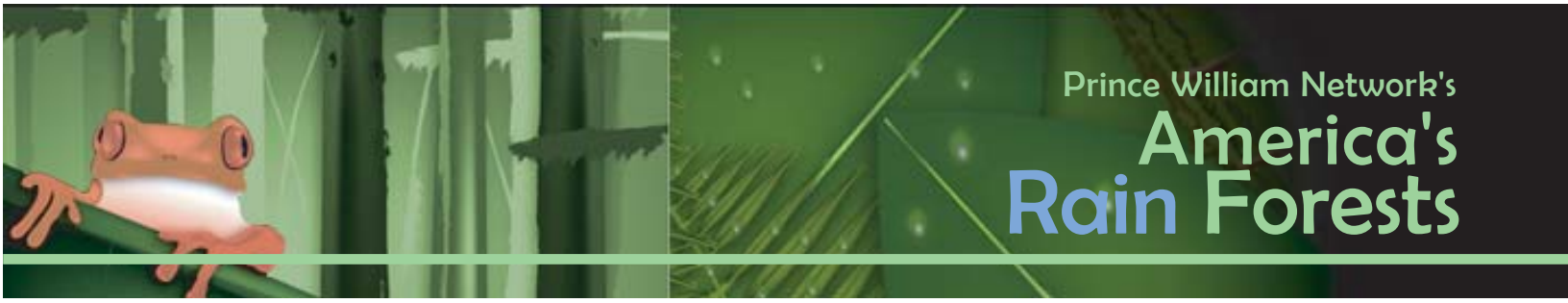


Tropical Treehouse

Rain Forest Values & Challenges

National Science Education Standards

- Standard C: *Life Sciences* — Populations and ecosystems.
- Standard C: *Life Sciences* — Diversity and adaptations of organisms.
- Standard F: *Science in Personal and Social Perspectives* — Populations, resources, and environments.

OVERVIEW

IIn this activity, studying tropical rainforests and issues involving the use of rainforests will enable your students to make more informed decisions regarding the future of such regions. While tropical rainforests and the temperate forests of North America operate on many of the same eco- logical principles, they differ greatly in their climates, and in the types of soil, plants, and animals that make up the forest ecosystems.

OBJECTIVES

Students will:

1. Describe the plants and animals that live in different levels of the tropical rain forest
2. Examine and discuss a case study that invovles the rights of native inhabitants of a tropical rain forest in a national park.
3. Describe the sounds they might encounter when visiting a rain forest.

SUBJECTS

Social Studies, Language Arts, Performing Arts, Visual Arts

VOCABULARY

emergent, canopy, understory, forest floor, epiphytes, leaching, erosion

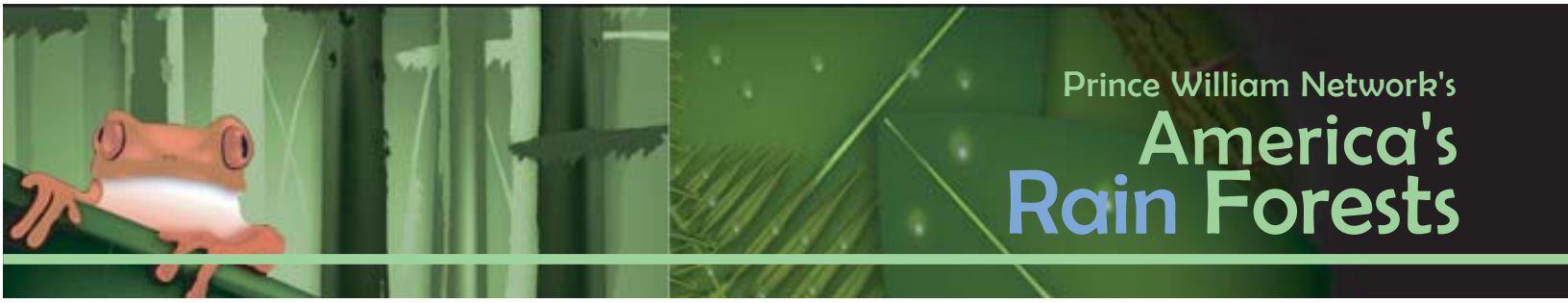
TIME

Preparation—20 minutes

Activity—Part A-30 minutes; Part B-30 minutes; Variation-20 minutes

MATERIALS

(all optional) pictures of rain forests, pictures of rain forest animals, tape recorder, cassette tape of rain forest sounds.



BACKGROUND

What is a tropical rainforest? Tropical rainforests are wet, evergreen forests circling the equator in South and Central America, Africa, Asia, and many of the Pacific Islands. These complex ecosystems have evolved over millions of years. Their environment is distinguished by a warm, humid climate capable of supporting an immense variety of life.

Since tropical rainforests are near the equator, each day is roughly the same length. Temperature changes little throughout the year, with an average of 75 degrees F (24 degrees C). Regular rainfall of 60" to 90+" (152 cm to 229+ cm) annually allows plants to grow uninterrupted by seasonal fac- tors. Tropical plants return to the air much of the moisture they receive, helping to maintain the region's high humidity.

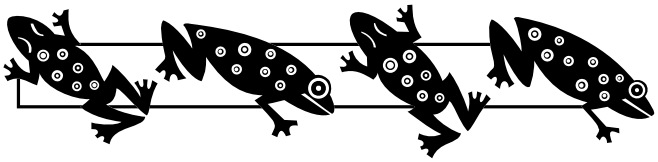
Although tropical rainforests cover only 7 percent of Earth's surface, they are believed to shelter almost half of all existing plant and animal species in existence. Literally thousands of species of trees and plants are in rainforests.

Similar to a high-rise apartment building, the vegetation is arranged in distinct levels. Each of these levels— the **emergent**, **canopy**, **understory**, and **forest floor**—is characterized by particular varieties of animal life. The tallest trees may reach heights of 140 feet (43 m) or more. These emergents (they "emerge" from the canopy) are exposed to stronger winds and sun than trees in the sheltered levels. Most emergent trees are hard- woods whose leaves are waxy to help them retain moisture. Harpy eagles, monkeys, insect-eating bats, snakes, and flying insects can be found at this level.

The **canopy** level is just beneath the emergent level. Its trees may grow to 100 feet (30 m). The large, leathery leaves of the canopy layer form a dense, nearly continuous layer 20 feet (6 m) thick, which blocks 80 percent of the sunlight from levels below. Those leaves create a warm, humid, and sheltered habitat for many animals, most of whom will rarely step foot on the ground. Inhabitants of the canopy level include margay cats, monkeys, sloths, bats, toucans, parrots, hummingbirds, snakes, lizards, tree frogs, ants, and beetles. Many of these animals feed on the abundant fruits, nuts, and leaves provided by the trees.

The **understor**y level consists of small trees and shrubs from 10 to 20 feet (3 m to 6 m) tall. This level receives little light. Many of these plants tolerate shade and will remain at this level; others will grow and replace older trees that fall. Many familiar house plants come from this part of the rainforest. It is also home to animals such as parakeets, snakes, lizards, frogs, toads, ants, termites, beetles, and butterflies.

The **forest floor** is the lowest level. Since only 2 percent of sunlight reaches this far down, there are few flowering plants. Larger animals, like peccaries, tapirs, and giant armadillos, forage for edible roots and tubers. Fungi and plants survive by consuming leaves and other dead materials that fall from the upper levels. This litter is also food for large numbers of termites, millipedes, centipedes, cockroaches, scorpions, slugs, earthworms, and beetles. A leaf that would take one year to decompose in a temperate forest vanishes in a rainforest within six weeks.

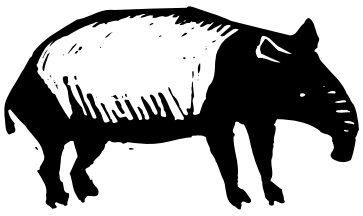


BACKGROUND

The many plants and trees have developed numerous adaptations for survival. Bright and fragrant flowers attract nectar-feeding hummingbirds that carry pollen with them as they hover among blossoms. Flowers that are pollinated by bats are paler by comparison, making the flowers more easily seen at night. The seeds of many fruits develop tough coatings, so they can pass through the digestive tracts of monkeys, hornbills, toucans, and fruit bats without harm.

The straight tree trunks of the rainforest have little branching but are covered with thick climbing vines, or lianas (*lee-AH-nuhs*), and air plants, or epiphytes (*EP-uh-fights*) (whose roots are not in the soil, like orchids). These vines act like thick cables, connecting tree trunks and often span- ning different levels of the rainforest. The vines provide a habitat for many rainforest animals. They also support bromenads (*bro-MEE-lee-ads*), cup-like plants whose fibrous leaves collect and store water, and often serve as miniature ponds for tree frogs and aquatic insects.

Despite what the luxurious growth might suggest, the soil is only moderately fertile. It is not rich in minerals like temperate soils, where bacteria decay matter and return nutrients to the soil. Instead, vast amounts of spe- cialized fungi cycle minerals directly and efficiently into the tree roots themselves. Because most of the organic material is in the living parts of the forest, topsoil may only be a few inches thick.



In contrast to temperate regions, human attempts to farm on deforested areas of tropical rainforest have been largely unsuccessful. Once the trees and fungi are destroyed, the soil rapidly loses its fertility through leaching and erosion. The rainforest is a fragile ecosystem that cannot tolerate tradi- tional Western agricultural practices.

Many rainforest plants and animals have specialized and limited distribution. Large-scale clearing for agriculture or harvesting for forest products can severely affect habitat and can endanger plant and animal species. The loss of these species, many of which remain to be discovered, upsets the ecological balance of the rainforest, affecting indigenous peoples and their traditions. Further, potentially beneficial resources, such as pharmaceutical materials and crop plants, are lost to people all over the world.

Destruction of vast areas of the rainforest may have global climatic consequences as well and could lead to undesirable changes in weather patterns. It is important for tropical rainforests—and for our future—not only to identify and understand these problems, but also to develop practical solutions to them.

BEFORE THE ACTIVITY

Activity—Make copies of student pages 1-3.
Variation—(Optional) Buy or borrow an audio tape of rainforest sounds. Record or book stores often sell these tapes as mood or relaxation music, or your library might have some. Bring the tape and a tape recorder to class.

Prince William Network's

America's Rain Forests

Part A—Inside the Rain Forest

ACTIVITY

1. Use the "Cross-Section of a Rainforest" sheet on page 165 to discuss the different rainforest levels, types of plants, and their characteristics. Use the "Rainforest Inhabitants" sheet on the following page to discuss animals' habitat needs and at what level in the rainforest the animals might be found.

2. Hand out a copy of both sheets to each student. Have students cut out the characters on the rainforest inhab- itants sheet and place them on the cross-section of the rainforest scene at the appropriate levels. Once the inhabitants are placed in the correct levels, they can be glued on and colored. Explain that the inhabitants on the sheet come from different rainforests around the world and would not be found all together in the same forest.

3. Have students research and prepare a report about a particular person, animal, or plant of the rainforest. (They can choose an inhabitant from the rainforest scene or another that they think of.) They should also describe the particular type of rainforest where the person, animal, or plant lives (including its continent and country).

4. Let students develop a classroom or hall display on the rainforest. Have them make a large mural depicting a cross-section of a rainforest and then draw or tape pictures of animals at appropriate levels.

5. Ask students to develop a cross-section of a forest typical to their own region and compare it with a rainforest. Point out that many birds indigenous to temperate forests, such as the yellow-hooded warbler, spend their winters in tropical rainforests.

Part B—Parks and Native Peoples

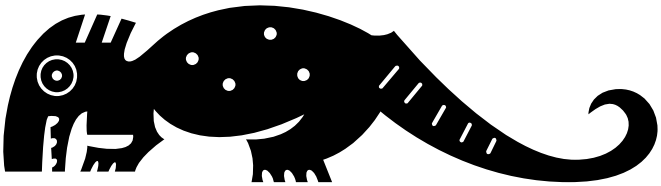
ACTIVITY

1. Read the following excerpt about Public Law 100-571 to your students. You may need to explain difficult terms that appear. The students can also read the actual bill on the following page.

A National Park in American Samoa was established by public law in October 1988. Congress approved this park because it would protect "one of the last remaining undisturbed paleotropical forests," which is "the largest such forest under direct control of the United States," and also "contains the habitat of the last remaining populations of the Pacific flying foxes."

Additionally, the law states that "Tropical forests contain 50 percent of the world's plant and animal species, contribute significantly to the advancement of science, medicine, and agriculture, and produce much of the earth's oxygen. The loss of these forests leads to extinction of species, lessening the world's biological diversity, reduces the potential for new medicines and crops, and increases carbon dioxide levels in the atmosphere contributing to the greenhouse effect that is altering the world's climate."

However, while intending to protect the tropical rain forest environment, the law also allows people from villages within the proposed boundaries to use the park's natural resources in certain ways.



"Agricultural, cultural, and gathering uses shall be permitted in the park for subsistence purposes if such uses are generally prior existing uses conducted in areas used for such purposes as of the date of enactment of this Act, and if such uses are conducted in a traditional manner and by traditional methods. No such uses shall be permitted in the park for other than subsistence purposes."

2. Break the class into small teams and give every student a copy of the case study on page 168. After teams have familiarized themselves with the situation, focus their attention on the part of the bill that states: "Agricultural, cultural, and gathering uses shall be permitted in the park for subsis- tence purposes if such uses are gener- ally prior existing...." Briefly discuss how this statement might apply to Tuima'a's situation. Then, each team should discuss the following questions and write down students' responses.

- What would constitute traditional manners and methods of Tuima'a's family's use of the park resources? Are bush knives, chain saws, planting sticks, tractors, weed killers, insecticides, fishing nets, and fish poison appropriate?
- How does a dictionary define subsistence? How would you define it according to congressional legisla- tion? Which definition applies to Tuima'a's family?
- How do the farming and fishing activities of Tuima'a's family relate to the legislative purposes of the park? Do you feel that Congress has the right to limit use to traditional methods?
- If you were the Park Superintendent, how would you address these issues in a written letter to Tuima'a? What would you do if the native people continued to clear more forest than you thought they should?
- How would you respond to the National Park if you were a member of Tuima'a's family?

JUNGLE TUNES— Variation

1. If you have a tape of rainforest sounds, have students sit very still and play the tape for a few minutes.

2. Tell students that they are going to create a "symphony" of rainforest sounds.

3. With everyone in a circle, instruct students to imitate what you do, until you indicate otherwise. Sit where everyone can see you and perform the following motions and sounds in order.

- Rub palms together back and forth (wind).
- Snap fingers slowly, then quickly (first raindrops).
- Clap hands, not all in the same rhythm (steady, light rain).
- Slap thighs (heavy rain).
- Stamp feet rapidly on ground, while sitting (downpour).
- Slap thighs.
- Clap hands.
- Snap fingers quickly, then slower and slower.
- Rub palms.

4. Divide your class in three sections: rainmakers, birds, and insects (like a symphony's different sections). Tell students that you are the conductor. When you point to a section and raise your hand, that section should get louder; when you lower your hand, it should get softer. If you raise or lower both your hands, everyone should get louder or softer.

5. Have the rainmakers start softly with a light rain (snapping fingers, clapping hands, tapping feet). Next, have the bird section join in softly with tweets, whistles, hoots, screeches, caws, and so forth. Then have the insects join in softly with clicks, buzzes, whirs, hums, rattles, and chirps.

6. Conduct the rainforest orchestra, having the sections get louder and softer at intervals. Eventually, have everyone grow loud and then very soft until the whole group is quiet.

7. Afterward, ask the students what images the rainforest sounds (either the tape or their own symphony) con-jured in their minds? How did it make them feel? (Excited? Scared? Sleepy?)

Tropical Forest Products

Many common products have their origins in the tropical forests (including dry, moist, and rainforests). The following are examples that may easily be obtained for use in the classroom:

WOODS
balsa, mahogany, rosewood, sandalwood, teak

HOUSEPLANTS
anthurium, croton, dieffenbachia, dracaena, fiddle-leaf fig, palm, parlor ivy, philodendron, rubber tree plant, schef- flera, silver vase bromeliad, spathiphyllum, swiss cheese plant, zebra plant

FRUITS
avocado, banana, breadfruit, coconut, durian, grapefruit, guava, jackfruit, lemon, lime, mango, mangosteen, orange, papaya, passion fruit, pineapple, plantain, rambutan, tangerine

PHARMACEUTICAL
annatto-red dye
curare-muscle relaxant for surgery
diosgenin-birth control pills, steroids, asthma and arthritis treatment,
quassia-insecticide
quinine-anti-malarial, pneumonia treatment
reserpine-sedative, tranquilizer
strophanthus-heart medication
strychnine-emetic, stimulant
tuba root-rotenone, flea dip

SPICES
allspice, black pepper, cardamom, cayenne, chili, cinnamon, clove, ginger, mace, nutmeg, paprika, sesame seeds, tumeric, vanilla

VEGETABLES & OTHER FOODS
Brazil nuts, cane sugar, cashew nuts, chayote, chocolate, coffee, cucumber, macadamia nuts, manioc/tapioca, okra, peanuts, soft drinks (cola), tea

FIBERS
bamboo-furniture, baskets raffia-rope, cord, baskets ramie-cotton-ramie fabric, fishing line rattan-furniture, wickerwork, baskets, chair seats jute/kcnaf-rope, burlap kapok-insulation, life jackets, sound-proofing

OILS
baby oil-perfume camphor oil-perfume, soap, disinfectant, detergent cascarilla oil-confections, beverages coconut oil-suntan lotion, candles eucalyptus oil-perfume, cough drops oil of star anise-scents, confections, beverages palm oil-shampoo, detergents patchouli oil-perfume rosewood oil-perfume, cosmetics, flavoring sandalwood oil-perfume tolu balsam oil-confections, soaps, cosmetics, ylang-ylang-perfume

GUMS AND RESINS
chicole latex-chewing gum copaiba-perfume, fuel copal-paints and varnishes gutta pertha-golf ball covers rubber latex-rubber products tung oil-wood finishing

EXTENSIONS

1. Visit your local zoo or botanical garden. A major emphasis of these facilities is the preservation and display of endangered animals and plants. Pamphlets and other materials are frequently available through the institution's educational department. Curators, keepers, and educational staff can provide information regarding a particular species.

2. Survey local pet stores to see which animals, including many tropical fish, birds, and reptiles, are natives of rainforests. NOTE—Because of the endangered species issues, many pet stores will not sell animals caught in the wild, but will work only with breeders who raise their own stock.

3. The study of native, historical, and cultural uses of plants is called ethno-botany. Research what types of plants were used by Native Americans and early settlers in your area.

4. Research the historic and economic importance of a tropical forest product (see the Tropical Forest Products box on page 163). Compare it with a major North American crop, such as corn. Compare agricultural practices (labor intensive or mechanized), deriv- atives (such as palm or corn oils) and efforts at hybridization to develop more desirable qualities. Investigate the extent to which these practices affect the local environment.

5. Find areas of the school grounds that do not have good vegetative cover, and look for signs of erosion. Check the depth and pH of the remaining topsoil, and compare these findings to areas that still have vegeta- tion. A typical wooded area will have a very rich layer of topsoil, composed largely of humus. Compare this to the rainforest, which has very little topsoil.

6. Many of the birds indigenous to the United States, such as the yellow- hooded warbler, spend their winters in tropical rainforests. Research species of birds that migrate, tracing their flight paths and calculating the distances that they travel.

7. Save information from newspapers and magazines describing research efforts of scientists looking for new medicines or products in the rainforest.

8. Have your students read about the lifestyles of indigenous peoples of the rainforests. Compare a day in a rainforest to a student's typical day.

ASSESSMENT

Public Law 100-571 states that one of the reasons for establishing a national park in American Samoa is "to provide for the enjoyment of the unique resources of the Samoan tropical forest by visitors from around the world." Have stu-dents in pairs imagine that they are advertising specialists for the Park Service in American Samoa and that their job is to come up with an advertising campaign to attract visitors to the new park. They can create a series of bill-board advertisements, radio or television commercials, or newspaper or magazine stories. They should base their campaign on at least some of the findings that are listed in the selected sections of the actual congressional law on the following page.

CREDIT

This activity is adapted with permission from Project Learning Tree (PLT). PLT is a program of the American Forest Foundation. Go to *http://www.plt.org/* for more information about this award-winning environmental education curriculum.

STUDENT PAGE®

CROSS-SECTION OF A RAINFOREST

STUDENT PAGE

RAINFOREST INHABITANTS

Student Page

Name _____

Tropical Treehouse

EXCERPTS FROM PUBLIC LAW 100-S71-OCTOBER 31,1988 AN ACT TO ESTABLISH THE NATIONAL PARK OF AMERICAN SAMOA

Be it enacted by the Senate and House and House of Representatives of the United States of America assembled.

Section 1. Findings and Purposes.

(a) Findings—The Congress finds that:

1. Tropical forests are declining worldwide.

2. Tropical forests contain 50 percent of the world's plant and animal species, contribute significantly to the advancement of science, medicine, and agriculture and produce much of the earth's oxygen.

3. The tropical forest in American Samoa is one of the last remaining undisturbed paleotropical forests.

4. The tropical forest in American Samoa is the largest such forest under direct control of the United States.

5. The tropical forest in American Samoa contains the habitat of one of the last remaining populations of Pacific flying foxes.

6. The flying foxes of American Samoa are responsible for a large part of the pollination which maintains a significant portion of the species which inhabit the Samoan rain forest.

7. Information presently available indicated the existence of extensive archeological evidence related to the development of the Samoan culture which needs to be examined and protected.

8. The people of American Samoa have expressed a desire to have a portion of the tropical forest protected as a unit of the National Park System.

(b) Purpose-The purpose of this Act is to preserve the tropical forest and archeological and cultural resources of American Samoa, and of associated reefs, to maintain the habitat of flying foxes, preserve the ecological balance of the Samoan tropical rain forest, and, consistent with the preservation of these resources, to provide for the enjoyment of the unique resources of the Samoan tropical forest by visitors from throughout the world.

Section 3. Administration.

(b)Traditional Subsistence

Uses—1. Agricultural, cultural, and gathering uses shall be permitted in the park for subsistence purposes if such uses are generally prior existing uses conducted in areas used for such purposes as of the date of enactment of this Act and if such uses are conducted in the traditional manner and by traditional methods. No such uses shall be permitted in the park for other than subsistence purposes.

2. Subsistence uses of the marine areas of the park shall also be permitted in accordance with paragraph 1, and no fishing or gathering shall be permitted in such marine areas for other than subsistence purposes.

Name _____

Student Page

Case Study

Tuima'a and his extended family have farmed and fished for many years in a rain forest that has now been designated part of a U.S. National Park. His family comprises people from many villages in the different islands that make up American Samoa.

Throughout the years, this family has used both crops and fish harvested from the park area. They used products from the area primarily at traditional family events. They divided any surplus between home use and small sales to obtain money for necessities.

Additionally, Tuima'a practices crop rotation on 10 acres that now lie in the park. He plants only a few acres intensively each five years. Afterwards, he leaves the land uncultivated for several years to restore soil fertility while he clears and plants a new area. More than 15 years have passed since the first area was put to fallow, and it has begun growing back as secondary growth of trees. Soon it will be time to replant.

Farming practices include removing most young trees and controlling weeds by cutting or spraying with weed killer. Tillage operations are used only to grow veg- etable crops. Insect problems are managed by a combination of mechanical, biological, and chemical controls.

Fishing practices include hand nets, poles and lines, and traditional tree-derived fish poisons.