Resources

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Introduction

1 Great Speaker, River Sea: The Mighty Amazon

To learn about the vast South American rainforest, we must first learn about the heart that gives life to the forest. It is the mightiest river in the world. Its name is AMAZON.

The Amazon River is born high in the Andes Mountains. It begins as a cold trickle of water, no wider than a mouse. As rain falls and snow melts, other streams from far away flow to meet it. The river grows larger, louder, faster. Indians call it "great speaker." It rushes over forest cliffs and makes thunderous waterfalls. Sun strikes the mist and a double rainbow appears! The river twists, turns, flattens and widens. In some places it seems like a big, quiet sea. Indians call it "river sea." This vast, flowing water network is one of the biggest and most mysterious wildlife homes on our planet!

KEY IDEAS

1. *The Amazon River begins high in the Andes Mountains and empties into the Atlantic Ocean.*
2. *The water network formed by the Amazon and its tributaries is one of the biggest wildlife homes on our planet.*
3. *The Amazon is much more than one river. The total region drained by the Amazon and its tributaries is called the Amazon Basin. It is more than ten times the size of France.*

Waters of the Amazon River and its **tributaries** contain 5,000 different species of fish, with perhaps 2,000 more awaiting discovery. Look closely in these waters, and you might see some tiny, familiar friends. Many fish commonly found in home aquariums are South American freshwater species. Electric eels, secretive stingrays, sharks, and razor-toothed piranhas also swim here. Long-nosed pink river dolphins click and clack and squeak, using **echolocation**, like the fish-eating bats above them, to find food and avoid obstacles. Gentle giants, the Amazonian manatees, graze on underwater plants and communicate with each other by muzzle-to-muzzle touching and chirps. Giant river otters, one of the most endangered mammals in the world, frolic and play, but become deadly serious when it's time to eat. All this , and yet only ripples and the odd splash made by a jumping fish give any clue to the abundance of life beneath the water surface.

But the Amazon is much more than just one river. Like veins in a leaf, hundreds of streams join larger ones until they reach the mighty Amazon. The entire area, known as the Amazon basin, is more than ten times the size of France!

Amazon River: Facts and Figures

- ☐ From source to sea (the Atlantic Ocean), the Amazon River flows for 4,000 miles.
- ☐ It carries more water than any other river in the world.
- ☐ The volume of water coming out of the Amazon is enough to fill a million bathtubs in less than a minute!
- ☐ The Amazon has more than a thousand major tributaries: ten of these are more than 620 miles in length.
- ☐ The river discharges into the Atlantic in a flow so powerful that it dilutes the ocean water for 100 miles.
- ☐ It is estimated that it would take 9,000 trains pulling 30 ten-ton trucks every day to carry the same amount of sediment as the waters of the Amazon carry with it.
- ☐ The Amazon basin covers almost half the land of South America, including much of Brazil and parts of Peru, Venezuela, Colombia, Ecuador, and Bolivia.

ACTIVITY: CHAPTER 1

Top Ten Longest, Top Ten Largest: Famous Rivers of the World

Purpose: Students will become familiar with some of the great rivers of the world, their location, and relative sizes. Collectively, these rivers represent the world's water resources, as they carry virtually all the water that is available for people and wildlife.

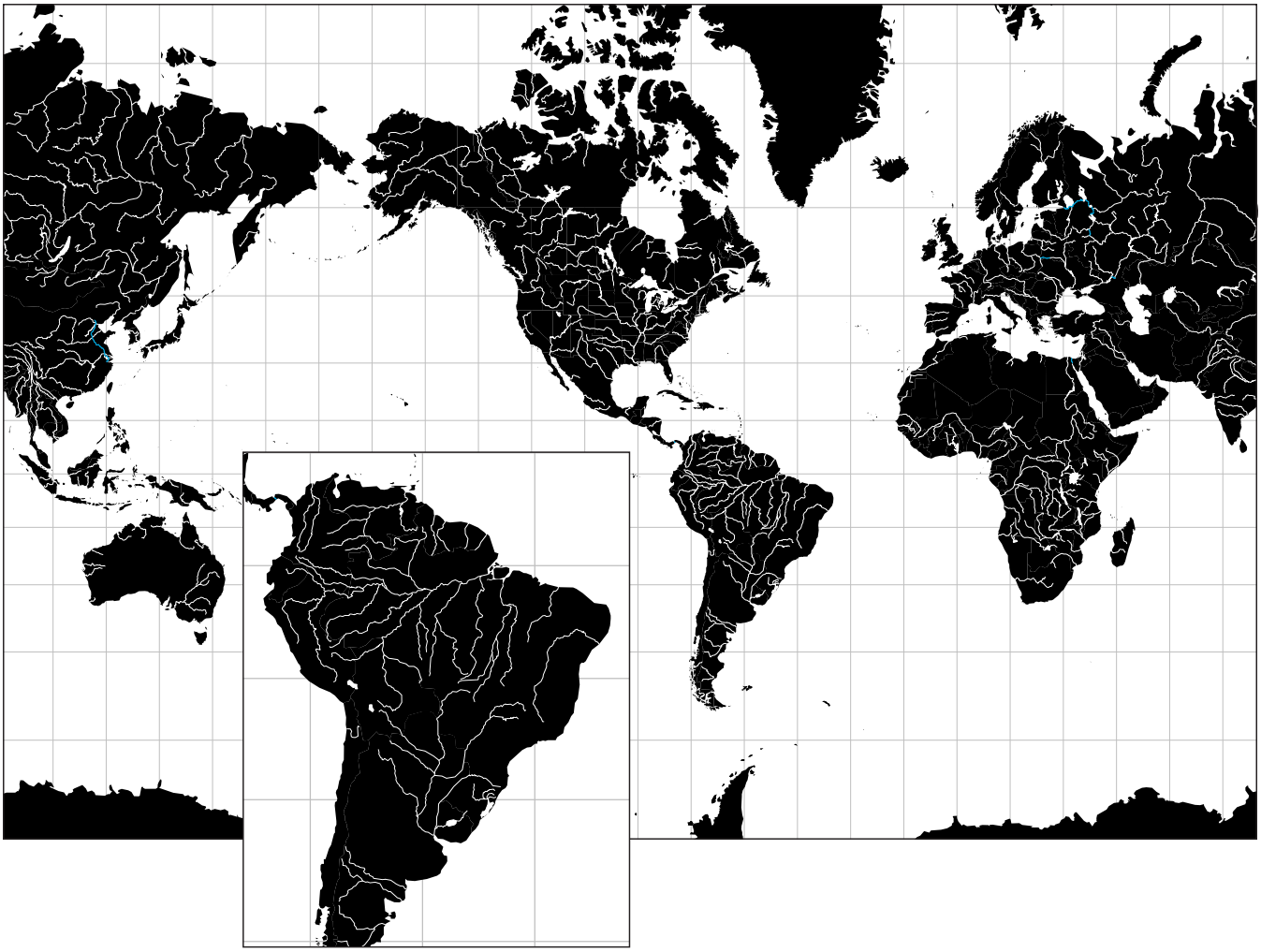
"Longest" refers to the river's length in miles. "Largest" refers to the total amount of water carried by the river. For example, the Amazon is the largest river in the world, but the Nile is the longest.

Materials: Maps of the world
20 - 8½" x 11" pieces of cardboard.

Procedure:

1. Make 10 cards, each listing the name of one of the 10 longest rivers, the country or continent where it is found, and the length in miles.
2. Pass the cards out and have students work in pairs to find their river on a world map.

The Major Rivers of the World



3 Have 10 students holding the cards come to the front of the room, and arrange themselves to show the ten longest rivers in order of length.

4 Repeat the activity with the top ten largest rivers.

Table 1:

The Longest Rivers of the World

RIVER	LOCATION	LENGTH
Nile	Northeast Africa	4,132 miles
Amazon	South America	4,000 miles
Yangtze	China	3,915 miles
Huang He	China	2,903 miles
Congo	Africa	2,900 miles
Missouri	United States	2,714 miles
Lena	Russia	2,600 miles
Niger	Africa	2,600 miles
Yenisei	Russia	2,566 miles
Parana	Argentina	2,450 miles

Table 2:

The Largest Rivers in the World

RIVER	LOCATION	AVERAGE DISCHARGE
Amazon	South America	6,350,000 ft^3/sec
Congo	Africa	1,400,000 ft^3/sec
Yangtze	China	1,200,000 ft^3/sec
Parana	Argentina	777,000 ft^3/sec
Orinoco	Venezuela	706,000 ft^3/sec
Brahmaputra	Tibet, India, Bangladesh	706,000 ft^3/sec
Ganges	India	670,000 ft^3/sec
Yenisei	Russia	670,000 ft^3/sec
Mississippi	United States	645,000 ft^3/sec
Lena	Russia	547,000 ft^3/sec

Discussion: *What is the longest river in your state? What is the largest?*
Rivers have played very important roles in the course of history. Why are rivers crucial to the survival of people and wildlife?

2 The Amazon Forest: Where Life Overflows

"The land is one great wild, untidy luxuriant hothouse made by nature for herself."

—Charles Darwin

As the Amazon River flows to the sea, it also rises to the sky, becoming clouds. Everyday it rains, bringing life to the forest. In every available space, something grows; ferns, vines, mosses, shrubs, orchids and fungi, tiny trees and forest giants that are home to hundreds more clingers, creepers and climbers. The forest is so wet that the trees themselves rain. It smells like life. This is the tropical rainforest.

KEY IDEAS

1. *Tropical rainforests form a broken green band around the equator. They receive at least 80 inches of rain per year, and the average temperature is around 77 F.*
2. *Tropical rainforests cover less than 7% of earth's land surface, but may hold more than 50% of all species.*
3. *The Amazon rainforest is the largest expanse of tropical rainforest in the world.*
4. *Contrary to earlier beliefs, tropical rainforest soils are very poor.*
5. *Tropical rainforests are complex ecosystems where the survival of one species is directly tied to the survival of many others.*

Warmth
(from the tropical sun)
+
Wetness
(from equatorial rains)
=
Rainforest

Tropical rainforests form a broken, green band around the equator, between the Tropic of Cancer and the Tropic of Capricorn. By definition, they receive more than 80 inches of rain a year, with some areas regularly getting more than 200 inches and a few getting more than 400! The average temperature is around 77 F.

Moist, hot conditions over millions of years have created the perfect conditions for the explosion of life; and indeed the tropical forests of the world represent the greatest show of plant and animal diversity on Earth! Though they cover less than 7% of earth's land surface, scientists think they may hold more than 50% of all species.

The Amazon rainforest is the largest expanse of tropical rainforest, nearly as large as the continental United States. Together, the river and forest are home to over one million species; more than are found any place else on Earth. Although it is famous, the Amazon forest probably has more unexplored territory than any area in the world. Most of the forest grows on dry land, called ***terra firma*** rainforest. The other main type is called ***igapo***. This is forest near the rivers that is flooded during the wet season. The trees here do not grow as tall.

Living Lavishly On Next to Nothing

In the past, people believed the Amazon rainforest was situated on fertile soil because plants grew so well. Now we know that most Amazon soils are very poor. Instead of nutrients from the soil, the terra firma forest depends on rain and rotting vegetation to provide the food needed. As plants die, they feed other plants. Everything is recycled and in balance.

A Fragile Complexity

In this complex ecosystem, the survival of one species is directly tied to the survival of many others. Solving this ecological puzzle can be overwhelming, especially with hundreds of new pieces uncovered each year. Each species plays a slightly different part, and each katydid, treefrog, bat, parrot and monkey, contributes a splash of beauty and excitement to this intense and dramatic world.

ACTIVITY: CHAPTER 2

Where in the World Are Tropical Rainforests?

Purpose: Students will locate the equator, the Tropic of Cancer, and the Tropic of Capricorn on a globe. Students will name the continents that support tropical rainforests.

Materials:

☐ Inflatable globe

Procedure:

1. Place the palm of your hand on the widest part of the globe. (over the equator)
2. Now spin the globe .
3. Your open hand will pass over all of the tropical rainforests of the world.

Discussion: *Which contintents support tropical rainforests?* South America, Africa, Asia, Australia, North America—on the North American continent,there are rainforests in Central America, Hawaii, Puerto Rico, American Samoa, U.S. Virgin Islands).
Why do rainforests grow in these places?

ACTIVITY: CHAPTER 2

Create A Rainforest In a Soda Bottle

Purpose: To demonstrate on a small scale the water and nutrient cycle of the tropical rainforest

Materials:

- □ Two-liter plastic soda bottle
- □ Scissors,
- □ Plastic wrap
- □ Gravel
- □ Charcoal (sold for use in fish tank filters)
- □ Two small tropical plants such as a fittonia, philodendron, prayer plant, artillery plant, etc.
- □ Potting soil

Procedure:

1. Take the label off the bottle and remove the black bottom, rinse the bottle
2. Cut the top off the bottle where it begins to curve.
3. Line the detached bottom with plastic wrap that has been folded several times.
4. Spread about one-inch of gravel over the plastic wrap. Spread a thin layer of charcoal over the gravel and fill with potting soil.
5. Dig a little hole in the soil for each of your plants. Place them in the holes and press lightly.
6. Water the plants with about one-third cup of water. Invert and place the plastic cover over the plants forming a dome.
7. Place the terrarium in a spot that will receive alot of light, but not direct sunlight.
8. Watch your rainforest to see the water released from the plants form droplets on the inside of the dome. These will rain down on the plants and continuously water them. (You might have to add a small amout of water to the soil every few weeks.)

Discussion: *Which*

3 The Rainforest Is Closer Than You Think!

To most people, tropical rainforests seem like faraway places that we might dream of visiting. In fact, plant pieces of the mysterious rainforest puzzle play important roles in our daily lives that we either are not aware of or take for granted. Open your closets, medicine cabinets, garages, refrigerators and pantries. Visit a florist, a hospital, a bakery, a theatre, a hardware store, candy store—not to mention a grocery store, and you will quickly realize that rainforests are closer than you think!

KEY IDEAS

1. *Rainforest plants play important roles in our daily lives.*
2. *Many food plants that the world now depends on grow wild in tropical rainforests*
3. *n addition to foods, rainforests are home to plants important for medicines, fibers, oils and other valuable products.*
4. *Only about 1% of rainforest plants have been studied for their potential usefulness to people*
5. *We all have a stake in the welfare of tropical rainforests.*

Jungle Produce

Every year the average American consumes more than 25 pounds of bananas, and today there are few places in the world where it is not possible to buy a banana. Introduced to Europe in1882, bananas were the first rainforest fruit discovered by westerners and were originally available by prescription only. "Florida" oranges originally came from the rainforest, as did lemons, limes, and grapefruits. Tomato, potato, pineapple and papaya, cashews, coffee, cloves and corn, all have wild roots in tropical rainforests or other tropical habitats near rainforests. A recent tour at the Brooklyn Botanical Gardens entitled, "Ten Plants That Shook the World," included six history-changing plants that originated in the tropics. (sugarcane, corn, bamboo, rubber, quinine, and pepper). Count the number of tropical fruits for sale at your local grocery store. It is only a fraction of the 3,000 types of fruits that grow in the world's tropical rainforests!

While you're thanking the rainforest for favorite foods, thank it for life-changing, life-saving medicines, woods, fibers, canes and oils, gums, resins, dyes and houseplants.

Just A Blip On the Screen of Possibilities

Describing the plants of a tropical rainforest is a little like trying to describe the people of New York City or Los Angeles. The plants are every bit as diverse as the people of these two large cities. In spite of decades of exploration and exploitation, scientists have only thoroughly examined about 1% of the hundreds of thousands of rainforest plants. Besides being good for people, new jungle products could be good for the jungle too; if they are properly managed. In many ways, some of which we don't even understand yet, all of us have a stake in the welfare of tropical rainforests and of the people, wildlife, and plants that thrive in them.

ACTIVITY: CHAPTER 3

Explore the Grocery, Discover the Rainforest!

Purpose: Learners will discover that the local grocery store would be a very different place without tropical rainforests.

Materials:

☐ List of fruits, vegetables, spices, flavorings, nuts and other food products from tropical rain forests and habitats near tropical rainforests.

avocado	banana	grapefruit
guava	lemon	lime
mango	orange	papaya
passion fruit	pepper	pineapple
plantain	potato	sweet potato
tangerine	tomato	yam
allspice	black pepper	cardamom
cayenne (red pepper)		chili pepper
chocolate or cocoa		cinnamon
cloves	ginger	mace
nutmeg	paprika	turmeric
vanilla		
Brazil nuts	cashew nuts	coconut
coffee	corn	macadamia nuts
peanuts	rice	sesame seeds
sugar	tapioca	tea

Procedure:

1. Take a class trip to a local grocery store.
2. Divide the students into groups and have them explore the store for forests products in their

raw form or as ingredients in processed foods.

3 Assign one group fruits and vegetables, another group spices and flavorings, and a third group nuts and other miscellaneous products.

4 If a trip is not possible, students can search for these products with their parents at home or during family trips to the grocery store.

5 Have students choose a favorite food for further research. In what part of the world did it originate? (tropical America, tropical Asia, tropical Africa). How is the plant used by native people? Is it grown comercially or still harvested from the rainforest?

Discussion: *Which*

ACTIVITY: CHAPTER 3

Rainforest Recipes

Purpose: Taste some rainforest foods and create rainforest recipes

Materials:

□ Selected rainforests foods

Procedure:

1 Purchase some of the products on the list.

2 Taste them in class, and have students work together to create original rainforest recipes to share with parents or younger students.

3 (for example: tropical rainforest citrus salad, chocolate-banana pudding, avodado sun sandwiches, rice surprise (with corn, tomatoes, peanuts and pepper).

Discussion: *Which*

4 Kingdom of Ants

"If human beings were not so impressed by size alone, they would consider an ant more wonderful than a rhinoceros."

—E.O. Wilson

As human beings, we live in a sensory world of sight and sound. We are attracted to and impressed by the big and loud, the bold and beautiful. When we imagine tropical rainforests, we summon images of large, colorful parrots, noisy monkeys, enormous snakes and crocodiles, and the big land predators; tigers in tropical Asia and jaguars in the Amazon. But although they are beautiful and interesting, these animals are relatively rare in jungles.

KEY IDEAS

1. *Large animals are relatively rare in jungles.*
2. *The truly dominant creatures of the tropics are ants.*
3. *In the Amazon forest ants have more than four times the biomass of all the land vertebrates combined.*
4. *People live in a world of sight and sound. Ants live in a chemical world of taste and smell.*
5. *The chief herbivores of Amazonia are the leafcutter ants.*
6. *The leafcutter colony is a society of females; a large mother queen and her millions of daughters.*
7. *Leafcutter ants grow their own food in underground fungus gardens.*
8. *The fungus and the leafcutters are completely dependent on each other. This relationship is an example of symbiosis.*

The truly dominant creatures of the tropics seized control of a large part of the terrestrial environment long before the first primates, let alone the first human beings, walked the earth. The tropical rainforest is really the **Kingdom of the Ants!**

There are about 10,000 known species of ants in the world, and scientists think that there may be two or three times that many. And while to us they might seem like little specs scurrying around on a pointless mission, there is alot of diversity among this group of social insects. The world's smallest ant forms a colony that could easily fit inside the brain case of the world's largest ant. Professor E.O. Wilson, the world's leading myrmecologist, calls ants "the little things that run the world." He estimates that at any given moment there are about 10 15, or a million billion, ants in the world!

In the Amazon rainforest the ants alone have more than four times the biomass of all of the land vertebrates combined - amphibians, reptiles, birds, and mammals. One millimeter above the ground, where ants exist, things are very different than they seem to people looking down from a thousand times that distance. Instead of a world of sight and sound, ants live in a chemical world. They travel and communicate largely by taste and smell.

In Amazonia, where there are lots of plants and lots of creatures to eat them, the chief herbivores are the famous and fascinating leaf-cutter ants. Their actions remove about 15% of leaf production. It is a common and comical sight to look down and see hundreds of dime-size green leaf-banners marching along in the jaws of the tiny leaf-cutters as they rush back to their nest. The work capacity of leafcutters so impressed E.O. Wilson, that he converted into human terms the speed at which they run and the weight they carry during their leaf-transporting trips.

> *"If one of these ants were a six-foot-tall person, it would be running along those odor trails at a pace of about 3:45 minutes to the mile. That's about the current world record. At the end of the trail it would pick up a load of 300 pounds or more—after running roughly the distance of a marathon—and carry it home at the slightly slower pace of four minutes to the mile. Upon reaching the nest, it would run down through the galleries and chambers of the nest for a distance of up to one mile before depositing its leaf load."*

The leafcutter ant kingdom (really a queendom) is a society of females. Like all ants, leafcutters are daughters of the same mother queen. The queen is a huge ant, about half the size of your thumb. She can live for ten, maybe even 20 years, and during her lifetime she gives birth to about 150 million daughters! Each daughter will grow into a soldier or a worker depending on her size, and each will play some role in the maintenance of the colony.

The leaf-cutter ants do not eat the leaves they gather—it is much more complicated than that. They actually turn the fresh vegetation into mushrooms! Here's how it works:

1. The largest workers gather leaves and bring them to the nest.
2. There they are turned over to a class of slightly smaller workers, which cut the leaves into pieces about a millimeter across.

3 These pieces are taken over by still smaller workers which chew them into pulp and fertilize with deposits of rich fecal fluid.

4 Other ants apply the leaf paste over a base of dried leaves in new chambers.

5 Another group hauls in bits of fungus from older chambers and plants it in the leaf paste.

6 Meanwhile, a caste of tiny workers cleans and weeds the garden, and then harvests the fruits of the fungus for the entire colony to eat.

The fungus and the leafcutters are completely dependent on each other. The ants eat only the fungus, and the fungus grows nowhere else but in the ant gardens. This story is just one of thousands of symbiotic relationships that form the intricate web of interdependency in a rainforest ecosystem.

Ants are very important to the cycles of life. They make and turn the soil, speed up the process of decay, pollinate, prey on other insects, and are food for a great number of larger animals. A healthy forest is home to many hardworking ants.

ACTIVITY: CHAPTER 4

Happy Trails

If you've seen one ant...you've seen something very unusual! Ants are social insects that cooperate in gathering food, defending their nest, and raising baby ants. In order for this huge ant family to accomplish their tasks, they must communicate. Ants and other insects talk to each other using chemicals.

When an ant finds food she leaves a chemical trail on the ground to lead her and her hungry sisters back to the food. This chemical trail contains important ant information.

Purpose: Students will locate an ant colony, or an active trail of ants. They will observe the "scouts" that arrive first at the food, and the streams of followers that use the scout's chemical trail.

Materials:

- ☐ Four pieces of flat cardboard
- ☐ Honey
- ☐ Two or three active colonies of ants that you've found outside

Procedure:

1 Place a large spoonful of honey a few feet away from your ants on a hard surface (like a sidewalk).

2 Surround the honey with the cardboard pieces. Arrange them so that the ants must pass over a piece of cardboard to get to the honey.

3 Once you have at least 40 ants on the path, pick up the piece of cardboard and turn it around so the path has been reversed 180 0.

4 Wear gloves - remember some ants can bite!

5 Be careful of little lives. Don't hurt the ants.

6 Write down your observations.

Discussion: *Which*

ACTIVITY: CHAPTER 4

SignificANT Achievements

- ☐ An ant can lift fifty times its own weight. If people could lift like that, we could each lift a car!
- ☐ Ants have been around since before the dinosaurs.
- ☐ One species of ant can live up to 14 days submerged in water.
- ☐ Scientists found 43 different species of ants living in one tree in Peru.
- ☐ Some kinds of mound-building ants make nests that are seven feet tall. These nests can last hundreds of years.

Procedure:

1 Find out some more ant facts

2 Draw a cartoon to illustrate an amazing ant fact.

ACTIVITY: CHAPTER 3

Down and Dirty: Up Close With Ants

(Look for Donald Stokes book, A Guide to Observing Insect Lives)

Procedure:

1 Get a hand lens and you can observe ants cleaning themselves, gathering food, greeting members of their colony, or fighting ants from other colonies. It's fun!

5 The World's Most Beautiful Roof

From an airplane, the rainforest canopy looks like vast fields of bulging broccoli. From the forest floor, it looks like a twisted maze of branches, vines and streamers. Both views are misleading. To the millions of plants and animals that live out their entire lives in the roof of the rainforest, the canopy is a sunny paradise with room to scamper across well-traveled branch paths, or even to fly, glide or leap.

The Canopy Takes a Lot of Heat (Wind and Rain Too!)

KEY IDEAS

1. *The canopy is the powerhouse of the rainforest where 90% of photosynthesis takes place.*
2. *Scientists have only recently begun to study the canopy. In many ways it is still an unexplored continent.*
3. *Fifty percent of rainforest animals live in the canopy.*
4. *Through discovery of thousands of new species in the canopy, scientists have learned that life on Earth is even more diverse than previously imagined.*
5. *In contrast to the canopy, the forest floor is a dark place where decomposition is the dominant process.*
6. *The canopy and floor are connected through the nutrient cycle*

The canopy is the powerhouse of the rainforest, where more than 90% of photosynthesis takes place and, in the fullest sense, life begins. Wind and pounding rain cause dead leaves and branches to rain down constantly from the canopy. On the floor, they decompose, and are sucked up as nutrients by tree roots, and then returned to the canopy to continue the cycle of life. The brightly lit, noisy world of the rainforest canopy, some 100 feet or more above the floor, is in alot of ways an undiscovered continent.

Boldly Going Where No One Has Gone Before

Though it teems with life—ants, plants, monkeys and macaws, the canopy was off limits to people until recently. It still remains largely unexplored, but a new generation of scientists is trying a variety of wildly imaginative tactics to get up close and personal with life in the treetops. They can't stay away! Fifty percent (maybe more) of all rainforest species live in the canopy. Determined women and men have constructed platforms, nailed ladders to trees, built walkways suspended across crowns, and used mountain-climbing equipment—all in an effort to unlock the ecological secrets of the canopy. They've found a poisonous caterpillar that looks like Cousin It, and giant weevils that carry miniature gardens of mosses and lichens on their backs. Amid hundreds of individual plant and animals discoveries, the most important discovery is that life on our glorious planet is even more diverse and more plentiful than anyone imagined!

A Rottin Place to Live

As photosynthesis is the dominant natural process is the canopy, the forest floor is a dark house of decomposition. Here, the work of nature is carried out by termites, ants, fungi, bacteria and millipedes —the "cleaning crew" of the forest. These organisms break down dead plants and animals into nutrients —and they work fast! Decomposition is so quick in the tropics, that the forest floor is pretty empty. Can you see how these two layers of life—the canopy and the forest floor—are connected?

"To know the forest, we must study it in all aspects, as birds soaring above its roof, as earth-bound bipeds creeping slowly over its roots."

—Alexander Skutch

ACTIVITY: CHAPTER 5

Swingin' In the Rain

Animals also have special adaptations for living in the treetops. Monkeys and other primates have prehensile tails, opposable thumbs, tremendous upper-body strength, and large, forward-facing eyes for judging distance.

Purpose: Students will choose a rainforest primate to "profile" and learn the life history of their animal.

Materials:

- □ Books about primates,
- □ copies of Profile Of A Primate page
- □ markers and crayons.

Procedure:

1. Pass out copies of profile page on page 19.
2. Students can work alone or in pairs to record information about their rainforest primate.

Microhabitats

In the canopy, life is piled on top of life. A single large branch, in addition to its own leaves, can be host to hundreds of epiphytes (ferns, orchids, mosses and bromeliads). Epiphytes are plants that do not need to root on the ground, but can grow on other plants. In addition to creating beautiful hanging gardens, epiphytes provide habitat for countless tiny canopy creatures.

Purpose: Look at a cutaway of a bromeliad and identify some animals that call it home. Observe the ways in which a bromeliad is adapted to capture and hold water.

Materials:

- ☐ Copies of bromeliad cutaway drawing
- ☐ Crayons and markers
- ☐ A bromeliad plant from a local plant nursery
- ☐ Eyedropper

Procedure:

1. Pass out copies of Bromeliad Microhabitat
2. Students match the numbers on the drawing with the description of each animal.
3. Drop water on the ends of bromeliad leaves. What does the water do? (leaves work like water slides—water rolls down to center of plant)
4. Pour a cup of water in the center of the bromeliad. What happens? (the center of the bromeliad holds water).
5. How are bromeliads adapted to capture and hold water?

Bromeliad Microhabitats

____ Frog tadpoles wriggle in the pool. Some frogs lay their eggs here. Others carry newly hatched tadpoles on their backs and drop them off to complete their development.

____ A red-eyed treefrog looks around for insects to eat.

____ Lying in wait, a daddy longlegs will pounce on mosquitoes and other small insects.

____ A slug inches up the side of a leaf. They need bromeliad water to keep their body moist.

____ Swimming in the tiny pool, a crab searches for mosquito larvae.

____ Mosquito eggs drift at the water surface. Just below the surface, hatched mosquito larvae hang upside-down in the water.

6 In The Jungle, The Indian Knows Everything

KEY IDEAS

1. *Indians have lived in the rainforest for thousands of years.*
2. *Contact with outsiders has often been devastating for Indians.*
3. *In the jungle, the Indian knows everything.*
4. *Indians live in harmony with the forest by using the resources sustainably.*

For thousands of years, Indians have lived in the rainforests. Some live in areas so deep and far into the forest that they have not yet been contacted by the outside world. Some live on lands that have been exploited by goldminers and others who have come to take parts of the forest. In many ways, contact with outsiders has been devastating for rainforest Indians. Thousands have died; either from direct killing or from introduced diseases for which Indians have no natural immunity. Over 90 Indian tribes have become extinct in Brazil alone since 1900.

We have all heard the expression "extinction is forever." This saying is usually heard in conversations about endangered animals or plants. But the extinction of unique groups of people is just as final.

"The beauty and genius of a work of art may be reconceived though its first material expression be destroyed; a vanished harmony may yet again inspire the composer; but when the last individual of a race of living things breathes no more, another Heaven and another Earth must pass before such a one can be again."

In the South American country of Suriname, there is a saying, Na boesi, ingi sabe ala sani. "In the Jungle, the Indian knows everything." People from developed countries have sometimes looked upon Indians and their cultures as primitive, simple and crude. Many have tried to change the way Indians live their lives. But when it comes to living in the rainforest—the Indians know best.

Indians thrive in the rainforest because of their astonishing familiarity with this environment. They know which trees make the best canoes and which ones are good for burning or making blowguns or arrows or shelters. They know the plants that yield food, dyes, resins, oils, fibers for weaving and medicines for healing. They grow crops in the rainforest by using ancient slash-and-burn agriculture. The Indians cut the trees in a small area, allow them to dry, then clear the "slash" by burning it. At first, the ash left by the fire makes a nutrient-rich bed for crops. They grow yams, sweet potatoes, bananas, plantains, cocoyams, cassava, and about fifty other crops. The field loses its fertility within a few years, and it is eventually abandoned and allowed to return to jungle. Because Indian populations are low, and because they let their fields lie fallow for a long time after cultivation, they can practice slash-and-burn agriculture without permanently destroying the land. Their use of the forest is sustainable.

Indians hunt and fish, but they learned long ago that if they take more from the forest than they need to live, the forest will kill them slowly but surely. The Indians recognize the forest animals long before they see them, by their footprints, their calls, even their smells. To Indians, the forest is grocery store, drugstore, hardware store, and toy store. As one Peruvian Indian said, "We respect the forest; we make it produce for us."

Ailton Krenak is the National Coordinator of the Union of Indian Nations. He comes from the small tribe of Krenak Indians of Brazil. He has said to the world;

> ***"If we can build in the heart of the people of the city a beautiful forest made of friendship, music and celebration, then we can pacify their spirit so they can live with the people of the forest. This is our message..."***

We have already benefited tremendously from the knowledge of Indians. As ethnobotanist Mark Plotkin has said, "Virtually every useful medicinal or agricultural plant that has come to us from the rainforest was first learned from indigenous people." The forest Indians have alot more to teach. Will the rest of the world be smart enough to learn from them?

ACTIVITY: CHAPTER 6

Indians of Amazonia

Directions: Find the names of 12 Amazonian Indian tribes hidden in the puzzle below.

Apalai
Bororo
Huaorani
Jivaro
Kampa
Kayapo
Krenak
Marubo
Tirio
Waiwai
Wayana
Yanomami

ACTIVITY: CHAPTER 6

Words From the Forest

Because they live in small, sometimes isolated groups, Indians have developed many unique languages.

You can learn some words spoken by Amazonian Indians.

In the Language of the Tirio Indians:

HELLO	ku-day-mah-nah
GOODBYE	ko-ko-ro-pah
FOREST	ih-tuh-tuh
JAGUAR	ky-kwe

In the Language of the Yanomami Indians:

FRIEND	sho-e

In the Language of the Wayana Indians:

A-OKAY!	e-pok!

ACTIVITY: CHAPTER 6

No Waste

Indians make multiple-use of the plants and animals around them. The fruit of a plant might be eaten, and the leaves of that same plant used as medicine. A deer is eaten, and the leg bone is fashioned into a flute.

Palms are probably the best example of multiusefulness in the Amazon rainforest.

Directions: Circle the ways in which Indians use parts of palm plants from the forest.

as food	as a source of fibers
for fuel	for oil
for waxes	as medicines
to make toys	to build shelters
as backpacks	as drinking cups
as bird calls	as weapons
to make hammocks	for fishing line
for fishing hooks	to make hair combs
to make musical instruments	

(You should have circled all of these!)

7 Conservation Hero: The Shaman's Apprentice

Deep in the jungle of South America, Mark Plotkin found himself face-to-face with a jaguar—the largest and most feared predator of the Amazon rainforest. It entered his hut and silently moved toward him, looking directly into his eyes. Suddenly he woke up, trembling and covered in sweat. He was alone. Had this been a dream or reality? The next morning he sent a message to the shaman of the Indian village. "I have seen the jaguar," he said. The shaman smiled, "That was me." Mark still doesn't know why he had this dream, but it is just one of the incredible experiences he has had since he began working in the jungles of South America.

KEY IDEAS

1. *Ethnobotanists have found that tribal knowledge of medicinal plants is in danger of being lost if no younger Indians learn from the shamans.*
2. *Mark Plotkin became an apprentice to the shamans and wrote down what he learned so the knowledge would be preserved.*
3. *The Shaman's Apprentice Program encourages partnerships between shamans and younger members of Indian tribes for the purpose of passing information to the next generation.*
4. *Preserving rainforests and Indian cutures will benefit the entire world.*
5. *Many of our medicines already come from rainforest plants and ethnobotanists feel that many more are awaiting discovery.*
7. *The Ethnobiology and Conservation Team (ECT) is dedicated to biodiversity conservation.*

Dr. Mark Plotkin is an ethnobotanist; a scientist who studies the ways that indigenous people use plants as medicine. If you've never heard of an ethnobotanist, it's probably because this field of study has only had a name for about fifty years—a very short time in the history of science. Dr. Plotkin and other ethnobotanists use a combination of anthropology, (the study of people and their cultures), and botany, (the study of plants), to learn how indigenous people use plants for healing and other purposes. Mark's studies have taken him to some very interesting places like Argentina, Colombia, Suriname, Brazil, and Madagascar. Traveling can be hard work sometimes, but Mark really enjoys meeting and working with people from all over the world.

Dr. Plotkin has been fascinated by nature since he was a young boy growing up in New Orleans. He liked going into the swamps to look for snakes, lizards and turtles, and his mother and father encouraged his interests. He went to college to study biology, but didn't think he was cut out to be confined to a laboratory. Mark moved to Massachusetts to work at the famous Museum of Comparative Zoology at Harvard University. He signed up for a class taught by Richard Evan Schultes, who is known as the "father of ethnobotany." Mark entered the classroom and everywhere he looked he saw maps of the Amazon, Indian clothing, bows, arrows, blowguns, strange tropical fruits, and beautiful carvings and weavings. Then Professor Schultes turned out the lights and began to show pictures of a strange and wonderful world. Mark was mesmerized by slides of witch doctors, hunters, princesses, Indian children, and pictures of plants that the Indians used for food, medicines and fibers. From that moment on, Mark was hooked! Hooked on plants, hooked on Indians, and hooked on the Amazon. An ethnobotanist was born!

Mark first traveled to the rainforests of South America in 1979. He went to learn about medicinal plants, but soon learned something that he found sad and shocking. The Indians' priceless knowledge of medicinal plants, developed over thousands of years, was in danger of being lost because no younger Indians were voluntering to become apprentices to the tribal shamans. Mark asked the shamans if he could become their student, and in exchange he would write down what he was taught and preserve this knowledge. The shamans agreed, and Mark began to live with and learn from the Indians. He followed the shamans through the forest that they knew so well, learned their language, and wrote down all they taught him. Then he made a book, as he had promised, and gave it to the Indians. The ancient knowledge was saved! But this is not the end of the story. Other wonderful changes were taking place while Mark was studying with the Indians.

Because Mark respects the Indians and their culture, they also respect him. He became good friends with many of the young Indians; they call him "yah-ko" which means brother. Mark helped the Indians see the importance of preserving their culture and their knowledge of medicinal plants. He worked with them to set up the Shaman's Apprentice Program. Now the shamans are teachers to their own young people, and they are once

again passing on their priceless botanical knowledge to the next generation. The idea worked so well, that other Indian tribes in Central and South America have begun similar programs!

Preserving rainforests and Indian cultures will benefit the entire world. We already use many medicines that come from rainforest plants, and Mark thinks there are still many "wonder drugs" waiting to be found. In 1994 Dr. Plotkin and Costa Rican conservationist Liliana Madrigal founded an organization called The Ethnobiology and Conservation Team (ECT). Mark and Liliana have dedicated their lives to biodiversity conservation. They believe in the sacredness of life and feel that no species should be driven to extinction through ignorance or greed.

Mark Plotkin is a scientist, an author, a teacher, and a conservationist. But he is much more than these words can describe. He is a person whose values and dedication to conservation are really making a difference in this world where sometimes it seems like there is no good news. His work has been, and continues to be, an important contribution to world conservation.

Good News for Kids!

Dr. Plotkin wrote a popular book about his experiences called *Tales of A Shaman's Apprentice*. He recently wrote a book just for kids entitled, *The Shaman's Apprentice*. Look for it next year in your local book stores. Visit The Ethnobiology and Conservation Team on the World Wide Web at: `www.ethnobotany.org`

ACTIVITY: CHAPTER 7

What Shamans Know Could Save Your Life

Purpose: Students will learn that many important medicines are derived from tropical plants.

Materials:

- ☐ List of medicines derived from tropical plants, encyclopedias, books about medicinal plants (*Medicines From the Earth* and *Seeds of Change* by Henry Hobhouse are good sources).

Procedure: Study the list of medicines derived from rainforest plants and their uses. Why are these medicines important? Invite a pharmacist to visit your class. Talk about how medicines are made and tested.

Though discovery and testing of drugs takes years of painstaking work, scientists have plenty of reason for optimism: More than one-third of the current 121 prescription drugs derived from plants have their origins in the rainforest. Here's a partial list:

DRUG	PLANT	USE
Atropine	Belladonna	asthma
Cocaine	Coca	anesthetics
D-tubocurarine	Chondodendron tomentosum	skeletal muscle relaxant
Diosgenin	Mexican yam	birth control
Papain	Papaya	chronic diarrhea
Picrotoxin	Seeds of the Levant berry	convulsions
Pilocarpine	Pilocarpus	glaucoma
Quinine	Cinchona	malaria
Reserpine	Snakeroot	hypertension
Vinblastine	Rosy Periwinkle	Hodgkin's disease
Vincristine	Rosy Periwinkle	Acute Leukemia

8 Discover Earth

Have you ever dreamed of traveling to an unexplored planet; of encountering bizarre animals and plants never before seen by human eyes? Well, pinch yourself, wake up, and get started! You live on the unexplored planet—it's **Planet Earth**!

Life Adds Up

For years, scientists believed that there were about 2 million species on earth. But that low number is history! Since scientists began focusing on the tropics, and particularly the canopy of the tropical rainforest, we have learned that we have no idea how many species there are. Ten million is a low estimate, and some say the number could reach 100 million! These new estimates are largely due to the discovery of thousands of insect species, but two new bird species are discovered each year, and scientists occasionally come across unknown monkeys, rodents, and hoofed-animals too. Remember, eleven species of whales were discovered in this century!

KEY IDEAS

1. *We live on a largely unexplored planet.*
2. *Biodiversity is the word commonly used to describe the variety of life found on our planet.*
3. *All life is interconnected in ways we are just beginning to understand.*
4. *Biodiversity is disappearing because of habitat loss, introduced species, pollution, human population growth, and over-consumption of natural resources.*

Biodiversity is the word commonly used to describe the amazing variety of life found on our planet. It's a short way of saying "biological diversity," and it includes everything from blue whales to bacteria, fungi, plants; every living thing. But it's more than just species. Biodiversity also includes the different ecosystems—like rainforests, wetlands, deserts, grasslands, and coral reefs. And it also includes the variety within species—the genes that make each individual in a species different from the rest.

The great German zoologist Karl von Frish dedicated his life to the study of honeybees. He said the honeybee is like a magic well: the more you draw from it, the more there is to draw. A person can choose any species, study it for a lifetime, and still leave unanswered questions. But as amazing as individual species are, the truly mind-boggling aspect of our planet is that each species is part of a multi-million-piece jigsaw puzzle. All of this glorious life is connected, and humans—that's right, each one of us—is connected to the puzzle in ways we are just beginning to understand.

AMAZON

Never before has earth had so many species—so much biodiversity. And yet having just discovered that we are living in a biological treasure house, we find that it is in the process of being demolished. We are losing species at a rate not seen since the end of the Age of Dinosaurs, 65 million years ago. Some scientists think that up to one half of all species will disappear in the next 40 years. **Why?**

Habitat Is Home

Habitats are the places animals live and get the food, water, shelter, and space they need to survive.

Destruction of habitat is the main reason we are losing biodiversity. Other important reasons include:

Introduced (or exotic) Species
Pollution
Human Population Growth
Over-Consumption of natural resources.

We have alot of difficult problems to face if we want to turn the tide of biodiversity loss. One thing is for sure, it will take the efforts of each and every one of us. Dr. E.O. Wilson, one of the world's leading experts on biodiversity says, "The rest of life is the cradle in which the human species evolved. It is very much to our advantage to maintain the cradle."

Bio-Bits:

- A single tree in a rainforest can be home to more than 1000 species of insects.
- In an area of Amazonia the size of a suburban lawn, one could find 300 species of trees.
- One-fourth of all prescription drugs used today were originally derived from plants. Only 5% of all plants have been studied for medicinal use.
- For every 100 pounds of people, there are 1,000 pounds of termites.
- More than half the Earth's species are believed

to live in the tropical rainforest. Fewer than 1,500 scientists worldwide are trained to identify tropical organisms.

- To survive, a single harpy eagle requires 39 square miles of rainforest. An eyelash mite spends its entire life in a person's eyelashes.
- 99% of all species (excluding plants) are smaller than a bumblebee.

ACTIVITY: CHAPTER 8

In Your Own Backyard

Purpose: You don't have to travel far to see a great deal of biodiversity. If you were to watch any organism in your backyard, you would discover new things that nobody knows about.

Procedure: Have students start a "living things" journal and keep a daily record of the living things they observe as well as their observations of the interdependence of life.

ACTIVITY: CHAPTER 8

Live Simply So That Others May Simply Live

The average American's energy use is roughly equivalent to that of:

- 2 Japanese
- 6 Mexicans
- 12 Chinese
- 33 Indians
- 147 Bangladeshis
- 281 Tanzanians

or

- 422 Ethiopians

Since over-consumption of natural resources is one of the reasons for biodiversity loss, start thinking of some ways that you can conserve water, electricity, gas, paper—everything—at school and at home.

Profile of a Primate

Make a drawing of your primate here.

Common Name
Scientific Name
Habitat
Diet
Adaptations for living in the canopy
Gestation Number of Young Lifespan (if known)
Conservation Status (endangered, threatened etc.) Other Interesting Information

Vocabulary

Andes Great mountain system that forms the western fringe of South America extending through the countries of Colombia, Venezuela, ecuador, Peru, Bolivia, Chile, and Argentina

tributary A stream that flows into a larger stream or body of water

sediment Matter deposited by wind or water

echolocation The use of reflected sound fom an emitter (such as a bat or dolphin) to locate objects

Amazon Basin The region drained by the Amazon River and its tributaries

equator An imaginary circle around the earth equally distant at all points from the North Pole and the South Pole: it divides the earth's surface into the Northern Hemisphere and the Southern Hemisphere.

ecosystem A system made up of a community of animals, plants, and bacteria and its interrelated physical and chemical environment.

diversity Variety of life

westerner (in this context) A person from America or western Europe

fiber Any substance which may be separated into threads or threadlike structures to be woven or spun. (Fibers are extremely important to the survival of humankind. Rope, baskets, clothing, paper, furniture and fishnets are just a few items made of plant fibers).

exploitation The act of utilizing or turning to one's own use

social insects Insects that live together in colonies

myrmecologist A scientist who studies ants

biomass The total mass or amount of living organisms in a particular area or volume

herbivore Plant-eating animal

symbiosis The living together of two different organisms in close association, especially where this is advantageous to both

interdependency Mutual dependence

canopy The layer of the forest formed by the crowns of tall trees.

photosysthesis The process by which green plants make food

decomposition The process by which dead plants and animals are broken down into simpler elements (to rot, to decay).

immunity Resistance to a disease. The power to resist infection.

developed country Usually a largely urban and industrialized nation with high levels of income and education.

slash-and-burn agriculture Cutting down trees and then burning them to clear land for agriculture.

fallow Left uncultivated or unplanted.

sustainable agriculture Agriculture that can be maintained for many years through the efficient and wise use of resources.

shaman A tribal healer and/or doctor who has great knowledge of the medicinal qualities of native plants

ethnobotanist A scientist who studies the ways that people use plants.

indigenous Occurring naturally in a certain area. Indigenous people is most often used to mean the tribal peoples, such as Indians.

anthropology The study of people and their cultures

botany The study of plants

medicinal Plants plants that contain chemicals with curative properties

apprentice A person who works for another in order to learn a trade

culture The sum total of ways of living built up by a group of human beings and transmitted from one generation to another

biodiversity The variety of life on Earth.

ecosystem All the living and non-living things that interact in a particular place in the environment.

genes The coded information in organisms' cells that makes species and individuals unique and that is transmitted from one generation to the next.