can also help save habitats by avoiding products that result in rainforest destruction.

Follow-up

Locate sources of environmentally safe rainforest products. Some useful resources listing local retailers of rainforest friendly products can be found on the Internet references on the last page.

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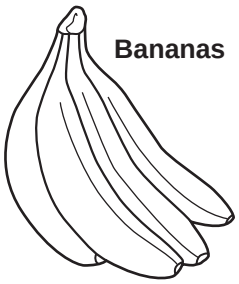
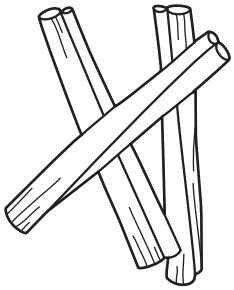
Tropical Rainforest Products

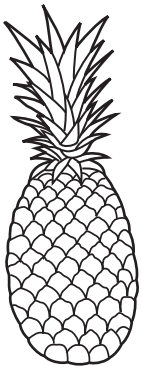


Bananas

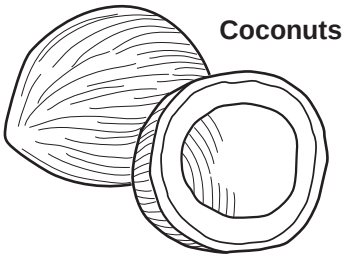


Cinnamon sticks

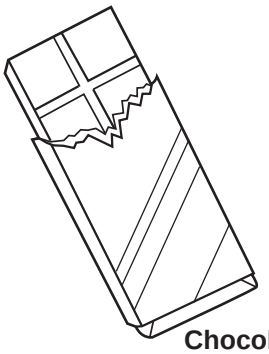
Ginger root



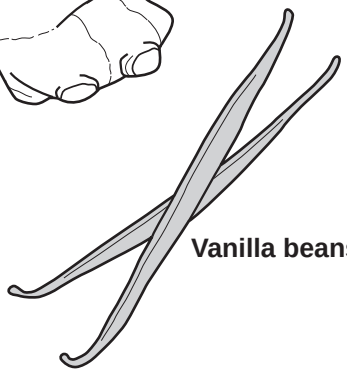
Pineapple



Coconuts

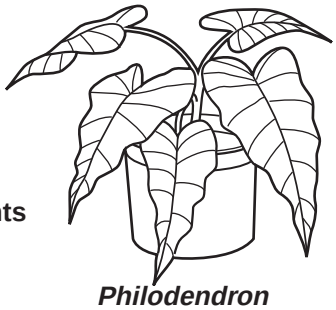


Chocolate



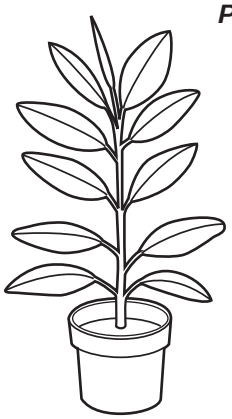
Vanilla beans

Citrus fruits
Lemons, limes, oranges, tangerines and grapefruit

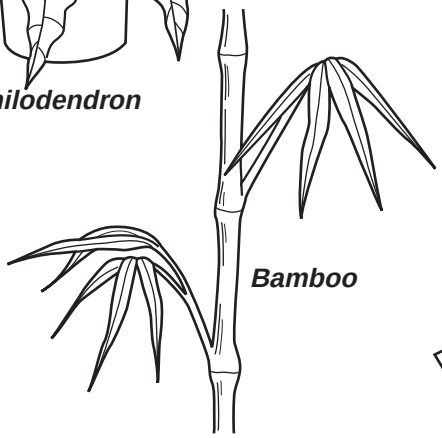


Houseplants

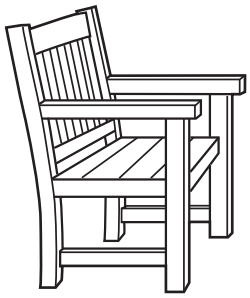
Philodendron



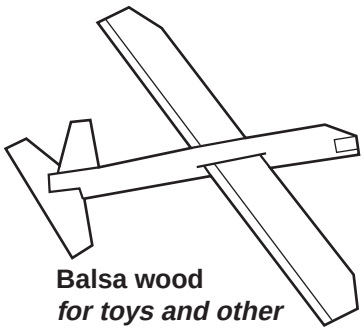
Rubber tree plant



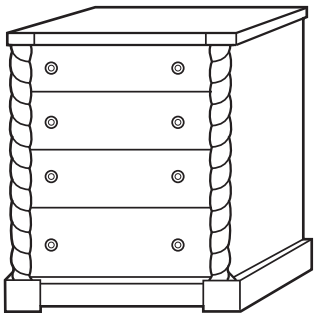
Bamboo



Teak wood
for outdoor furniture



Balsa wood
for toys and other lightweight uses



Mahogony wood
for inside furniture

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Pre-trip Activities: Grades 2 - K

6. Fruit from the Tropical Rainforest

Concepts

Forests are wild places covered by trees. (see *Concepts to be Developed #2* on page 10.) Tropical places are warm all year long. (*Concept #3*) Rainforests are wet and humid all of the time. (*Concept #4*) The year round warmth and wetness of the tropical rainforest helps to create a special habitat for many kinds of animals that can live nowhere else. (*Concept #5*)

Background

In this activity, the students will have the opportunity to taste tropical fruits that came from the rainforests.

Materials

1. Four to eight pieces of as many of the following fruits as possible: avocado, banana, breadfruit, coconut, grapefruit, guava, lemon, lime, mango, orange, papaya, passion fruit, pineapple, plantain, or tangerine
2. A large fruit bowl
3. Paper bowls and spoons for each student
4. Samples of 3 or 4 of the following: allspice, black pepper, cardamon, cayenne, chile, cinnamon, cloves, ginger, mace, nutmeg, paprika, sesame seeds, turmeric and vanilla
5. A plastic cup with a napkin crumpled up inside it.

Preparation

1. Prepare one plate for each fruit. Place one uncut fruit on each plate. Cut up a second piece of fruit into small slices or cubes - one per student (You may need to use a few pieces of fruit).
2. Cut the remaining fruit into cubes and place them into a large bowl to make a fruit salad.

Action

1. Show one of the whole, uncut fruits to the class. Ask if anyone knows what it is. If not, name the fruit for the students and write it on the board. Pass the sliced samples around for each student to get a taste. Repeat this procedure with each of the other fruits. Compare the different tastes. Leave a sample of each fruit uncut so the children can refer back to them.

2. Give each child a bowl of mixed fruit and a spoon. As they eat the fruit salad, the students may try to identify the individual tastes of the fruits and may refer to the remaining uncut fruit to check their identities.

3. Explain that many spices also come from the rainforests. These include allspice, black pepper, cardamon, cayenne, chile, cinnamon, cloves, ginger, mace, nutmeg, paprika, sesame seeds, turmeric and vanilla. Place a few drops of each sample that you have

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into a cup and label the cup with the name of the spice. Pass the samples around for the students to sniff.

4. Note that there are many foods used by native peoples that we aren't at all familiar with. These may provide food resources and genetic properties that may become useful to us in the future. Destruction of the rainforests threatens their potential.

Follow-up

1. Many other rainforest plants produce seeds that you can try growing in the classroom. Try growing some of the seeds or pits from rainforest fruit such as avacados or mangos. Instructions for growing many of these seeds can be found on the Internet or in books.

2. Buy some other foods that originate in rainforests. Some examples that are locally available include: brazil nuts, cashews, chocolate, coconut oil, cola, cucumbers, macadamia nuts, manioc, okra, peanuts, peppers, sugar cane, sweet potatoes and tapioca. These may be prepared and shared with the students after checking medical records for any allergies.

3. Plants are the basis for food chains in almost all ecosystems. The wide variety of plants in rainforests is a good part of the reason for the great variety of animals found there. Name some rainforest herbivores that the students may be familiar with and ask them what plants these animals eat. Some examples could include: elephants eat grasses, monkeys and toucans eat fruits, cockatiels eat seeds, apes and gorillas eat leaves.

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Pre-trip Activities: Grades 3 - 5

7. Where are Tropical Rainforests Found?

Concepts

Tropical rainforests are located near the equator between the Tropic of Cancer and the Tropic of Capricorn. They have many trees and are warm and wet every day. (See *Concepts to be Developed #1* on page 10.) The interrelationships between plants, animals, people and the environment are an important part of the rainforest. (*Concept #4*) Rainforests are being cleared at an alarming rate. This practice destroys plants and animal species, many of which are unknown to science. (*Concept #5*) Humans can help protect tropical rainforests as well as local habitats. (*Concept #6*)

Background

General sets of ecosystems that cover thousands of square miles are known as biomes. Biomes are defined or recognized by the dominant plant types that result from the amount of rainfall and temperature variations and are often characterized by the formation of certain soil types.

Some basic biomes on land include tundras, deserts, coniferous (evergreen) forests, rainforests, deciduous forests, mixed forests, shrub forests, savannahs, and other grasslands. Mountains show gradations of these different biomes as elevation increases.

Materials

1. A map of the world's rainforests provided on the following page
2. Six colors of crayons or colored pencils for each student or group: yellow, green, light green, red, light blue and dark blue

Preparation

1. Make one copy of the map per student
2. Have enough colored pencils or crayons for the class

Action

1. Explain the term "biome" and write the definition on the board: "A biome is an area of the Earth's surface distinguished by rainfall, temperature, soil and plant types."

2. Have the students locate the equator on the maps. If they are not already familiar with it, explain that the equator is an imaginary circle around the earth, halfway between the North and South Poles. Temperatures at the equator are warm. These warm temperatures cause a lot of water to evaporate, which results in frequent rain and the growth of rainforests. Tropical rainforests are located in a band around the equator (zero degrees latitude), mostly in the area between the Tropic of Cancer (23.5 degrees N latitude) and the Tropic of Capricorn (23.5 degrees S latitude). This 3,000 mile wide band is called the "tropics."

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3. Instruct the students to color the different rainforests of the world on the map according to the key given. Younger students may need guidance.

4. Use an atlas or other source of maps to locate the particular nations in which the rainforests are found.

Follow-up

1. Students may research various nations to find out how each nation uses its rainforests. Students may discover which nations have preserved rainforests and in which nations are the rainforests most threatened. Encourage students to explore the reasons why some nations have decided to preserve rainforests and why others are deforesting them.

2. Help students learn about their own biome (deciduous forest on the east coast of the U.S.). Locate the deciduous forests on a biome map. Take a trip to a local woodland and compare it to the rainforests. How are they similar? Are any of the animals the same? For instance, both have birds and rodents. Which are different? What animals are herbivores and carnivores in each type of ecosystem? Are food webs in rainforests more complex than deciduous forests? Why? What problems do rainforests have that are similar to the deciduous forests?

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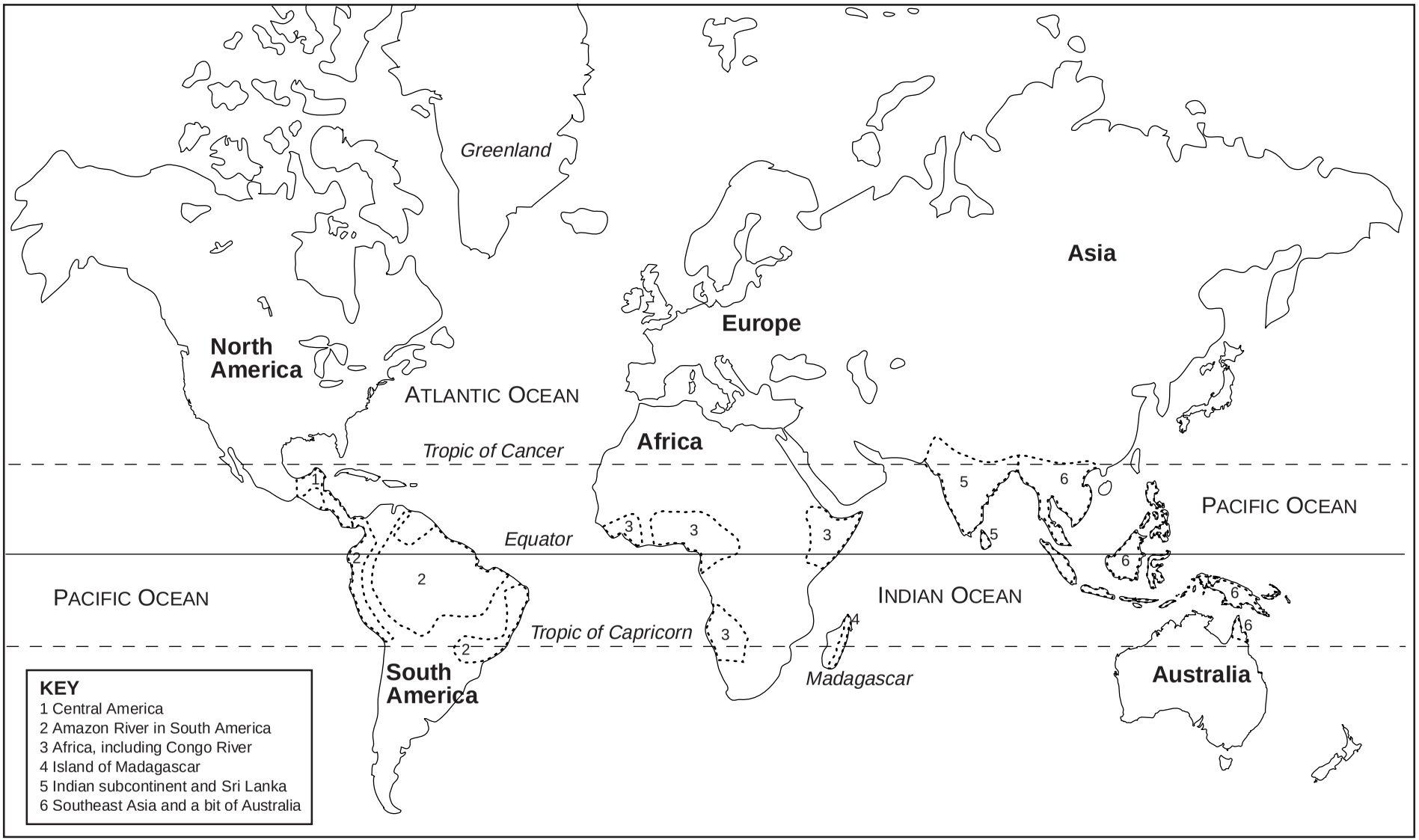
Where are the Tropical Rainforests Found?



Tropical rainforests cover only 7% of the Earth's surface. The rainforests of the world are shown on the map. Six major regions of rainforests are highlighted. Color each of the rainforests according to the following key:

1. Central America from southern Mexico through Panama contains large areas of rainforests. Costa Rica is one Central American nation that has set aside rainforests for preservation. Color the Central American rainforests light green.

2. The largest rainforests are in the Amazon River Basin of South America. Use dark green to color the Amazon rainforest.

3. The Congo River Basin in western Africa is the home of the chimpanzee and gorilla. Color this rainforest dark blue.

4. Madagascar is the large island off the eastern coast of Africa. Its unique rainforests are threatened by development. Color this island light blue.

5. India contains areas of rainforests, as does the island of Sri Lanka, on its southern coast. Color these rainforests yellow.

6. Southeast Asia and the large islands above Australia include rainforests that are the home of the orangutan. Color this area red.

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Pre-trip Activities: Grades 3 - 5

8. Life in the Layers of the Tropical Rainforest

Concepts

Tropical rainforests are located near the equator between the Tropic of Cancer and the Tropic of Capricorn. They have many trees and are warm and wet every day. (see *Concepts to be Developed #1* on page 10.) Tropical rainforests have different layers of growth. They are the emergent layer, the canopy, the understory and the forest floor. (*Concept #2*) Over one-half of all the plant and animal species on earth find their habitats in the different layers of the tropical forest. (*Concept #3*) The interrelationships between plants, animals, people and the environment are an important part of the rainforest. (*Concept #4*)

Background

Biodiversity refers to the wide variety of different species in the world. The more bidiversity, the more stable ecosystems are. The warm, moist conditions and vertical structure of the rainforest provide space for more ecological niches than any other biome. Rainforests are the most diverse ecosystems of the world, containing about half of all species of plants and animals on Earth. A typical four-square mile patch of rainforest contains as many as 1,500 species of plants, 750 species of trees, 125 species of mammals, 400 species of birds, 100 species of reptiles, 60 species of amphibians and 150 species of butterflies. Insects are so numerous that it is difficult to even estimate an average density. Many species are only found in one area of the forest and nowhere else in the world. Of the millions of species that live in the rainforest, only about one percent have been studied.

Materials

"The Rainforest Environment" activity sheets

Action

1. Distribute "The Rainforest Environment" activity sheets to each student. Instruct them to read the descriptions of the four layers along with you.

2. Ask the students to use the illustration to identify some of the types of plants found in each layer.

3. Explain that the animals of the rainforest are adapted to life in each of these layers. Ask the students to find the animals listed on the activity sheet in the diagram. As they identify each animal, they should then list it in the layer(s) in which it lives.

4. Identify the animals in the diagram as herbivores (plant eaters), carnivores (meat eaters) or as omnivores (eating both plants and animals). Construct a food web by drawing arrows on the diagram connecting each animal to its food source.

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Follow-up

1. Have the students investigate other plants and animals found in each of the four layers. What endangered species do they come across? Why are they endangered? The students should describe each animal's physical appearance and its classification, list what it eats and explain how it gets food and how it defends itself from predators.

2. Have the students do an art project to create a rainforest animal. Start by using a potato or carrot as a body. Pipe cleaners, paper clips, styrofoam balls and other art supplies can be used as arms, legs, tails and heads. The animals may be modeled after real animals or may be imaginary. Before beginning construction, each student should decide which layer the animal lives in and what its adaptations are for living in that layer. Ask students to give a short speech about their animal and how it lives. Encourage older students to simulate adaptations that they think would be necessary for that animal to survive. They should be able to describe the advantage of any and all adaptations they give their creations.

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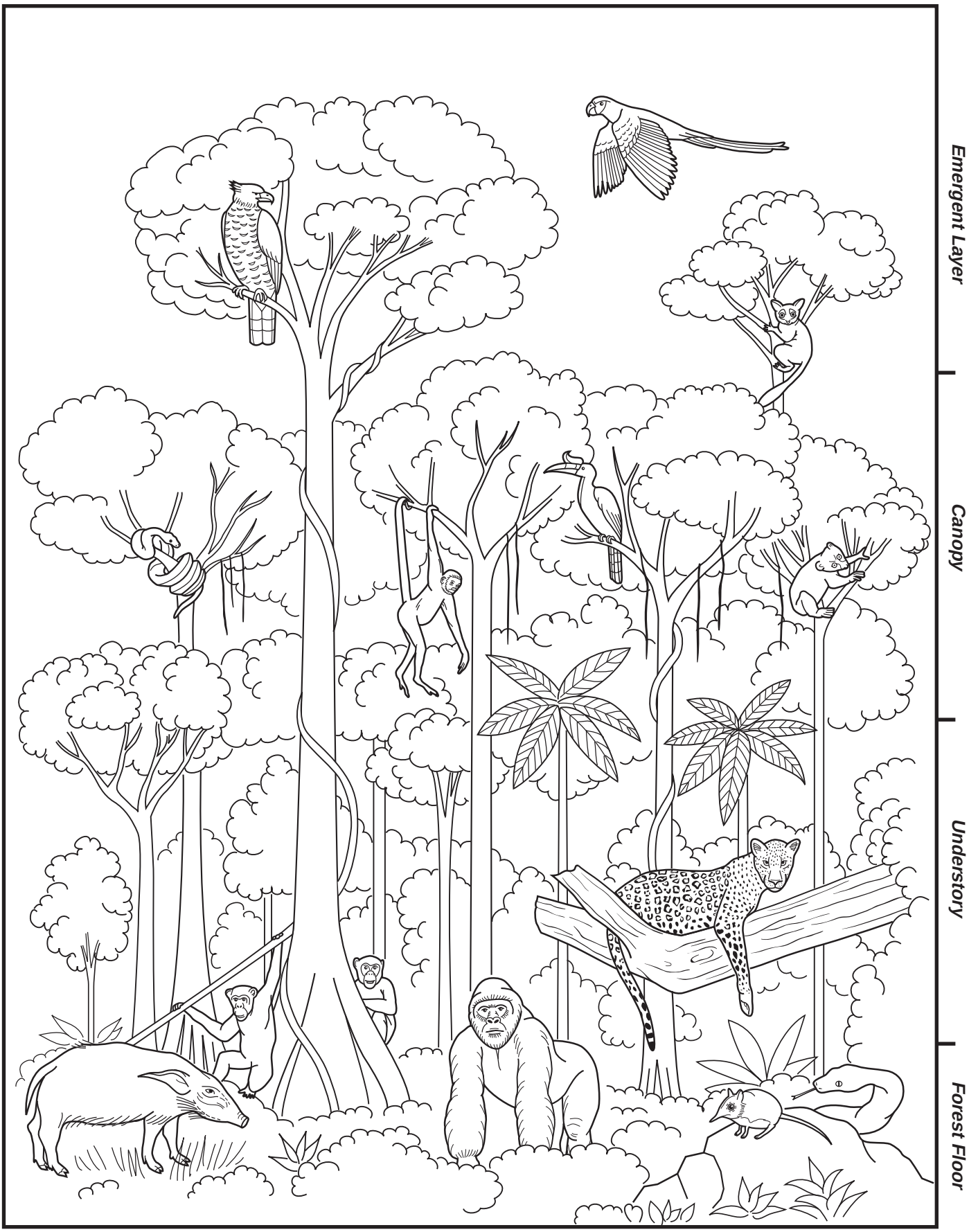
The Rainforest Environment

Animals from rainforests around the the world.



Key to Layers of the Tropical Rainforest

Emergent Layer The tallest trees scattered throughout the rain forest are called emergents. These 120 to 200 feet tall trees are scattered throughout the rainforest. Emergent trees usually have small leaves and slender trunks.

Canopy The trees found in the canopy are 60 to 110 feet tall. These trees create a canopy like a giant umbrella that covers the lower layers. There is ample sunlight and moisture for numerous varieties of flowers, fruits, nuts, and spices to exist in this layer.

Understory Small trees that grow to 15 feet including very young canopy trees, palms, smaller bushes and woody vines are found in the understory. This layer is often hot and humid since the heat and moisture of the forest are trapped beneath the canopy layer.

Forest Floor Mosses, herbs, fungi, seedlings, ferns and bromeliads grow on the forest floor. These plants are often only a few inches tall. Vegetation is sparse due to lack of sunlight. High temperature and high humidity cause rapid decomposition.

CHART

Layer	Plants	Animals
Emergent	The tallest trees, to 120 - 200 feet high	Parrot Galago (Bushbaby) Crowned Eagle
Canopy	Tall trees, to 60 - 110 feet high; flowers, fruits, nuts, and spices	Woolly Monkey Hornbill Python Potto (a primitive primate)
Understory	Small trees to 15 feet high, like young canopy trees, palms, bushes, vines	Chimpanzee Leopard
Forest Floor	Mosses, herbs, fungi, seedlings, ferns and bromeliads	Gorilla Elephant Shrew Python Bush Pig

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Pre-trip Activities: Grades 3 - 5

9. People and the Tropical Rainforest

Concepts

Rainforests are being cleared at an alarming rate destroying plants and animals, many which scientists haven't even discovered yet. (see *"Concepts to be Developed" #5* on page 10.) Humans can take several measures to help protect tropical rainforests as well as local habitats. (*Concept #6*)

Background

Rainforests are almost entirely located in developing nations. The resources of the rainforest can provide a quick source of land and income to these countries. Lumber and beef industries supplying American needs are primarily to blame. As a result of human overpopulation, displaced residents from areas bordering rainforests are also clearing rainforests to use the land as well as hunting rainforest animals for food. While native populations have been doing this for centuries, these newcomers are becoming an increasing problem.

Although rainforest conservation is a nice idea to outsiders, the people of developing countries see the rainforest as a resource to be used for national growth just as the industrialized nations have already used the natural resources within their own borders.

In this activity, students examine this problem from the point of view of the nations in which rainforests exist.

Materials

A copy of the map of the island for each student.

Actions

1. Describe the following scenario to the class:
You are the residents of a medium-sized island country located on the equator. For a long time people thought that space and resources would always exist. The coast of the island was once a grassland, but now is mostly used for farming. Most residents live on the coastal region. The interior of the island is dense rainforest. A native tribe lives in part of the rainforest. Although they are friendly to outsiders, they do not wish to leave the rainforest.

Although most people in your country are presently poor farmers, there are rich resources on your island. Overfarming has caused farms to produce smaller amounts of crops and the growing population needs more land on which to live. Some people have already begun to cut down areas of rainforests to build houses and raise crops.

A large company from the United States has offered to buy a large

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section of the rainforest. Once the lumber has been removed, they intend to use the land for beef production. They are offering jobs to many local people to help cut the timber. This company also believes that there is an oil field under part of the rainforest and would like to build oil wells in the center of the rainforest.

A number of smaller companies have also shown an interest in your country. One company would like to harvest fruits and herbs from the rainforests in limited quantities that would not harm the forest. Another company would like to develop a tourist trade that would bring people to visit an undisturbed rainforest and the animals living there. Another company would like to collect medicines from rainforest plants and animals.

This is a democratic country with an elected president and Congress similar to the United States. The newly elected president wishes to develop the country to the greatest benefit of the people of the nation, but realizes that future generations will need natural resources for their continued progress.

2. Students are to play the roles of different people in the population. Assign students to play the following roles in this country.

(a) The President (teacher may play this role)
(b) Representative of the large U.S. company
(c) Parks Director
(d) Representative of the native tribe
(e) Representative of the Fruit and Herb company
(f) Representative of the tourist company
(g) Representative of the medical company
(h) Farmers

3. Help students research their roles as they learn about the reasons behind rainforest destruction and the needs of people in developing countries. Each student should prepare a short statement explaining what they want from the President and Congress.

4. Allow each student to present their statement to the president in front of the class. After all statements are read, the rest of the students may ask questions or the representatives may have a debate (moderated by the teacher).

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5. The President will consider each statement overnight. On the next day, the President will offer a proposal on the use of the rainforests. A vote by Congress of the nation (the rest of the class) will determine whether or not the proposal is accepted. Revisions may have to be made.

*Alternatively: A debate between the representatives and the Congress of the nation (the rest of the class) may be used to negotiate a resolution which may then be voted on.

Follow-up

Research the island of Madagascar and compare it to your island and its solutions. Many of the most endangered animals in the world are from the rainforests of Madagascar. Find some examples. Why are they so endangered? How did your solution to the development of your island nation compare to Madagascar's experiences. See references.

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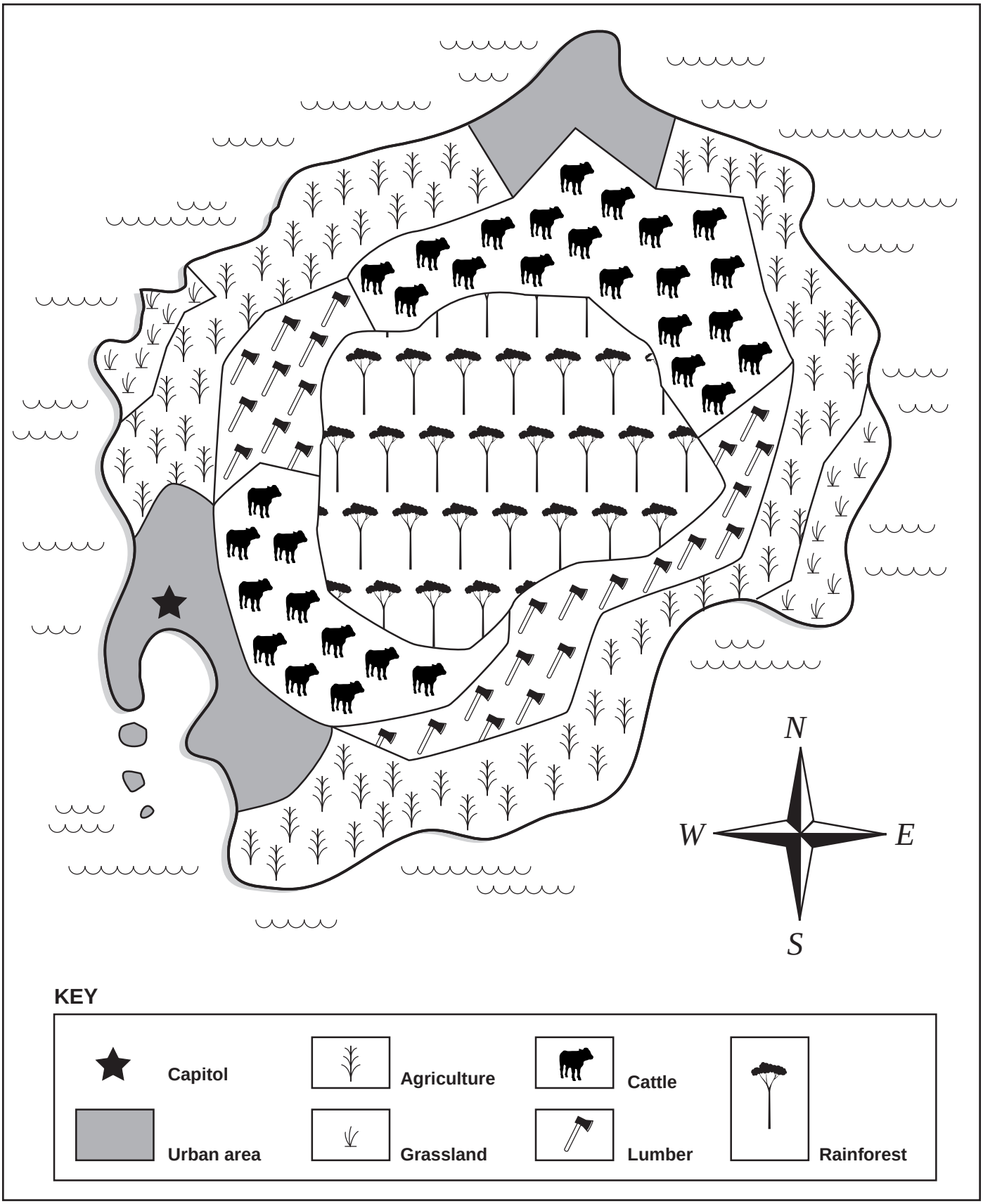
An Equatorial Island Nation



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Pre-trip Activities: Grades 3 - 5
10. The Costs of Extinction

Concepts

Over one-half of all the plant and animal species on Earth find their habitats in the different layers of the tropical forest. (see *Concepts to be Developed #3* on page 10.) The interrelationships between plants, animals, people and the environment are an important part of the rainforest.. (*Concept #4*) Rainforests are being cleared at an alarming rate. This practice destroys plants and animal species, many of which are unknown to science. (*Concept #5*)

Background

The increasing rate of species extinction in rainforests has been well publicized in recent years. Some estimates claim that as much as 40% of the land species will become extinct in the next century as human pressures increase and habitat is lost. The consequences of accelerated rates of extinction are more than just the loss of biodiversity. In this activity, students explore some of the real effects that result from rainforest destruction.

Materials

"Tropical Rainforest Resources" activity sheet for each student

Action

1. Explain that rainforests are important to us in many ways, even though they are so far away. Preservation of the rainforest matters for a number of practical reasons.

2. Distribute the "Tropical Rainforest Resources" activity sheets to the students. Have students read the descriptions of each resource from the rainforest that are listed on the left.

3. In the right hand column are six examples of events that demonstrate why rainforests are important. Ask the students to match the examples listed on the right to the rainforest resources described on the left. It is possible for an event to represent more than one of the reasons for preserving rainforests.

4. As connections are made, discuss how or why each event is related to our lives.

Follow-up

Explore some more examples that demonstrate why rainforests matter to us. What other medicines are manufactured from rainforest organisms? Which plants do indigenous people use for food? Could any of these be grown for export? What other kinds of resources do we get from rainforests?

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Tropical Rainforest Resources

Resources

1. Many indigenous people survive directly on the resources of the rainforests. They eat wild game and use the plants for food and medicine. Many identify certain species as sacred and essential parts of their life. When these resources are destroyed, the people lose their homes, their food, and their way of life.

2. The **genetic diversity** found within the rainforests provides valuable varieties of plants which help maintain and improve domestic crops. Wild plants often contain genes which can be crossed with regular crops to make them better protected against pests and diseases. Without a variety of strains, crops can easily be destroyed by bacterial or fungal diseases.

3. Some **medicines** that we use come from rainforest species. A large number of species that may be useful are still undiscovered. The rainforests are likely to hold important medicines to fight present and future diseases. As more and more species disappear from the earth, more and more sources of possible medicines are lost.

Examples

A. Chemicals found only in the rosy periwinkle, a rainforest plant, have the ability to keep certain cancer cells from growing. These chemicals have helped increase the survival rate for childhood leukemia.

B. Crossing rainforest relatives with crops more than doubled the amount of some fruits and vegetables produced in the US between 1930 and 1980.

C. Recently an American oil company began test drilling on the ancestral territory of the U'wa people in Colombia. The U'wa believe this will have devastating social and environmental repercussions for their people and their land.

D. Quinine water is made from the bark of a tree. At first, it was imported to Europe as a popular drink, but it was soon discovered to be useful in treating malaria.

E. Many rainforest tribes use the plant we call Cat's Claw for treating certain diseases. Chemicals in this plant are being studied for treatment of arthritis, allergies and intestinal disorders.

F. The Venezuelan government is planning to build electrical transmission lines across the Canaima National Park, home to thousands of Pemon Indians. While this will benefit mining companies operating in the area, it will damage the Indians homelands.

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Pre-trip Activities: Grades 3 - 5

11. How Fast is Extinction Happening?

Concepts

Over one-half of all the plant and animal species on Earth find their habitats in the different layers of the tropical forest. (see *Concepts to be Developed #3* on page 10.) The interrelationships between plants, animals, people and the environment are an important part of the rainforest. (*Concept #4*) Rainforests are being cleared at an alarming rate. This practice destroys plants and animal species, many of which are unknown to science. (*Concept #5*)

Background

The earth's species are dying at an alarming rate; many times faster than the natural rate of extinction. By carefully examining fossil records and ecosystem destruction, some scientists estimate that as many as 137 species disappear from the earth each day; which adds up to an astounding 50,000 species disappearing every year.

Tropical rainforests contain at least half of the earth's species. The incredible diversity of the rainforests means that most species have evolved to inhabit very specialized niches in their environment. When humans disrupt that environment, many species cannot survive. This breakdown of rainforest ecosystems will likely lead to the disappearance of up to 10% of the world's species within the next 25 years.

Materials

A copy of the ”How Fast is Extinction Happening?” activity sheet for each student

Action

1. Explain that no species of animal or plant lasts forever. Dinosaurs, sabertooth tigers and mastodons may be used as examples. Explain that new species evolve to replace those that have become extinct, but that this is naturally a slow process. If species become extinct at a faster rate than normal, the number of different species on Earth (biodiversity) decreases.

2. Distribute the ”How Fast is Extinction Happening?” activity sheet to the class. Work through the problems with older students or lead younger students through the activity sheet.

3. After completing the activity sheet, point out to the class that over one-half of all the species of plants and animals on the earth are found in the tropical rainforests. Since many live in very specific environments, the rapid rate at which rainforests are being destroyed is rapidly increasing the rate of extinction.

Explore some more examples that demonstrate why rainforests matter

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to us. What other medicines are manufactured from rainforest organisms? Which plants do indigenous people use for food? Could any of these be grown for export? What other kinds of resources do we get from rainforests?

Follow-up

1. Create a rainforest with sound effects. Ask for audience participation on the sounds. In addition to vocal effects, participants may use props and instruments such as taut rubber bands to strum and paper to crumple to create fire sounds. Start with quiet sounds like buzzing insects, gurgling water and hissing snakes, then add birds, monkeys and big cats. Finally add the sound of bulldozers and fire. Keep the fire sound going while you diminish the animal sounds one by one.

2. Have students create profiles of extinct animals. Research some recently extinct animals and find out why they have become extinct and what effects their extinction may have had on their ecosystems. The Dodo bird and the Calvaria tree is an excellent example to start with. Some other species to explore might include the passenger pigeon, the Tasmanian wolf and the Caribbean monk seal.

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How Fast is Extinction Happening?

Determining how often animals become extinct, both in the present and past involves careful scientific study and calculations. This includes using the fossil record. Fossil records can reveal how long different animals generally exist on the earth before becoming extinct. From this information, scientists can find the natural rate of extinction without human intervention.

Mammals are one of the best-studied animal groups. The fossil record shows that most mammal species live for about one million years.

By examining some recent data we can compare the rate of extinction in the past to the present rate at which mammals are becoming extinct.

Problem #1 There are 5000 species of mammals alive today. Some of these have been around longer than others. Since the average existence of a species is 1 million years, we can find the natural rate of mammal extinction by dividing 1 million by 5000.

Problem #2 Between 1600 and 1900, 40 species of mammals became extinct due to humans - mostly because of hunting. To find the extinction rate, divide the number of species that have become extinct by the number of years between 1600 and 1900.

Problem #3 Problem #3: Between 1900 and 2000, at least 50 mammals have become extinct. Many of these extinctions have occurred because humans destroyed the habitats in which particular animals live. To find the present extinction rate, divide the number of species that have become extinct by the number of years between 1900 and 2000.

Problem #4 Problem #4: To find how much faster the rate of extinction is increasing, divide the natural rate of extinction by the rate of extinction in the last 100 years (Divide the answer to Problem to #1 by the answer to problem #3).

Answers appear on the back of this page.

Extinction happens naturally. Usually, extinction occurs when species fail to adapt to a changing environment. At present, however, humans are altering the environment too quickly for other species to adapt. Only in modern times have so many species become extinct in such a short period of time.

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Answers

Answer to Problem #1:
The natural extinction rate would be one species every 200 years.

Answer to Problem #2:
Between 1600 and 1900, a period of 300 years, the extinction rate was one species every 7 1/2 years.

Answer to Problem #3:
Between 1900 and 2000, a period of 100 years, the extinction rate was one species every 2 years.

Answer to Problem #4:
The rate of extinction is presently 100 times the natural rate.

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Pre-trip Activities: Grades 3 - 5

12. Saving the Tropical Rainforests

Concepts

Rainforests are being cleared at an alarming rate. This practice destroys plants and animal species, many of which are unknown to science. (see *Concepts to be Developed #5* on page 10.) Humans can help protect tropical rainforests as well as local habitats. (*Concept #6*)

Background

Two hundred years ago, rainforests covered nearly twice the area they do now. Experts estimate that as many as 137 species of plants and animals may become extinct every single day due to deforestation of rainforests and that the last remaining rainforests could be consumed in less than 50 years.

Nearly half of the world's species of plants, animals and microorganisms will be destroyed or severely threatened over the next quarter century due to rainforest deforestation.

Most rainforest trees are cleared by chain saws, bulldozers and fires for their timber value and then are followed by farming and ranching operations.

The distant rainforest seems to be so remote that students may have difficulty sensing the results of preservation efforts. In this activity, students design posters to show how local action can affect preservation of rainforests and then put their suggestions into effect..

Materials

1. Construction paper or poster board
2. Markers or crayons
3. Glue and craft supplies as needed

Action

The following is a partial list of some things that can be done to preserve rainforests. Have the students work individually or in small groups to design posters to show how each can help save rainforests. When students have completed the posters, have them describe ways they can put their suggestions into action and then do so!

1. One way to help preserve rainforests is to avoid using wood that comes from rainforests. Lumbering is one of the reasons that the rainforests are being destroyed. Often only a few trees in an area of rainforest are useful, but the whole area is cut down because it makes the job easier. Rainforest woods include teak, mahogany, rosewood, balsa and sandalwood.

2. Use less paper as well, since paper production is another reason trees are cut down. Some ways to accomplish this include:
A. Use post-consumer waste (PCW) recycled paper whenever possible.

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B. Use tree-free paper, which is made from plants like kenaf, corn stalks or wheat straw.
C. You can also save paper by writing on both sides of the sheet and by using scrap paper for notes
D. Always remember to recycle.

3. Cut down on eating red meat (with parental permission). Another major reason rainforests are being destroyed is for raising cattle for beef. Millions of acres of rainforest are burned so that the land can be turned into grass pastures for cows. The meat from these cattle often ends up in fast-food hamburgers, frozen meat products and canned pet food for the United States. Fifty-five square feet of rainforest is destroyed for every quarter-pound fast-food hamburger that comes from the rainforest.

4. Fund raise for the rainforest! Selling wildlife T-shirts or producing a rainforest art show are two ways to do this. Raising money to help protect rainforest land is important. A number of organizations are involved in buying areas of rainforest for preservation. Even small donations matter. Some websites set up by rainforest and other conservation organizations even have links that will donate money to saving rainforest land if you just click on them.

5. Write a letter. There are many corporations that destroy the rainforest by logging the trees, drilling for oil or using rainforest beef in their products. Writing letters to the presidents of companies that destroy the rainforest sends them a message that their consumers aren't happy with what they are doing. This may cause the companies to change the way they do business.

Follow-up

1. Call the Zoo to make an appointment to bring the posters for display.

2. Have the students explore the concept of sustainability. Define what sustainability is (maintaining the functions and processes of an ecosystem while meeting the needs of the present and without compromising the needs of future generations) and why it is important to saving rainforests.

3. Make recycled paper with the class. An old blender, newspaper and water are the minimal requirements. Shred the paper, mix with lots of water in the blender and blend as thoroughly as possible. Spread the pulp between two pieces of screen and roll with a brayer or rolling pin. Instructions for fancier versions of paper making can be found on the Internet. You may even use this as an introductory activity and use the homemade recycled paper for making the posters.

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Pre-trip Activities: Grades 3 - 5

13. Bromeliads are adapted to the Tropical Rainforest

Concepts

The interrelationships between plants, animals, people and the environment are an important part of the rainforest. (see *Concepts to be Developed #4* on page 10.) Rainforests are being cleared at an alarming rate, destroying plants and animals, many which scientists haven't even discovered yet. (*Concept #5*)

Background

Bromeliads are a group of plants that are well-adapted for life in the tropics and subtropics of the New World. They show a great diversity of plant forms with many species having attractive, brightly-colored leaves, flowers and fruits.

The majority of bromeliads are epiphytes - they grow supported on other plants without harming their hosts. Many of them hang from the branches of trees in tropical rainforests where they can trap enough water to survive with their leaves from the rainfall and humid air. Some bromeliads are known as urn plants because their overlapping leaves form funnels for collecting water.

Bromeliads, like other rainforest plants, are important to animals. Some frog species use the water that collects in basal leaves to lay their eggs. The tadpoles develop in these "penthouse ponds."

Materials

For each group of students:
1. two bromeliads of the same species and similar size
2. gravel
3. sandy soil
4. two flower pots
5. a large, clear plastic bag

Action

1. Allow the students to observe the bromeliads. Direct their attention to the adaptations for absorbing water; upward facing leaves arranged in a whorl at the top of the fruit and/or aerial roots. Explain that bromeliads capture water in the base of these leaves and absorb water from the air.

2. Ask the students to devise a way to create a rainforest environment given the materials available. If they are familiar with the green house effect, they may be know that a plastic covering will act as a greenhouse. Cover one entire plant, including the pot, with a clear plastic bag. This will keep moisture and heat in creating a rainforest environment for the plant. Don't cover the other plant, but keep all other conditions the same.

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3. Place both plants in a warm, sunny spot but not in direct sunlight. Have the students observe and compare the plants daily. Direct students to observe the differences in temperature and humidity. Direct students to observe how the leaves of the covered plant help catch extra water if they don't notice this on their own. Give each plant an equal amount of water every few days.

4. After a month has passed, note the general appearance and health of the two plants. Which is doing better? Why might this be?

Follow-up

1. Buy some other foods that originate in rainforests. Some examples that are locally available include: brazil nuts, cashews, chocolate, coconut oil, cola, cucumbers, macadamia nuts, manioc, okra, peanuts, peppers, sugar cane, sweet potatoes and tapioca. These may be prepared and shared with the students.

2. Try growing some of the seeds or pits from the fruit that were used in this activity. Students may experiment in attempting to grow seeds from rainforest plants. Instructions for growing avocados and many other rainforest plants can be found in exotic gardening books or on the Internet.

3. Many common items are made with wood and fibers from the rainforest. Students may find examples in their own homes. These include woods such as: teak, mahogany, rosewood, balsa and sandalwood. Items made of these woods include: doors, doorframes, windowsills, flooring, paneling, veneer, cabinetwork, dressers, drawing boards, salad bowls, toys, garden furniture, packing cases, insulation and plywood.

Fibers from the rainforest include: rattan (used in wickerwork, baskets and chair seats), bamboo (furniture and baskets), jute (rope and burlap), kapok (insulation, soundproofing and life jackets), kenaf (rope and burlap), raffia (rope and cord, baskets) and ramie (fabric and fishing lines)

4. House plants that come from the rainforest include anthurium, croton, dieffenbachia, dracaena, fiddle-leaf fig, mother-in-law's tongue, parlor ivy, philodendron, rubber tree plant, schleffera, swiss cheese plant and the zebra plant. Students may find examples of some of these plants in their own homes.

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What to Do After Your Trip to the Zoo

Fundraise for the Rainforest

Fundraise to donate money to a program or organization that either buys rainforest land for conservation, contributes to native peoples to help them develop in environmentally sound ways or otherwise conserves rainforests. Fundraising projects may include carwashes, tee-shirt or even rainforest chocolates. Some organizations which accept contributions for such programs include:
(a) The Rainforest Action Network's "Adopt an Acre" program http://www.ran.org/paa/paa.html
(b) The Rainforest Alliance's "Allies of the Rainforests" program at http://www.rainforest-alliance.org/programs/allies/index.html
(c) The Nature Conservancy's "Adopt an Acre" program at http://www.tnc.org/international/specialinitiatives/adoptanacre/

Educate Your School

Create a publication or design a bulletin board with the class to inform other students in the school about the importance of rainforests. The product should define what a rainforest is, where rainforests are found, why rainforests are important, and what can be done to save them.

Research Indigenous Peoples

Have students work in groups to research the culture of the indigenous people of the rainforests. How do they build shelters, cultivate crops and raise animals for food? Can students find recipes for foods used by the people of the rainforest? Is any of the rainforest wildlife mentioned in their music or mentioned in songs? Information about indigenous people of the rainforest may be found at a number of the references listed on the next page. The links found in the Raintree "Help with School Reports" site on the Internet is a good place to begin.

Investigate Endangered Species

Investigate endangered animals that inhabit rainforests. Half of the known species of plants and animals are found in the rainforests. Some are endangered by habitat destruction, some by human hunting and some by pollution. Choose a few species for the class to investigate individually or in small groups.

Make a Food Web

Use animal cards in activity #3 to construct a food web. Children may play the roles of different animals to construct a food web by linking prey to their predators using lengths of yarn. Simple food chains may be constructed with lower grades. Older students may interconnect the food chains to produce food webs demonstrating the interconnections between animals in the savannah. Have children hold up pictures of the animals they represent when connected with yarn and take a photo to send to the Zoo.

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Have students construct diorama of the savannah environment. Encourage some students to build kopjes, and others to build grassland or river habitats. Three or four animals should be included in each habitat and students should be able to explain how the animals are adapted to finding food, water, and shelter in their habitat. (Younger students may be assigned only one or two animals.)

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References for the Rainforest

Internet

1. The Rainforest Action Network at **http://www.ran.org** has a vast wealth of information about rainforests including an activity filled curriculum supplement for grades 3-6, information about indigenous peoples, a children's section and up to date action alerts about current events involving rainforests.

2. Raintree Nutrition, Inc. maintains an extensive collection of information and educational resources available on the internet at **http://www. rain-tree.com/** . The "Help with Rainforest School Reports" contains many very useful links to topics related to rainforests.

3. The Rainforest Alliance at 65 Bleecker Street, New York, NY 10012 (212) 677-1900 or (888) MY EARTH sponsors an "Allies of the Rainforest" program and contains much useful information for teachers and students. It can be found on the Internet at **http://www.rainforest-alliance.org/**

4. "What is a Rainforest?" maintained by the Enchanted Learning Company is a useful site for children can be found at the website: **http://www.EnchantedLearning.com/subjects/rainforest/Allabout.shtml**

5. "Help Save the Rainforests!" at **http://www.urich.edu/~ed344/hunts/rainforest.html** is an Internet Treasure Hunt about Rainforests from the University of Richmond. Made for children, it contains many helpful links for research.

6. Compiled by the World Conservation Monitoring Centre, a list of 140 threatened species linked to information sheets with plenty of information about individual species can be found at the website: **http://www.wcmc.org.uk/species/data/species_sheets/**

Books

How Monkeys Make Chocolate : Foods and Medicines from the Rainforests by Adrian Forsyth (September 1995) Owl Communications; ISBN: 1895688329 (Ages 9-12)

Exploring the Rain Forest : Science Activities for Kids by Anthony D. Fredericks, (September 1996) Fulcrum Pub; ISBN: 1555913040

A Teacher's Guide to a Walk in the Rainforest (Teacher's Guide) by Bruce Malnor, Carol Malnor (May 1998) Dawn Pubns; ISBN: 1883220742

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Feedback Questionnaire

We thank you for utilizing the information in the Staten Island Zoo's Teacher Activity Packets. We would appreciate any feedback about the effectiveness of the activities and suggestions provided. The information you provide in the following questionnaire will help us to further meet the needs of teachers using the Zoo as an educational resource.

Name _____

School or Organization _____

What Teacher Activity Packet/s have you used or considered for use?

_____

How would rate the effectiveness of each activity?

Teacher Activity Packet Title _____
Activity Number _____
Effectiveness: Circle one: Excellent Good Fair Poor

Comments:

Do you feel that the information, activities and suggestions provided coordinate well with the science curriculum set forth by the State and/or City of New York?

Circle one: Always Usually Sometimes Never

Comments:

Do you agree that conservation information and messages are clearly stated and sufficiently represented throughout the Teacher Activity Packet(s)?

Circle one: Always Usually Sometimes Never

Comments:

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Have you conducted any of the multidisciplinary activities that involve subjects such as the arts, social studies or mathematics?

Circle one: YES NO

If so, did you find the activity useful in teaching the subject?

Teacher Activity Packet Title: _____
Subject: _____
Effectiveness: Circle one: Excellent Good Fair Poor

Comments:

How would you rate the overall quality of the Teacher Activity Packet(s)?

Circle one: Excellent Good Fair Poor

Comments:

Have you conducted any of the long-term activities from the Teacher Activity Packets such as research or conservation projects?

Circle one: YES NO

If so, did you feel the project(s) was successful?

Circle one: YES NO

Comments:

Would you be interested providing further suggestions by joining a panel of teachers assembled to review these Teacher Activity Packets periodically?

Circle one: YES NO

If you are interested, please give us your name and telephone number in the space below.

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