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Rain forest curriculum for upper elementary and middle grades

Nancy Jane Brinkley

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RAIN FOREST CURRICULUM FOR UPPER
ELEMENTARY AND MIDDLE GRADES

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education: Environmental Education

by
Nancy Jane Brinkley
December 1996
RAIN FOREST CURRICULUM FOR UPPER ELEMENTARY AND MIDDLE GRADES

A Project
Presented to the Faculty of California State University, San Bernardino

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Approved by:

Dr. Darleen Stoner, First Reader

Dr. Iris Riggs, Second Reader

Dec 12, 1996
ABSTRACT

This project focuses on the development of lessons on the rain forest for the upper elementary or middle school age students. Through these lessons students can become aware of the special role the rain forests play in our environment. The lessons focus on the development of healthy personal attitudes toward the rain forest of the world, awareness and knowledge concerning the wise use of our natural resources, and motivation for constructive actions. The lessons give teachers either a starting point from which to teach about the rain forest or an enriching extension of lessons already taught.
ACKNOWLEDGMENTS

To Audrey Dryden: Thank you for your ever present help and support.

To Amy Schneider: Thank you for your encouragement and faith.

To Tim and Chris Schneider: Have a dream and then make it happen.
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INTRODUCTION

I have always preferred to be out in nature as opposed to being cooped up indoors. Some of my fondest memories from childhood are of time spent camping, hiking, and communing with nature. This love of the outdoors only grew as I became older. As I spent time in nature I became more concerned about the destruction of our environment.

I have always enjoyed incorporating the out-of-doors with my teaching. Thus, when I decided to further my educational experiences, I naturally chose the field of environmental education in order to learn more about the methods that I, as a teacher, could use to present important environmental issues to my students. When I began looking for lessons that I could use with my students, I found that there were some isolated lessons that addressed environmental issues but few which presented a comprehensive unit of study. Since presenting the information as a comprehensive, sequential unit was my goal, I began creating lessons for my own use.

At about this same time I noted that, while many of my colleagues shared my environmental concerns, they did not feel compelled to take the time and energy that are required to incorporate this crucial information into lessons that would inform their students and enable them to be active
participants in environmental areas. These barriers that I observed were also found by researchers Ham and Sewing (1988), who categorized the barriers into four broad groups: logistical, conceptual, educational and attitudinal.

The logistical barriers dealt with a lack of time to develop comprehensive curriculum with specific objectives and goals. Then time is also needed to prepare the materials, work out the lesson plans, and find actual class time to implement the lessons. Also under the logistical barrier was lack of funding, lack of available instructional materials, and suitable class size to carry out the lessons.

The conceptual barrier dealt with the misconception that environmental education is relevant only to science curriculum and is frequently equated with outdoor education.

Educational barriers found teachers having misgivings about their own competence to carry out environmental programs. A poor background in this area promoted a lack of interest or commitment to provide adequate instruction in that area of study.

The attitudinal barrier stemmed from teachers not having a positive feeling toward teaching environmental education. If this attitude prevailed, then little or no instruction in this area will occur in the classroom.

The logistical barriers were further emphasized by researchers Ramsey, Hungerford, and Volk (1992). The big
question is, How do teachers implement environmental education into an already overloaded curriculum? Is it best done by insertion (adding a separate course of study to the curriculum), or infusion (integration of content and skills into existing courses in a manner as to focus that content without jeopardizing the integrity of the courses themselves).

Most instructional methods, including the investigation skill approach and case studies by students, had a variety of problems, barriers and limitations. Although these methods gave the teacher flexibility and control, they required a great deal of time, energy, and skill in putting them together. Although the students can be involved in the selection of the investigation or case study, the teacher remained the basic curriculum designer. The responsibility for finding and selecting original sources such as videotapes, printed matter, films, field trips, and possible guest speakers rested with the teacher. Decisions must be made about specific learning outcomes, handouts must be prepared, and evaluation instruments must be designed and evaluated.

Significance of the Project

After taking a personal trip to the rain forest, I returned with the resolve to relate my experiences to my students. I began designing the lessons which would allow
me to do this. In discussions with fellow educators, I found that many of them shared my concerns for the environment, but were less informed than I, and were not able to do the research necessary to effectively teach their students about the many aspects of the rain forests. When deciding upon a topic for this project, I decided that I could share both my knowledge and the materials I had created with other teachers.

The lessons have been designed to follow a logical sequence and will provide students with hands-on experiences. Though I have limited my focus to deal with geographic information, biodiversity, and loss of habitat, I know that teachers will find ways to increase the scope of the material they present to their students. Writing letters to publishers of magazines which are not printed on recycled paper and asking them to consider using recycled paper is one example of a powerful way to utilize language arts with the study of rain forests. Creative teachers will have no trouble finding ways to enhance students' experiences. Suggestions are offered, where appropriate, in order to stimulate adaptation of lessons.

In the project, I offer some recommendations for reading which will greatly increase the teachers' knowledge of the various problems concerning the rain forests of the world. It is my hope that teachers will become familiar
enough with some of the suggested literature that they will be able to relate other subject areas to the lessons.

Statement of Needs

A worldwide shift in perception of the ecological value of the rain forest is needed if we are to halt the process of rain forest destruction (Head and Heinzman 1990). As teachers, we need to do our part by presenting lessons to our students. Our lessons need to include many examples of ways each of us can make a difference, in both large and small ways.

It has only been within the past 10 years that problems of the rain forest have become evident (Nichols 1990). Those who write about, and those who are working with these problems, agree that the main areas of concern focus around a few issues: loss of biodiversity and habitat due to the logging industry and agriculture; potential for global warming; and the loss of the culture of indigenous peoples of the forest (Denslow and Padoch 1988). We must all concern ourselves with these problems. As educators we can enable our students to be concerned and to consider possible ways in which they can make a difference.

Background Reading for Educators
About the Rain Forest

A teacher wishing to become familiar with key books on the rain forest should begin by reading material on

Goulding reviewed the formation of the South American rain forests caused by continental drift, the rise of the Andean Mountains, and the influence of the Ice Age. He showed how all of these provided new ecological opportunities for an increase in the number of species.

Hirsch, a renowned environmentalist, primarily addressed the rain forests of Ecuador (1993). He pointed out that there are an estimated 3 million species living in the Equadorian rain forests. He went into some detail about the 8,000 to 10,000 species of plants and the more than 200,000 animals who make their homes in the rain forest of Ecuador. Hirsch defined and elucidated the importance of biodiversity.

*Rainforests: A Celebration* (Silcock 1990) dealt with the uniqueness of the rain forests. Biodiversity and quantity of species are emphasized. For example, it is pointed out that the Amazon River is home to over 3,000 varieties of fish, which is more than in all of the Atlantic Ocean; that in the rain forests of Panama more than 1,500 different kinds of butterflies have been discovered compared with only 763 known species in the United States and a mere 68 species in Britain; and that the rain forests of
Madagascar have five times more trees than in all of North America. Through examples like these, the reader soon becomes aware of the importance of the rain forests around the world as they relate to the subject of biodiversity.

After becoming familiar with the subject of biodiversity, the teacher should read material which addresses the loss of habitat and the way in which destruction of the rain forests has affected both plant and animal life. There are a number of books which address this problem, but I have found a few that are most interesting and informative. Among these are *Jungle Rescue* by Christina G. Miller and Louise A. Berry (1991), *The Last Rain Forest* by Mark Collins (1990), *The Mighty Rain Forest* by John Nichols (1990), and *The Brazilian Rain Forest* by Alexandra Siy (1992).

Miller and Berry (1991) described Dr. Russell Mittermeier’s Golden Lion Tamarin project. Dr. Mittermeier is a primate specialist who created the World Wildlife Fund primate program in 1979. This project is a good introduction to the problems created by loss of habitat. The tiny squirrel-sized monkeys have beautiful golden hair that forms a mane around their faces. They live in families and find shelter in old hollow trees. Many families use the same tree for years. Each family needs about 123 acres in order to find enough fruit, insects, spiders, bird’s eggs,
and lizards to support the group. The Golden Lion Tamarin are found only along the Atlantic Coast of Brazil. Today less than 2 percent of the original forest occupied by these monkeys remains. With this loss of habitat, the monkey’s numbers have diminished to a dangerous degree. Dr. Mittesmeiu’s program, which was designed to study and to help save these animals, has resulted in their reintroduction back into the same rain forest areas.

Another interesting project which Miller and Berry (1991) described is the Iguana Management Project in Panama which was set up in 1983 by the Smithsonian Tropical Research Institute. They described how the green or common iguana, which was plentiful in the forests from Mexico to Brazil 20 years ago, has been threatened by extinction due to loss of habitat and overhunting. The iguanas were used for food by those native to the area. The goal of the project was to learn how to raise iguanas in captivity so they could continue to be an important source of food for the local people. Female iguanas, ready to lay eggs, were placed in a dirt pen where they deposited their eggs in underground nests. The researchers dug up the eggs and cared for them, weighed and measured the newly hatched iguanas, and fed them fruit, flowers, and leaves. Since there were no predators, more survived. When the iguanas become seven months to one year old, they are distributed to
farmers in the Central American countries as part of the repopulation program. The farmers are taught how to create "shelter belts" between their land and the forest. When the iguanas are ready to reproduce, farmers help to insure the survival of the eggs by building artificial nests. Iguana farmers can potentially supply more meat per acre than can cattle ranchers. After reading a description of this project, the reader will have gained insight into not only the problem, but the way in which some solutions have been tackled.

An excellent source of information concerning loss of habitat is The Last Rain Forest by Collins (1990). Collins is the head of the Habitats Data Unit at the World Conservation Monitoring Centre in Cambridge, England. His wide experience includes a decade of living in the tropics of Asia, Latin America, and Africa where he has carried out ecological research in all the major rain forests of the world. One of the problems he discussed is the habitat fragmentation which has affected the Asian elephant in Sumatra. Villages have been created along the edges of the forest where the elephants are found because the Indonesian government has recently moved thousands of people from Java, Madura, and Bali to Sumatra as part of its transmigration program. Deforestation for agricultural purposes has left isolated forest islands for the elephants. Crops, such as
sugar cane and rice, are grown; these are particularly enjoyed by the elephants. Territorial conflicts have increased between villagers and elephants, and it is not uncommon to see the elephants with scars from wounds caused by guns used to drive them from the crops. Collins (1990) also related some of the problems of loss of habitat experienced in the Philippines. For example, the monkey-eating eagles are found only on the islands of Luzon, Somar, Leyte, and Mindanao. Their population is estimated at fewer than 200 birds. In the past, hunting and trapping contributed to the decline of the species, but deforestation is now the main threat. Suitable habitat has been reduced to such an extent that breeding is being disrupted. In describing the devastation of other species in the Philippines, Collins pointed out that, of the more than 540 species of birds found there, 388 breed there, 119 are migrants passing through, and 34 are irregular visitors. At least 162 of these are endemic, or native only to this area. Most of these birds are very sensitive to any disturbance. A recent survey on the island of Cebu found that only one of the original ten forest species had survived the logging in that area. Some are caught for food, and others are trapped for the caged bird market.

Collins (1990) detailed the endangerment and threat of extinction that has been caused by the logging industry. He
described the way trees were removed haphazardly in the past. In Indonesia, great teak forests began to be exploited as early as the 1850s. Since most logs were extracted with the use of elephants, the environmental impact was light. After the end of World War II, chain saws and bulldozers made their entrance, and the resulting damage to the forests has been devastating.

Another area of concern that Collins (1990) discussed is cattle ranching in Brazil. Cattle ranching has accounted for 70 percent of deforestation that has occurred there. Sections of the forest are cleared by ranchers to become grazing land for cattle and crops. But in only two year's time the soil's fertility is used up, and crops will no longer grow. The ranchers must move on and clear more forest land. While many ranchers have tried to enrich the soil with fertilizers, the end result is the same: weeds, compacted soil, and erosion with the coming of the rain, all of which result in land that is virtually useless to the farmer.

Another "must read" for anyone seeking background into the problems of the rain forests is The Mighty Rain Forest by Nichols (1990). Nichols does an excellent job of showing how people, in their quest for material things and money, have jeopardized many species of plants and animals. He described the ways people have exacted a toll on many of the
areas of the world. He described problems that can be attributed to logging, manufacturing, and agriculture with examples from all of the major rain forest regions in the world. For example, he described effects of logging in Indonesia, Bangladesh, Rio Grande do Sul, and Bahia. He pointed out that most of the logging is carried out by concessionaires who make a quick profit. Since the forest does not belong to them, the logging companies have no long-term interest in its future or in replanting. The damage done is extensive. The huge machines compact the soil so that seeds cannot penetrate the soil and begin to grow. The skidders, the machines which are used to remove the logs from the forest, tear great ruts through the ground, destroying topsoil and the seeds and roots that it contains. If the exposed soil happens to be on a steep slope, a layer several centimeters thick can be lost in less than a year. Another interesting aspect of Nichols' book addressed the medical uses for many of the plants of the rain forests.

Alexandra Siy, author of The Brazilian Rain Forest (1992), brought up many of the same problems that are discussed by the previous authors. I recommend her book because she approached the uniqueness of plants and their products from a different perspective. Rain forests contain relatives of some domestic crop plants. Scientists have crossed wild and domesticated species to develop new plants
that are stronger and healthier than the original domestic crops. For example, genes from wild peanuts found in the Amazon have helped domesticated peanuts fight off disease. This has saved peanut farmers $500 million a year. Siy also emphasized the valuable materials for industry that are supplied by plants of the rain forest. The potential of the rain forest in relation to providing medicine and chemicals is unknown but it is expected to be extremely high. To cite an example, it has been proposed that some species of rain forest plants may someday provide farmers with natural pesticides that do not pollute the environment.

Goals and Objectives

Goal of the Project

The goal of this project is to develop lessons on the rain forest for upper elementary or middle school-age students in order that these students may become aware of the uniqueness of the world's rain forests, along with developing a healthy personal attitude toward the wise use of our natural resources and a motivation for constructive action.

Project Objectives

The development of the rain forest curriculum reflects the following:
1. Creating new projects and activities concerning rain forests of the world
2. Providing suggestions for activities which are cross curricular
3. Utilizing a variety of teaching strategies (small group, large group, cooperative groups) to present material
4. Utilizing critical-thinking and problem-solving skills about existing rain forests
5. Providing opportunities for students to take appropriate actions in the conservation of resources
6. Creating an assessment tool for the evaluation of student learning
7. Tying the California State Science Framework into teaching about rain forests
8. Presenting updated information on the rain forests
9. Providing a reference list of existing materials on rain forests
10. Providing a list of children's literature, films, and videos available for the classroom
11. Providing sources and prices of rain forest plants that can be purchased and brought into the classroom

Design of the Project

Five years ago when I first became more aware of the importance of rain forests, I wanted to bring something on the subject into the classroom for my fifth and sixth grade
students. There was very little information, at that time, that could be used in an elementary classroom. This newfound enthusiasm sent me on a rafting trip down the Usumacinta River and into the last remaining rain forests of Mexico. I wanted to package all the sights, the sounds, the smells, the quiet, and the rain, and bring them back for my students to experience. Back home, I began to develop my own lessons, trying to bring to my students an excitement for learning about the rain forests.

The lessons developed involved active learning and covered all areas of the curriculum. It was so easy to use the rain forest as the theme because there were endless ideas that could be used in geography, science, social studies, language arts, and art.

The activities (lessons) presented in this project have been field-tested with students, ages ten through thirteen, at Margarita School in the Ontario-Montclair School District. The geography (which does not seem widely taught today) activities gave the students better global knowledge. It was always exciting to have one of the rain forest countries come up in the news and the students would know where it was located. The language arts lessons allowed the students to combine scientific fact with an adventure story. The science activities allowed students to explore areas that were new to them and to develop an appreciation for all
plant and animal life. The art lessons were enjoyed by all because they allowed for a wide range of creative ability to be developed. Making some of the flowers of the rain forest gave the students a new insight into the wonders of nature.

A video has been prepared from the slides taken on my trip to the rain forest. It zeros in on the last remaining rain forest of Mexico and how deforestation has taken its toll. It would be appropriate to show the video anytime during the study of the rain forest.

Conceptual Framework

The lessons developed use the following environmental concepts:

1. Rain forest diversity is important because 50 percent of all plants and animals in the world exist in the rain forest.

2. The health and well-being of both humans and wildlife are dependent on the quality of the natural environment.

3. Intrinsic values that can result from a study of the rain forest include development of a healthy attitude toward personal responsibility and an ability to make lifestyle choices to use our resources wisely.

4. Rain forests are usually, but not limited to, tropical and subtropical areas of the world.
5. Producers, consumers, and decomposers play a vital role in the life cycle of the rain forest.

6. All living creatures in the rain forest depend on photosynthesis and are part of the food web.

7. Everything in nature must be adapted to its surroundings in order to survive.

8. Humans have a far greater ability to alter or adjust to environmental changes than do wildlife or plants. The responsibility to consider the effects of their actions is therefore essential to survival of all forms of life.

9. Everything in nature is interconnected.

10. Human wants and needs have affected the delicate balance of nature, even in areas thousands of miles away.

11. Rain forest habitats are being removed (deforested), resulting in endangerment, and even extinction, of plants and animals.

12. Rain forests may plan an important role in preventing global warming.

**Implication for Educators**

Many lessons have been developed that can be used by teachers. It is my desire to share this information with other instructors in the hope that they will utilize these lessons with students. Hopefully, the teachers will go even further and expand their own knowledge and increase their commitment to environmental education. At the very least, I
feel the information imparted to the students will heighten their awareness of the environment and assist them in acquiring some lifelong habits that will further environmental efforts.

The scope of my project focuses on the rain forests of the world. It gives background information and essential understanding from the most current literature available so that a classroom teacher will be easily able to create an awareness in students of the unique qualities of the rain forests. I have emphasized the ways in which humans, and all other life, share Planet Earth. Students are made aware that the responsibility for conserving rain forests is shared by everyone—even those of us who live thousands of miles away. First and foremost, the lessons allow teachers, even those with limited knowledge about rain forests, to present their students with a comprehensive and sequential, hands-on experience. For teachers who utilize either a whole language or a thematic approach, many areas of the curriculum, in addition to science, can be incorporated into the topic. These lessons provide experiences in art, geography and social studies, as well as reading and language arts. Teachers will no doubt add their own unique twists to the study.
Background for Teachers -

Then and Now

Scientists have theorized that the huge land mass of Pangea started to drift apart about 80-90 million years ago. South America and Africa, our two largest tropical continents, began their separation forming a new ocean, the Atlantic. The continents, as we know them today became giant islands drifting slowly away from each other on the earth's crust. At that time much of the land mass was believed to have been covered by tropical forests, not necessarily as we know them today. Over millions of years these ecosystems have adapted their life processes to form a tremendously complex and bountiful environment where its inhabitants are outstandingly diverse. This diversity is held in a delicate balance, where the interaction of plants and animals is absolutely necessary for survival (Nichols 1990).

Today's tropical forests form a belt around the earth about 25 degrees latitude North and South of the Equator (between the Tropic of Cancer and the Tropic of Capricorn). Heating of the earth's surface is greatest at the equator, where the sun shines directly overhead throughout the year. Hot equatorial air masses expand and rise, absorbing moisture from the oceans and great river basins. As these air masses move away from the equator, they cool and shed their moisture within that belt (Science Plus 1992).
Rain forests are found in the Caribbean Islands, South and Central America, western and central Africa, southeast Asia, New Guinea, Madagascar, northeast Australia, and the Philippines. The temperature in these Rain forests averages 75 degrees Fahrenheit, and never falls below freezing.

About one thousand years ago the landmass consisted of 14 percent tropical forest. Today, it is estimated there is about 7 percent left (Nichols 1990).
Background for Teachers -

Types of Rain Forests

Rain forests today can be divided into two broad categories according to altitude—lowland and montane. The lowland rain forest is the most extensive type and is found, as the name suggests, in relatively low lying areas—generally up to 3,000 feet, but up to 6,000 feet in the western Amazon area.

The great Amazon and Zaire River basin are the two largest intact regions of lowland rain forest in the world.

Botanists have identified as many as forty different types of lowland rain forests, differing mainly because of unique patterns of rainfall, soil fertility, and drainage. Although there are broad similarities in the physical appearances of the rain forests on different continents, the actual species they contain vary widely.

The mangrove forests, which are considered a part of the lowland rain forest, are a special type of rain forest which is poor in its variety of species. The biggest and richest mangroves are in the wet tropics, particularly along the coast of Bangladesh, the Malay Peninsula, Sumatra, Borneo, New Guinea, and the other islands scattered throughout Southeast Asia.

Mangroves are evergreen trees and shrubs that live in silt-rich soils in saline coastal waters. Their main adaptation to the salty environment is their breathing
roots. They emerge from water-logged mud into the air, where they can absorb oxygen needed by the root system.

Traveling to the coastline of Queensland, Australia, one can see two types of a rain forest side by side. Twisted roots, which characterize the mangrove forest at the water’s edge suddenly turn and rise up to a typical lowland rain forest.

Montane rain forests are found at higher altitudes on forested mountains in the tropics. The hot, sticky humidity of the lowland gives way to a cooler dampness. These high altitude or montane forests are generally found between 3,000 and 6,600 feet, and between 6,600 and 10,500 feet. Mists often engulf the forest canopy and are frequently referred to as the "cloud forest." Montane forests are scattered over the continent of Africa, notably in Ethiopia, the highlands of the Twanda-Burundi-Zaire border, Kenya, northern Tanzania and Cameroon. Many isolated montane forests have their own unique group of plants and animals (Collins 1990).
Activity I

Locations of Rain Forests in the World

Objective: Students will become familiar with the locations of the rain forests of the world, where they were originally found, and what is remaining of them today; and more specifically, the countries in which the rain forests are found.

Conceptual Framework: 4

Materials: Overhead projector maps - (found in folders in the accompanying kit)
   a. Where rain forests were originally located
   b. Where rain forests are presently located
   c. Blank maps for students

Colored pencils recommended (crayons and markers can be used if colored pencils are not available

Overlays

Subjects: Geography

Time: 1 hour per rain forest location

Procedure:

1. Types of rain forests (see background for teachers.

2. Using an overhead projector, the teacher shows a map of South America and where rain forests were originally found. Then an overlay of South America is used which shows where rain forests of South America are still remaining.

3. Pass out the students' maps of South America. Using an overhead map of South America, the teacher can write in the names of the countries and the students can copy them in the right location.

4. An alternative to the above would be to give the students a list of the South American countries that have rain forests. The students can then use an
Act. I (Cont.)

up-to-date atlas to find where they are located. (Countries where rain forests are found are listed on a separate sheet with this activity.)

5. Repeat steps 2, 3, and 4 with the other rain forest locations.

Additional Suggestions:

1. To help the students learn the countries that have rain forests, the names could be part of a vocabulary list. The black silhouette shapes of the countries should be noted too because they will be used in another activity.

2. If the teacher wants to carry this map study further, the students could also label the following features:

   * Large bodies of water
   * Important rivers (that play a part in the makeup of the rain forest)
   * Equator
   * Tropic of Capricorn
   * Longitudinal and latitudinal degrees of different rain forest countries
   * Countries surrounding the rain forest countries
Activity II

Rain Forest Countries

Objective: Students will become more familiar with the rain forest countries in a given area by their silhouetted shapes.

Conceptual Framework: 4

Materials: Silhouette Country Cards of a particular area (in kit)
Country Name Cards (6 sets) (in kit)

Subjects: Geography
Social Studies

Time: 10-15 minutes a day

Procedure: This is a challenging activity that can be used in several different ways.

SUGGESTION ONE:

1. Divide the class into cooperative groups (six table groups work well). Each group is given a number or letter that recognizes that group.

2. The numbers or letters of the groups can be placed on the board in order to keep score.

3. The Country Name Cards are passed out to each group and they are spread out in front of the students so they can be seen by the whole group.

4. When everyone is ready the teacher holds up a Silhouetted Country Card and gives the groups a teacher-designated time to determine the country's shape.

5. After discussing the possibilities, the group selects the Country Name Card that the group has agreed on. When the teacher counts to three the appointed person from each group holds the selected card up.
Act. II (Cont.)

6. Each team with the right answer receives a point which is then marked under the group’s number or letter.

SUGGESTION TWO:

1. Divide the class into two teams.
2. Have one student from each team stand and face the teacher.
3. The teacher holds up a Silhouetted Country Card.

SUGGESTION THREE:

1. Once again use cooperative groups.
2. Provide each group with a set of Silhouetted Country Cards.
3. The teacher holds up a Country Name Card and the groups try to find the correct Silhouetted Country Card.
4. When the teacher counts to three, the appointed person from each group holds up the one the group thinks it is.
5. Points can be earned and a score can be kept.
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Activity III

Biodiversity

Objective: Students will learn the meaning of biodiversity as it relates to the rain forests of the world. They will be able to demonstrate through their own creativeness examples of biodiversity.

Conceptual Framework: 1

Materials: Video - You Can’t Grow Home Again
(Children’s Television Workshop, Box HV, One Lincoln Plaza, New York, New York, 10023; or call 1 800 321 7511)
Whatever materials students decide to use

Subject: Science

Time: 2-3 days

Procedure: 1. Vocabulary:
*biodiversity - many kinds of life

2. Begin by showing the video You Can’t Grow Home Again. The first part deals with the concept of biodiversity. You may not want to show the whole film at this time.

3. Brainstorm ideas of items that could be used to demonstrate this concept of biodiversity (marbles, crayons, pins, fabrics, shapes, toys, colored paper, leaves, rocks, etc.).

4. Students are then asked to create their own biodiversity, along with an explanation. The student should be able to explain his/her biodiversity in this way: In a temperate forest there are many of the same species. If some are removed there would still be plenty of the same kind. In a rain forest there are many different kinds of species. If some of them are removed they may be gone forever.
5. Each student can then present his or her own idea of biodiversity in front of the class or a display can be set up somewhere in the classroom.

6. The rest of the film can now be shown.
Background for Teachers -
Layers of the Rain Forest

Most scientists name four layers to the rain forest: the emergent layer, the canopy, the understory, and the floor. Perhaps one more layer should be added to that group . . . the below-water habitat. Each is distinct with its own particular species, but each depends on the other layers for survival.

The emergent layer is where you will find many unnamed trees. This is so because the rain forest is one of the last frontiers to be explored. The dome-shaped crowns find it sunny and are kept dry by the strong winds. The leaves are smaller than down below and a lighter green. While many of these giant trees reach 200 feet, the Tualang in southeast Asia has been known to grow to 272 feet (Hirsche 1993). The seeds from these big trees are carried by the wind, sometimes drifting many miles away.

The canopy layer is the most unexplored place in the rain forest. So many trees are still unnamed. The trees here act as a roof in a greenhouse. They hold in the heat and moisture. Many leaves in the canopy begin their life dressed in brilliant colors . . . reds, purples, blues, and even whites. This defers their being eaten by predators and gives them a chance to grow. As the leaves mature they turn green (Hirsch 1993).
Another name for the canopy is the umbrella layer. While the wind is cruising along at a high speed and the rain is pelting down, the trees in the umbrella layer are protecting the vegetation below. Some rain water never reaches the ground but is held by leaves, epiphytes, and crevices in enormous branches.

Each tree seems to have its own boundary. The outermost leaves stop short of touching another tree adjacent to it. "Crown shyness" is a phenomenon thought to be a defense against caterpillars (Collins 1990).

The upper canopy receives the most light and is therefore the most favorable place for plants, such as orchids, ferns, peppers, bromeliads, and prickly-leaved plants (Silcock 1990). Since these species are so far above the ground, it is very difficult to view all that exists.

In the lower canopy you will find the leaves a dark green, housing extra green pigment called chlorophyll. The trees here grow to about 50-60 feet. Many times this layer is so dense that you cannot see the upper canopy. The temperatures here are cooler than above but the air is still and humid. The tree trunks are blotched with mosses and lichens.

In the **understory layer** we notice that the leaves are a dark green. There are shrubs and bushes, many of which resemble dwarf trees. The plants that live here must be
able to tolerate a lot of shade. The larger mammals of the forest are usually found here.

The floor layer is a still place where hardly anything naturally moves. The humidity is about 90 percent and the temperature around 82 degrees. This layer is like a nursery where plants and tree seedlings begin their life. Much of the floor is bare, with lumpy roots twisting and turning in every direction. The exotic sounds of birds and the clicking of insects can be heard, even though you do not see them.

The soil here on the floor is very poor. When the heavy rains come they wash over the ground leaching out the nutrients. The trees and other plants have very shallow roots which quickly absorb the nutrients as soon as they are released into the top soil. With this happening they have very little chance of seeping down into lower levels. The much-needed nutrients come from the decay of dead animals and plants. Millions of bacteria and other tiny organisms that live on top and within the soil begin their job of decomposing as soon as a dead species hits the ground. They are at work all the time and can have all remains gone in 24 hours (Silcock 1990).

The below-water layer teams with life. Even on these waterways one can find flowers. One such specie is the giant water lily. This plant’s saucer-shape leaves, usually
measuring 2½ feet in diameter (Goulding 1990), have been measured at 7 feet across and weighing in the neighborhood of 198 pounds (Siy 1992).

In flooded areas, forest fish and turtles play an important role in transporting seeds from the rubber tree. When they find a rubber tree seed floating in the water they crush it open with their strong jaws. The tambaqui (large fish) fattens up on great quantities of rubber seeds which tide it over until the next flood season (Goulding 1990).
Activity IV
Layers of the Rain Forest

Objective: Students will identify the layers of the rain forest by making a display, and be able to designate which species belongs in which layer.

Conceptual Framework: 1, 9

Materials:
- Corrugated cardboard (28¾" X 56")
- Cardboard box cut to teacher’s specifications
- Science boards (frequently used in science fair projects—already has fold creases for easy storage)
- Fabric for background
- Ruler/yardstick glue for fabric
- Super glue
- Scissors variety of fabrics (corduroy, felt, leather, wool, cotton, etc.)
- Tape - used to edge board
- Puff paint (found in craft stores)
- Set of animals found in rain forests
- Cardboard stock to back animals
- Velcro circles
- Animal/Fungus Description Cards (in kit)

Subjects: Science
- Art

Time: Teacher time will vary.
- One day will be enough to do the "Where does each species live" activity.
- For the student to make his/her own rain forest, 1-2 weeks should be allowed.

Procedure: Teacher Preparation

1. Decide on the size board to used. The one in the picture is 28¾" X 56". It is a good idea that it can stand freely and be able to fold for storage.

2. Either paint or cover the board with a blue fabric.
3. Edge the board (including the fabric in appropriate color).

4. Plan the layers of the rain forest . . . the emergent, the canopy, the understory, the floor, and the water habitat (rivers).

5. Patterns of various trees and plants can be made so you get an overall view of the way you want it to look.

6. Select interesting fabrics with different textures to represent palms, ferns, lianas, etc.

7. After all layers have been represented, glue all parts down.

8. A nice finishing touch is to take puff paints and outline the trees and plants.

9. The animals and decomposers included here can be mounted on a lightweight cardboard. Laminating them will help them last longer.

10. Separate the velcro circles, putting one half on the board in one of the layers where a particular specie is found, and the other half on the back of the specie.

   * Super glue works best for this because the velcro stays firmer on the board and on the animals when being taken off.

Student Activity

1. The layers of the rain forest must be taught first.

2. One animal or fungus and its corresponding description card (in kit) is given to either each student, a pair of students, or a table group in the class. They decide from the description where their animal or fungus belongs. As the teacher goes around the room, each group goes up to the board and places its
species in the correct layer. Keep going around the room until all species have been posted.

If there are any corrections to make, now is the time to do it. Of the 35 species represented, some live only in one layer. Otherwise, some species can be found in two or three layers. (See answer key.)

3. Students will now make their own rain forest . . . emphasizing the five layers: the emergent, the canopy, the understory, the floor, and water habitats (rivers).

They can use boxes or boards (science fair-type boards) and will use a variety of materials. Each layer must be represented. Animals may be added to enhance the project.

*Once again, students may do this process either by themselves, with a partner, or in a small group. The room could become quite crowded if each student did one.

(See samples.)
Answer Key to Activity IV

<table>
<thead>
<tr>
<th>Animal/Fungus</th>
<th>Layer Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cup fungus</td>
<td>Understory, floor</td>
</tr>
<tr>
<td>2. Earthball fungus</td>
<td>Understory, floor</td>
</tr>
<tr>
<td>3. Amazon electric eel</td>
<td>Water</td>
</tr>
<tr>
<td>4. Green vine snake</td>
<td>Canopy, understory</td>
</tr>
<tr>
<td>5. Orangutan</td>
<td>Canopy</td>
</tr>
<tr>
<td>6. Jaguar</td>
<td>Understory, floor</td>
</tr>
<tr>
<td>7. Blue morpho butterfly</td>
<td>Understory</td>
</tr>
<tr>
<td>8. Giant anteater</td>
<td>Floor</td>
</tr>
<tr>
<td>9. Ring-tailed lemur</td>
<td>Canopy</td>
</tr>
<tr>
<td>10. Red uakari</td>
<td>Canopy, understory</td>
</tr>
<tr>
<td>11. Leaf cutter ants</td>
<td>Canopy, understory, floor</td>
</tr>
<tr>
<td>12. King vulture</td>
<td>Emergent</td>
</tr>
<tr>
<td>13. Resplendent quetzal</td>
<td>Emergent</td>
</tr>
<tr>
<td>14. Toco toucan</td>
<td>Canopy</td>
</tr>
<tr>
<td>15. Red howler monkey</td>
<td>Canopy</td>
</tr>
<tr>
<td>16. Dart poison frog</td>
<td>Canopy, understory</td>
</tr>
<tr>
<td>17. Flying fox</td>
<td>Emergent, canopy, understory</td>
</tr>
<tr>
<td>18. Harlequin beetle</td>
<td>Canopy, understory</td>
</tr>
<tr>
<td>19. Boa constrictor</td>
<td>Understory, floor</td>
</tr>
<tr>
<td>20. Indris</td>
<td>Canopy</td>
</tr>
<tr>
<td>21. Scarlet macaw</td>
<td>Canopy</td>
</tr>
<tr>
<td>22. Spectacled owl</td>
<td>Forest edge, emergent, canopy</td>
</tr>
<tr>
<td>23. Sloths</td>
<td>Canopy</td>
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<tr>
<td>Animal/Fungus</td>
<td>Layer Found</td>
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<tr>
<td>24. Bird’s nest fungus</td>
<td>Floor</td>
</tr>
<tr>
<td>25. Baird’s tapir</td>
<td>Floor</td>
</tr>
<tr>
<td>26. Hercules beetle</td>
<td>Canopy, understory</td>
</tr>
<tr>
<td>27. Red piranha</td>
<td>Water</td>
</tr>
<tr>
<td>28. Tarantulas</td>
<td>Canopy, understory, floor</td>
</tr>
<tr>
<td>29. Parasol fungus</td>
<td>Floor</td>
</tr>
<tr>
<td>30. Agoutis</td>
<td>Floor</td>
</tr>
<tr>
<td>31. Siamang gibbon</td>
<td>Canopy</td>
</tr>
<tr>
<td>32. Spectacled caiman</td>
<td>Water</td>
</tr>
<tr>
<td>33. Capybaras</td>
<td>Floor</td>
</tr>
<tr>
<td>34. African golden cat</td>
<td>Understory, floor</td>
</tr>
<tr>
<td>35. Okapi</td>
<td>Floor</td>
</tr>
</tbody>
</table>
Act. IV (Cont.)
Act. IV (Cont.)
Act. IV (Cont.)

1. Cup fungus
2. Earthball fungus
3. Amazon electric eel
4. Green vine snake
5. Orangutan
Act. IV (Cont.)

6. Jaguar

7. Blue morpho butterfly

8. Giant anteater
9. Ringtailed lemur

10. Red uakari

11. Leaf cutter ants

12. King vulture

Act. IV (Cont.)
Act. IV (Cont.)

13. Resplendent quetzal

14. Toco toucan

15. Red howler monkey
Act. IV (Cont.)

17. Flying fox

16. Dart poison frog

18. Harlequin beetle

19. Boa constrictor

20. Indris
Act. IV (Cont.)

21. Scarlet macaw
22. Spectacled owl
23. Sloth
24. Bird's nest fungus
25. Baird's tapir
26. Hercules beetle
27. Red piranha
28. Tarantula
29. Parasol fungus
30. Agoutis
31. Siamang gibbon
Act. IV (Cont.)

32. Spectacled caiman

33. Capybaras

34. African golden cat

35. Okapi
Activity V
Animal Research

Objective: The student will research animals found in different rain forests of the world.

Conceptual Framework: 1, 6, 7, 11

Materials: List of species found in world rain forests
Books of rain forest species
Wild Life Fact Files - 444 Liberty Ave.
Pittsburgh, PA 15222
Encyclopedias
Crayons, colored pencils, markers or chalk
Drawing paper (size is optional)

Subjects: Science
Geography
Language Arts
Art

Time: Week

Procedure: 1. Depending on the teacher’s individual budget, the list of rain forest species can be duplicated and given to each student, or one copy can be used by a table group.

2. Each student will select a species, either mammal, bird, insect, reptile/amphibian or fish that they have either never heard about before or simply know the name but nothing else.

* If books and other animal information is limited, this could be an outside assignment that would require the students to go to the public library to do their research.

3. After doing a sufficient amount of reading on their choice species, give the students the Example Worksheet and Blank Worksheet to fill out.
* Complete sentences are necessary and correct spelling should be expected since most of the vocabulary being used is in the book they have used.

4. The student then draws a picture of selected species in its own environment. They should pay close attention to details (color, texture, etc.) about their species. If their species lives in a tree, what kind of tree might it be?

Additional Suggestions:

1. The research can be compiled in report form including such topics as follows:
   - Geographical location
   - Food
   - Type of habitat
   - Predator/Prey
   - Physical characteristics
   - Adaptation to environment
   - Means of protection
   - Fitting into the food web
   - Present and future outlook

* If research skills have been taught then the report could also include:
   - Well-designed cover
   - Title page
   - Table of Contents
   - Outline
   - Body of report
   - Pictures
   - Bibliography

2. The student’s species could also be done in paper mache.

   (1) Roll newspapers and tie them with string, wire, or tape to form the animal.

   (2) Tear newspaper strips. Soak them in a prepared paste and apply over the animal.
(3) Additional forms are built with wadded newspaper or tissue and additional newspaper strips applied.

(4) Allow figure to dry. Paint with tempera paints. For a nice final surface the figures can be lacquered or shellacked.

3. A diorama using a shoe box could be used to create an appropriate environment. Many kinds of materials can be used. Only the student’s imagination limits the use of materials.
<table>
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<th>RAINforest</th>
<th>CENTRAL AMERICA</th>
<th>SOUTH AMERICA</th>
<th>AFRICA</th>
<th>MADAGASCAR</th>
<th>S.E. ASIA</th>
<th>INDONESIA</th>
<th>BORNEO</th>
<th>AUSTRALIA</th>
<th>NEW GUINEA</th>
<th>PHILIPPINES</th>
<th>SAW AT THE ZOO</th>
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<tbody>
<tr>
<td>Agouti</td>
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<td>Cat, African Gold</td>
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<td>Cat, Tiger</td>
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<td>Chimpanzee</td>
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<td>Chimpanzee, Pygmy</td>
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* Nancy Brinkley, 1995
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### RAINFOREST. REPTILES/AMPHIBIANS

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Act. V (Cont.)

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Example Worksheet

Rain Forest Species

Name of species: Pangolin

1. In which of the rain forests does your species live?
   The pangolin lives in the rain forests of Southeast Asia and Africa.

2. In which layer of the rain forest does your species mainly live?
   The pangolin mainly lives in the canopy and understory.

3. What kind of food does your species eat?
   The pangolin digs through ant hills for ants.

4. Does this make your species a: (Circle)
   (a) carnivore   (b) herbivore   (c) omnivore
   Explain: Pangolins are meat eaters.

5. Is your species a predator/prey or both? Explain.
   The pangolin is a predator when hunting ants. It becomes prey when it is hunted by people for its excellent meat.

6. Describe your species' physical characteristics.
   The pangolin resembles an anteater and an armadillo.
   It has a long narrow snout, long tail, and sticky rope-like tongue which it can thrust far out to catch ants. It has a protective coat formed by overlapping horny scales. Scales are various shades of brown and are made of the same material as the armadillo's. It is about three to five feet long.
7. How has your species adapted to its environment?
   The pangolin has scales for protection. Its strong claws can tear up ant nests. A rope-like tongue can thrust out to catch ants.

8. In your opinion, what is your species' main way of protection?
   The pangolin's main way of protection is the scales and sharp plates on its tail that can tear flesh severely.

9. On a separate paper draw your species as part of a food chain/web.

10. Is your species on the endangered list? yes  no
    At this time the pangolin is not on the endangered list.

11. Draw a detailed picture of your species in its own environment. Use drawing paper and make sure you pay close attention to the details of your species and its environment. If your species lives in a tree what kind of a tree is it? Make sure the drawing is colored.
Student Worksheet

Rain Forest Species

Name of species: ________________________________

1. Which of the rain forests does your species live?

2. Which layer of the rain forest does your species mainly live?

3. What kind of food does your species eat?

4. Does this make your species a: (Circle)
   a. carnivore    b. herbivore    c. omnivore
   Explain: ________________________________

5. Is your species a predator/prey or both? Explain.

6. Describe your species' physical characteristics.

   _______________________________________
   _______________________________________
   _______________________________________
   _______________________________________
   _______________________________________
7. How has your species adapted to its environment?

8. In your opinion, what is your species' main way of protection?

9. On a separate paper draw your species as part of a food chain/web.

10. Is your species on the endangered list? yes no
    If yes, what is the cause?

11. Draw a detailed picture of your species in its own environment. Use drawing paper and make sure you pay close attention to the details of your species and its environment. If your species lives in a tree what kind of a tree is it? Make sure the drawing is colored.
Rain Forest Food Chain/Web

It is not easy to spot animals in the rain forest. You most likely would hear them more often than you would see them. They are there, however . . . millions of them . . . and they are all part of the never-ending cycle of the food chain/web.

If you could remove all the leaves in the forest, we could see the animals. They would probably be gathering or eating food. Most animals spend a great deal of time looking for and consuming food, which is their source of energy.

Each type of animal prefers certain kinds of food. In most cases, each animal becomes food for other animals. These relationships can be shown in a linked diagram or written out as a "chain." Such a diagram describes a food chain. It shows how certain living things depend on one another for food energy. Each organism can be called a "link" in the chain.

```
green plants → grasshopper → frog → snake → hawk
```

The arrows used show the direction in which food energy moves.
Not all real situations in the rain forest are this simple. Frogs get energy from organisms other than just grasshoppers, and snakes eat other animals besides frogs. If all the food for every single animal in the rain forest were included, the food chain would be very complicated.

A food web would show as many food relationships as possible between living things in an area. To be complete, a food web must include all scavengers, parasites, and decomposers.
Activity VI
Food Chain/Web

Objective: The students will demonstrate a food chain/web by drawing their previously researched species as part of a food chain/web.

Conceptual Framework: 6, 9

Materials: Film on food webs
Previously researched species material
Drawing paper
Crayons/colored pencils
Overhead film

Subject: Science
Art

Time: 1 day

Procedure:
1. Prior to activity, show a film on food chains/webs (usually available in school audio/visual department)

2. Vocabulary:
   * Producer - plants in the rain forest that use the energy from the sun, chemicals from the air and soil, and water from rainfall to produce sugar.

   * Consumer - animals that directly eat the plants getting the energy they need for their living activities. These are primary consumers (primates, deer, okapi).

   Other animals, such as jaguars, snakes, spiders, and eagles, eat the primary consumers. They are called secondary consumers.

   * Decomposer - an organism such as fungus, bacteria, ants, termites or beetles that break down dead matter and return it to the soil in the form of nutrients.
**Act. VI (Cont.)**

* Food chain - shows the relationship between the producer, consumer, and decomposer. It shows how certain living things depend on one another for food energy.

* Food web - shows as many food relationships as possible between living things in a given area.

3. Using the species researched in Activity V, have each student draw a food chain for it. If the species eats more than one kind of food, then a food web can be made.

4. Make sure the students label the chain/web: producer, consumer, secondary consumer, and decomposer.

5. The teacher can collect the drawings of all or some of the food chains/webs and prepare them for the overhead.

6. As each chain/web is shown, students can comment on its correctness: Is it labeled correctly with producer, consumer and decomposer; are the arrows going in the right way.

7. As a final note, remove either a producer, primary consumer, secondary consumer, or decomposer from a sample chain/web. Ask the students what would happen to the other organisms in the chain should one die out.
Activity VII

Fictitious Species

Objective: To create a fictitious species that might be found in one of the rain forests of the world.

Conceptual Framework: 1, 6, 7

Materials: Slips of paper with species characteristics
Crayons, colored pencils, markers, or chalk
Drawing paper
Worksheet (see Activity III)

Subjects: Science
Geography
Language Arts
Art

Time: 2-3 days

Procedure: 1. Duplicate the characteristic sheet that follows. Cut into strips making sure there are three characteristics per student. Pass out one to each student.

2. Attach this slip on the bottom of the drawing paper so the teacher can see later that the three characteristics are included in the drawing.

3. The student is to utilize the three characteristics on the slip of paper to create a fictitious species that could be found in a rain forest.

4. Once the species is completed, its environment should be drawn around it. Emphasize detail of species . . . size, color, outer covering, protection . . . and the environment it would need to survive in.

5. The student can now give the species a name, perhaps combining the names of several species.
Act. VII (Cont.)

6. A worksheet (see worksheet from Act. V) can now be passed out which will provide detailed and realistic information about their species.

7. When the students are done they can take turns coming to the front of the room and holding up their unknown species. The rest of the students can guess what are the three characteristics.

Additional Suggestions:

1. The fictitious species could be created using paper mache.

2. A diorama could also be used.
Act. VII (Cont.)
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<td>2. My sharp, spiked spines help protect my soft body.</td>
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<tr>
<td>3. My large bill helps me to eat fruit.</td>
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<td>1. My long tail gives support as I move from tree to tree.</td>
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<td>2. My shape helps to camouflage me.</td>
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<td>3. I have a very wide mouth and sharp teeth.</td>
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<td>1. My body is hairy.</td>
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<td>2. My two long antennae help me to smell food.</td>
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<td>3. I have a wide tail that helps me balance while I am flying.</td>
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<td>1. I am an excellent tree climber.</td>
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<td>2. My arms are twice as long as my body.</td>
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<td>3. I build a trap to catch my food.</td>
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<tr>
<td>1. Sharp claws and long toes help me to cling to the back of trees.</td>
</tr>
<tr>
<td>2. I have six pairs of legs.</td>
</tr>
<tr>
<td>3. I am covered with hard pointed scales that protect me from predators.</td>
</tr>
<tr>
<td>1. I kill my prey by constricting.</td>
</tr>
<tr>
<td>2. I am a marsupial.</td>
</tr>
<tr>
<td>3. I carry my eggs on my back.</td>
</tr>
<tr>
<td>1. My grip is so strong that I can run upside down along branches.</td>
</tr>
<tr>
<td>2. My long proboscis sucks up liquid food.</td>
</tr>
<tr>
<td>3. There is a crown of plumage on my head.</td>
</tr>
<tr>
<td>1. My feet are webbed and I live in the water.</td>
</tr>
<tr>
<td>2. A thick shell shields me from my enemies.</td>
</tr>
<tr>
<td>3. I have huge front teeth for gnawing.</td>
</tr>
<tr>
<td>1. I have large eyes so I can see well in the dark.</td>
</tr>
<tr>
<td>2. I have two body parts.</td>
</tr>
<tr>
<td>3. My long arms help me swing through the trees.</td>
</tr>
</tbody>
</table>
Act. VII (Cont.)

1. My long hind legs help me to leap with great agility.
2. I have skin flaps that act like wings.
3. I hunt only at night.

1. I have two fangs that inject poison into my prey.
2. There are sharp spines along my legs to grip my food.
3. My long arms help me swing through the trees.

1. I live only in the tree tops.
2. I have a pear shaped body that helps me push through thick patches of forest.
3. My large ears help me to hear if any predators are near.

1. I have jointed legs.
2. I have many different colored feathers.
3. My favorite food is fish.

1. I escape my enemies by running on water.
2. I am an excellent swimmer.
3. I have large eyes so I can see in the dark.

1. I have a large wingspan.
2. My big feet help me to push soil and leaves around to make a nest.
3. I kill my prey by constricting.

1. My body is hairy.
2. I live only in the treetops.
3. My long arms help me swing through the trees.

1. Sharp claws and long toes help me to cling to the bark of trees.
2. I am a marsupial.
3. I hunt only at night.

1. My grip is so strong that I can run upside down along branches.
2. My large ears help me to hear.
3. I can walk on two legs.

1. I have two fangs that inject poison into my prey.
2. My long tail gives support as I move from tree to tree.
3. My shape helps to camouflage me.
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>I am an excellent tree climber.</td>
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<tr>
<td>2.</td>
<td>My eggs are carried on my back.</td>
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<tr>
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<td>I have six pairs of legs.</td>
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</tr>
<tr>
<td>1.</td>
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<td></td>
</tr>
<tr>
<td>2.</td>
<td>My shape helps to camouflage me.</td>
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<tr>
<td>3.</td>
<td>I build a trap to catch my food.</td>
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<tr>
<td>1.</td>
<td>I have four simple eyes.</td>
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<tr>
<td>2.</td>
<td>I am covered with hard pointed scales that protect me from predators.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>My feet are webbed and I live in the water.</td>
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</tr>
<tr>
<td>1.</td>
<td>My bright colors warn others that I am poisonous.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>My long hind legs help me to leap with great agility.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>My favorite food is fish.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>My sharp, spiked spines help protect my soft body.</td>
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</tr>
<tr>
<td>2.</td>
<td>There is a crown of plumage on my head.</td>
<td></td>
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<tr>
<td>3.</td>
<td>I have huge teeth for gnawing.</td>
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</tr>
<tr>
<td>1.</td>
<td>My two long antennae help me to smell food.</td>
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</tr>
<tr>
<td>2.</td>
<td>My arms are twice as long as my body.</td>
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<tr>
<td>3.</td>
<td>I am an excellent swimmer.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>My long proboscis sucks up liquid food.</td>
<td></td>
</tr>
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<td>3.</td>
<td>I escape my enemies by running on water.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>I have two body parts.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>A thick shell shields me from my enemies.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I have a wide tail that helps me balance while I am flying.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>I have a pear shaped body that helps me push through thick patches of forest.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>There are sharp spines along my legs to grip my food.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I have a very wide mouth and sharp teeth.</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>My big feet help me to push soil and leaves around to make a nest.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I have a large wingspan.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I have two body parts.</td>
<td></td>
</tr>
</tbody>
</table>
1. I have many different colored feathers.
2. My long arms help me swing through the trees.
3. My long tail gives support as I move from tree to tree.

1. My large ears help me to hear if any predators are near.
2. Sharp claws and long toes help me to cling to the bark of trees.
3. My large bill helps me to eat fruit.

1. I have jointed legs.
2. I am an herbivore.
3. My bright colors warn others that I am poisonous.

1. My body is hairy.
2. I have wide tail that helps me balance while I am flying.
3. I hunt only at night.

1. I escape my enemies by running on water.
2. I kill my enemies by constricting.
3. There is a crown of plumage on my head.

1. My eggs are carried on my back.
2. I have two fangs that inject poison into my prey.
3. My two long antennae help me to smell food.

1. My body is hairy.
2. There are sharp spines along my legs to grip my food.
3. My proboscis sucks up liquid food.

1. I have skin flaps that act like wings.
2. A thick shell shields me from my enemies.
3. I have huge front teeth for gnawing.

1. I have large eyes so I can see well in the dark.
2. I am covered with hard pointed scales that protect me from predators.
3. My grip is so strong that I can run upside down along branches.

1. I have many different colored feathers.
2. I have a very wide mouth and sharp teeth.
3. My long hind legs help me to leap with great agility.
Activity VIII

Scientific Adventure Story

Objective: To write a scientific adventure story using the species researched in Activity V.

Conceptual Framework: 7

Materials: Copy of excerpt from Congo
"What Did I Read" worksheet
Assessment for story

Subjects: Language Arts
Science

Time: 4-5 days

Procedure: This activity was created from Michael Crichton’s book Congo. It is not a long book so it is recommended that the teacher read it prior to doing this activity.

1. If the teacher chooses not to have the whole class read the book, then he/she can introduce the book and author, and briefly give a summary of the characters and story and how they happened to be on the Ragora River. Many students may have already seen the movie Congo. The river scene in the movie, however, does not display as many details as the book.

The sheet labelled Ragora Hippopotamus can be read to the class by the teacher. Then the excerpt can be passed out to the students.

2. The teacher reads the excerpt allowing the students to enjoy the excitement of the adventure.

3. The students are asked to recall scientific characteristics mentioned about hippos in the excerpt.

These characteristics are written down on the board first by the teacher, and then on the upper half of the worksheet "What Did I Read?" by the students.
Act. VIII (Cont.)

(1) During the day the hippos were found in pools beside the riverbanks.
(2) Bulls will attack.
(3) At night hippos go ashore to forage.
(4) Hippos inhabit quiet water.
(5) Hippos eat grass.
(6) Hippos make low grunting sounds.
(7) Hippos have four stubby legs.
(8) Hippos have a gigantic mouth with four huge blunted teeth.
(9) The hippo is an enormous creature.

4. Using the "Great African Hippo" sheet, the teacher can further display on an overhead other scientific characteristics about the hippo.

5. The teacher can now read the excerpt once again, emphasizing those phrases that reflect scientific characteristics of the Ragora Hippo.

6. Using the scientific information of the animals researched in Activity V, the students can now begin to create their own adventure story. They can begin with a word web that suggests various topics surrounding their animal species.

7. A rough draft of their adventure story can now be written. Make sure to emphasize that there must be a beginning (setting the stage/scene), a middle (where the action takes place), and a conclusion (bring the story to a good ending).
Act. VIII (Cont.)

8. To further enhance these adventure stories the teacher reads the excerpt again, this time instructing students to listen for the author's use of colorful descriptions, a way of describing characters and events in an interesting way.

9. After the reading the students can independently, with a partner, a table group, or together as a class, find the descriptive phrases and underline them. Their ten favorite phrases can then be written down on the bottom half of the "What Did I Read?" worksheet.

* Flimsy rubber boats
* Clever plan
* Unexpected reason
* River twisted and turned
* Still pool
* Quiet waters
* Cut short as if the banks had been mowed (simile)
* Sounded like an old man trying to clear his throat of phlegm (simile)
* Plunged his paddle
* Partially submerged black rocks
* Gleaming in the moonlight
* Enormous creature
* Shallow water
* Four stubby legs
* Low magnesium flare
* Harsh white light
* Gigantic mouth
* Four huge glistening teeth
* Engulfed in a cloud of pale yellow gas
* Sizzled and descended
* Lengthening sharp shadows
* Wrenching crash
* Huge pink cavernous mouth
* Lateral slash
* Collapsing swiftly
* Huge cuts
* Racing down the shallow river like a powerboat (simile)
* Churning water
* Bellowing in anger
Some of this vocabulary will be new for students, so a discussion will be needed here as to what certain words mean and why the author chose to use them.

10. Students then go through their rough draft adding colorful language where it is appropriate. A student's Thesaurus should be available.

11. Further editing then follows. The student checks for complete sentences, sentences that run on for many lines, spelling (a dictionary is a must), paragraphing (a minimum of three paragraphs), capital letters for names of characters and places and the beginning of sentences, and periods.

12. Make a final copy using correct and careful handwriting.

13. Each student receives an assessment sheet for his or her story. The students carefully reads their story again, this time filling in the assessment sheet.

14. The assessment sheet is then passed to another student who reads it carefully. Once again, the assessment sheet is filled out.

15. Finally the teacher reads the story and fills out the assessment sheet.

16. Volunteers can read their stories to the class.
The twentieth century has been a period of intensive wildlife study, which overturned many long-standing conceptions about animals. It is now recognized that the gentle, soft-eyed deer actually lived in a ruthless, nasty society, while the supposedly vicious wolf was devoted to family and offspring in exemplary fashion. The African lion, the proud king of beasts, was relegated to the status of slinking scavenger, while the loathed hyena assumed new dignity. (For decades, observers had come upon a dawn kill to find lions feeding on the carcass, while the scavenging hyenas circled at the periphery, awaiting their chance. Only after scientists began night tracking the animals did a new interpretation emerge: hyenas actually made the kill, only to be driven off by opportunistic and lazy lions; hence the traditional dawn scene. This coincided with the discovery that lions were in many ways erratic and mean, while the hyena had a finely developed social structure—yet another instance of long-standing human prejudice toward the natural world of animals.)

The hippopotamus remained a poorly understood animal. Herodotus' "river horse" was the largest African mammal after the elephant, but its habit of lying in the water with just eyes and nostrils protruding made it difficult to study. Hippos are organized around a male. A mature male has a harem of several females and their offspring, a group of eight to fourteen animals together.

Despite their obese, rather humorous appearance, hippos are capable of unusual violence. The bull hippopotamus is a formidable creature, 14 feet long and weighing nearly 10,000 pounds (5 tons). Charging, he moves with extraordinary speed for such a large animal, and his four stubby blunted tusks are actually razor sharp on the sides. A hippo attacks by slashing, moving his cavernous mouth from side to side, rather than biting. Unlike most animals, a fight between bulls often results in the death of one animal from deep slashing wounds. There is nothing symbolic about a hippopotamus fight.

The animal is dangerous to man, as well. In river areas where herds are found, half of the native deaths are attributed to hippos; elephants and predatory cats account for the remainder. The hippo is a vegetarian, and at night the animals come onto the land, where they eat enormous quantities of grass to sustain their great bulk. A hippo separated from the water is especially dangerous; anyone
Act. VIII (Cont.)

finding himself between a landed hippo and the river he is rushing to return to does not generally survive the experience.

The hippo is essential to Africa's river ecology. His fecal matter, produced in huge quantities, fertilizes the river grasses, which in turn allows river fish and other creatures to live. Without the hippopotamus, African rivers would be sterile, and where they have been driven away, the rivers have died.

The hippo is fiercely territorial. Without exception, the male defends his river against any intruder. Intruders have included other hippos, crocodiles, and passing boats...and the people in them.
Act. VIII (Cont.)

Excerpt from the Book Congo

by MICHAEL CRICHTON

... But it took no effort to ride the river in the moonlight; most of the party could sleep, and they would advance themselves another fifty or sixty miles by dawn.

But more important, he hoped to avoid the Ragora hippos which could easily destroy their flimsy rubber boats. During the day, the hippos were found in pools beside the riverbanks, and the bulls would certainly attack any passing boat. At night, when the animals went ashore to forage, the expedition could slip down the river and avoid a confrontation entirely.

It was a clever plan, but it ran into trouble for an unexpected reason ... their progress on the Ragora was too rapid. It was only nine o'clock at night when they reached the first hippo areas, too early for the animals to be eating. The hippos would attack the boats ... but they would attack in the dark.

The river twisted and turned in a series of curves. At each curve there was a still pool, which Kahega pointed out as the kind of quiet water that hippos liked to inhabit. And he pointed to the grass on the banks, cut short as if the banks had been mown.

"Soon now," Kahega said.

They heard a low grunting, "haw-huh-huh-huh." It sounded like an old man trying to clear his throat of phlegm. Munro tensed in the lead boat. They drifted around another curve, carried smoothly in the flow of current. The two boats were now about ten yards apart. Munro held his loaded shotgun ready.

The sound came again, this time in a chorus: "Haw-huh-huh-huh."

Kahega plunged his paddle into the water. It struck bottom quickly. He pulled it out; only three feet of it was wet. "Not deep," he said, shaking his head.

"Is that bad?" Ross said.

"Yes, I think it is bad."
They came around the next bend, and Elliot saw a half dozen partially submerged black rocks near the shore, gleaming in the moonlight. Then one of the "rocks" crashed upward and he saw an enormous creature lift entirely out of the shallow water so that he could see the four stubby legs, and the hippo churned forward toward Munro's boat.

Munro fired a low magnesium flare as the animal charged; in the harsh white light Elliot saw a gigantic mouth, four huge listening blunted teeth, the head lifted upward as the animal roared. And then the hippo was engulfed in a cloud of pale yellow gas. The gas drifted back, and stung their eyes.

"He's using tear gas," Ross said.

Munro's boat had already moved on. With a roar of pain the male hippo had plunged down into the water and disappeared from sight. In the second boat, they blinked back tears and watched for him as they approached the pool. Overhead, the magnesium flare sizzled and descended, lengthening sharp shadows, glaring off the water.

"Perhaps he's given up," Elliot said. They could not see the hippo anywhere. They drifted in silence.

And suddenly the front of the boat bucked up, and the hippo roared and Ross screamed. Kahega toppled backward, discharging his gun into the air. The boat slapped down with a wrenching crash and a spray of water over the sides, and Elliot scrambled to his feet to check Amy and found himself staring into a huge pink cavernous mouth and hot breath. The mouth came down with a lateral slash on the side of the rubber boat, and the air began to hiss and sizzle in the water.

The mouth opened again, and the hippo grunted, but by then Kahega had got to his feet and fired a stinging cloud of gas. The hippo backed off and splashed down, ricking the boat and propelling them onward, down the river. The whole right side of the boat was collapsing swiftly as the air leaked out of the huge cuts in the rubber. Elliot tried to pull them shut with his hands; the hissing continued unabated. They would sink within a minute.

Behind them, the bull hippo charged, racing down the shallow river like a powerboat, churning water in a wake from both sides of his body, bellowing in anger.
"Hold on, hold on!" Kahega shouted, and fired again. The hippo disappeared behind a cloud of gas, and the boat drifted around another curve. When the gas cleared the animal was gone. The magnesium flare sputtered into the water and they were plunged into darkness again. Elliot grabbed Amy as the boat sank, and they found themselves standing knee-deep in the muddy water.

They managed to beach the Zodiac on the dark riverbank. In the lead boat, Munro paddled over, surveyed the damage, and announced that they would inflate another boat and go on. He called for a rest, and they all lay in the moonlight on the river's edge swatting mosquitoes away.
Great African Hippopotamus

1. The great African hippo is second in weight only to the elephant.

2. The hippo spends up to 18 hours a day in water to keep cool and minimize heat loss, and to support its huge body.

3. The hippo usually lives in groups of 8-14 animals.

4. The group of hippos live on territory guarded by a dominant, lone male who is at least 20 years old.

5. It takes about 34 weeks for the female hippo to give birth.

6. The hippo's skin secretes a sticky pink mucus, that protects the animal and helps it to retain water on land.

7. The hippo eats about 90 pounds of food a night.

8. Male hippos weigh anywhere from 3,000 to 10,000 pounds; and the females up to 3,300 pounds.

9. Hippos mainly eat grasses.

10. A hippo's life span is about 45-50 years.

11. A hippo has an extremely huge mouth.

12. Hippos are considered very dangerous.

13. Their four stubby stunted tusks are razor sharp.
What Did We Read?

There were nine characteristics (facts) mentioned in the excerpt from CONGO about hippopotamuses. Find them and write them down. Please use neat handwriting.

1. 
2. 
3. 
4. 
5. 
6. 
7. 
8. 
9. 

List ten descriptive phrases used in the excerpt we just read. The first one has been done for you. Remember! Neat handwriting.

1. Flimsy rubber boats
2. 
3. 
4. 
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8. 
9. 
10. 
## Rain Forest Adventure Story Assessment

<table>
<thead>
<tr>
<th></th>
<th>Student</th>
<th>Peer</th>
<th>Teacher</th>
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<tbody>
<tr>
<td>1.</td>
<td>There is scientific fact in the story.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>2.</td>
<td>Setting: Tells where story takes place. Paints a clear mental picture ... may include such things as the characters, sounds, time, transportation and so on.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>3.</td>
<td>Main part of story: This is where the action takes place. Is there action?</td>
<td>□</td>
<td>□</td>
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<tr>
<td>4.</td>
<td>Conclusion: Does the story come to a good ending? Possible endings ... calm, happy, surprise, shocking, scary ... Circle one of the above.</td>
<td>□</td>
<td>□</td>
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<td>5.</td>
<td>There are at least (minimum) of 4 paragraphs in the story.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>6.</td>
<td>Complete sentences were used.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>7.</td>
<td>Sentences begin with a capital letter.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>8.</td>
<td>Sentences end with a period.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>9.</td>
<td>Neat and correct handwriting was used.</td>
<td>□</td>
<td>□</td>
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<tr>
<td>10.</td>
<td>What grade would you give this story?</td>
<td>□</td>
<td>□</td>
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**Student Author**

**Peer Editor**
Background for Teachers -
Photosynthesis

The process of photosynthesis is a complex one. It is the bright light of the tropical sun that powers the rain forest. The plants use the solar energy to manufacture simple sugars from carbon dioxide in the atmosphere and from water, by the chemical process of photosynthesis. The sugars produced are the building blocks of molecules which make up the cell walls of plants. They are used first by the plant that manufactured them and, finally, by organisms that eat them (Silcock 1990).

The forest’s canopy is the first to capture the light, leaving the interior of the forest in a deep shade. If a plant in the rain forest is going to support itself by photosynthesis, it must either be able to live in semidarkness or be able to get its leaves into the canopy.

Some leaves have special motor cells at their base which allow them to begin life as part of the photosynthesis process. These motor cells allow the leaves to turn, orientating themselves to the direction and intensity of the sun. This remarkable adaptation shows how the leaves are geared toward seizing every chance to receive light (Silcock 1990).
Activity IX
Photosynthesis

Objective: Through three different activities, students will understand the concept of photosynthesis.

Conceptual Framework: 6, 9

Materials: Activity A: classroom plant
black construction paper
tape

Activity B: board or heavy cardboard

Activity C: two small plants per table group
small jars of petroleum jelly
data sheet (one per student)

Subject: Science

Time: 3-5 days

Procedure: Activity A:

1. New vocabulary should be introduced:
   *Photosynthesis - process by which a plant uses light to make its own food.
   *Chloroplasts - specialized structures in a plant cell containing chlorophyll.
   *Chlorophyll - green coloring matter of plants.
   *Carbon dioxide - gas taken in by plants to be used in photosynthesis
   *Glucose - sugar
   *Stomata - openings where carbon dioxide enters and oxygen is given out.

2. Put a drawing on the board how the process of photosynthesis works.

3. Question: What is absolutely necessary for the process of photosynthesis? (light)
Act. IX (Cont.)

sun's energy

carbon dioxide gas enters through stomata

oxygen being given off

water enters through roots
water + carbon dioxide $\xrightarrow{\text{light, energy}}$ glucose (sugar) + oxygen

4. Using a classroom plant, completely cover (top and bottom) several leaves with black construction paper.

5. Place the plant in a sunny location of the classroom or outside in a sunny spot.
6. After a few days remove the black construction paper. Notice any change.

7. Cover the leaves again, this time leaving them covered for a week. (leaf is light due to lack of photosynthesis)

8. Finally, remove the black paper and have students describe the leaf.

*Can they explain what happened?

**Activity B**
1. Review steps 1 and 2 in Activity A

2. Take the class outside and find a grassy spot in a sunny location that is not too many people travel.

3. Place a board or piece of heavy cardboard on top of the grass and leave it there for several days.

4. Question: What do they predict will happen to the grass under the board?

5. In a few days remove the board and see if their prediction was right.

6. Place the board back on the grass and this time wait a week.

7. Finally remove the board and have students describe the grass.

*Can they explain what happened?

**Activity C**
1. Review steps 1 and 2 in Activity A.

2. Pass out 2 identical plants to each table group.

3. Carefully rub petroleum jelly on all the leaves of one of the green plants. Coat both the top and bottom of the leaves.
4. Place the plants in a sunny location.

5. The groups should observe the plants every other day for two weeks.

6. The results are then recorded on their data sheets.

Additional Suggestions:

1. Repeat the above, only this time place one of the plants in a dark closet.

2. The student could also use plants that are not green and record the results.
(Worksheet) Photosynthesis Activity

Draw a picture every other day of your plants and comment about what happened to your plants at the end of your experience.

<table>
<thead>
<tr>
<th>DAY 1</th>
<th>DAY 3</th>
<th>DAY 5</th>
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<th>DAY 8</th>
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What happened?

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100
Background for Teachers -
Bromeliads, Passion Flower, and the Rafflesia

One cannot walk through any tropical forest without meeting up with epiphytes. They grow everywhere... on tree trunks, branches, even leaves. They are air plants, which means they receive all of their nutrients above the ground. They begin their life high up in the canopy with their aerial roots dangling over branches and absorbing moisture directly from the humid forest air. They have no stalk of their own but attach themselves onto a branch. As wind in the canopy deposits dead leaves and other debris, a small amount of soil is formed. From this source the epiphyte is able to take its nourishment (Nichols 1990).

The canopy is a dry place in the tropical forest and so the epiphytes high up are forced into perils of starvation and dehydration. They, like desert plants, have adapted into water tanks. One kind of epiphyte that has adapted very well is the bromeliad. Its spiky leaves channel water into the center of the plant. Some of these bromeliads have been found to hold as much as 18 pints of water. Dead leaves fall into the water of the bromeliad, rot and provide nutrients which it cannot get from the soil.

What a wonderful, necessary plant for the forest. It provides drinking water for passing monkeys and lizards, a place to lay eggs for giant damselflies and mosquitoes, and a pond for developing tadpoles. One scientist, while
studying these wondrous plants, found the following in one bromeliad: 4 harvestmen insects, a tiny spider guarding some eggs, 3 different kinds of woodlice, a centipede, a jumping millipede, a pseudo-scorpion, various metallic beetles, earwigs, a tree seedling in an advance stage of germination, fly larvae, a nest of ants, an earthworm, mites galore, and a small frog (Collins 1990).

Many plants in the rain forest develop defense mechanisms to protect themselves from preying insects. The passion flower has evolved extraordinary defenses. Some of the species lure ants by producing an abundant nector for them. In return, the ants act as a stinging guardian against predators (Collins 1990).

Imagine coming across a flower three feet in diameter. You could very well see one if you were in the tropical forest of Malaysia. The rafflesia, a plant with the largest flower known in the world, grows inside the stem of a liana. For the first six months the rafflesia seed sends out thin threads inside the liana to absorb moisture and nutrients. Next a bud develops and breaks through the bark of the vine. The bud resembles the head of a cabbage. As the bud continues to enlarge it begins to resemble a rose bud. It continues to grow for about 9 months, never opening. Finally, the bud spreads out its leathery, orange and brown
petals. After taking almost two years to bloom, the flower's life ends in less than a week.

To ensure its continuous existence, the rafflesia needs thousands of flies. They are beckoned to by the rotten meat smell emitted. They gather and crawl around picking up pollen which they deposit on other blooming rafflesias (Silcock 1990).
Activity Xa

Bromeliad (Guzmania)

Objective: To artistically construct one of the rain forest's most well-known and diverse plants.

Conceptual Framework: 1, 7

Materials: Patterns to make bromeliad
Toilet tissue holders (1 per student)
Yellow construction paper
Green construction paper
Orange construction paper
Crayons, colored pencils or chalk
Scissors
Glue
Tooth picks

Subjects: Science
Art

Time: 1-2 days

Procedure: 1. Using yellow paper, cut out 1 of #1 pattern (inner leaves).

2. Using a red-orange crayon or colored pencil or chalk, color only the very tips of the leaves. (See picture)

3. Glue this piece onto the tissue holder making sure the top edge is even with the holder's edge.

4. Using yellow paper again, cut out two leaves using the #2 pattern.

5. Using the red-orange crayon or colored pencil or chalk, color a little more of the tip . . . also putting on a few streaks of orange.
6. Glue this piece onto the holder having the top edge about \( \frac{1}{4} \) inch below the first piece's top edge.

7. Using orange paper cut out 2 of #3 pattern.

8. Using the same red-orange colored pencil or crayon or chalk, color in about \( \frac{1}{4} \) of the leaf with streaks added below that area.

9. Glue this piece a \( \frac{1}{2} \) inch below the top edge of the #2 pattern.

10. Glue the second orange leaves in the same way.

11. Using green paper, cut out 3 of #4 pattern (leaves).

12. Using crayon or colored pencil or chalk, stripe the leaves with yellow and a darker green.

13. Glue these next 3 pieces onto the holder, spacing them so the bottom edge of the third piece is even with the bottom edge of the holder.

14. Gently pull down the green leaves and the orange leaves.
15. Gently pull down the two yellow leaves, but also take a pencil and curl the tips under.

16. Cut out 1 black circle from #5 pattern.

17. Color the dots yellow, making the dot bigger.

18. Poke a small hole where the dots are located.

19. Cut out 5 yellow squares from the #6 pattern.

20. Starting at a corner, roll the paper around the toothpick.

21. Remove the toothpick and insert one end of the small rolled paper into one of the holes on the black circle.

22. Put a thin line of glue around the underside of the black circle and place on the round opening on top of the holder.
Bromeliad (Guzmania)
Act. Xa (Cont.)

BROMELIAD (GUZMANIA)

Cut 1
1st Leaves

#1

Cut 2

Cut 3
Leaves

#4

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BECHELIAD (GUZMANIA)
Activity Xb

Bromeliad (Vriesa Spendens) b

Objective: To artistically construct one of the rain forest's most unique and diverse plants.

Conceptual Framework: 1, 7

Materials:
- Bromeliad pattern
- Toilet tissue holder
- Green construction paper
- Orange or red construction paper
- Scissors
- Small piece of light weight cardboard (a 3 X 5 card can be used)
- Glue
- Toothpicks
- Crayons, colored pencils, or chalk

Subjects:
- Science
- Art

Time: 1-2 days

Procedure:
1. Cut 1½ inches off a tissue holder.

2. Cut out each pattern piece and set aside.

3. Using green paper, cut 10 leaves from the #2 pattern.

4. Using a white crayon, colored pencil or chalk, color in the white on the leaves.

5. Glue each leaf, colored side toward the center, around the inside of the holder.

6. Use a pencil to gently curl leaves under.

7. Using red or orange paper cut out 8 leaf sections from the #1 pattern.
8. Fold each leaf section in half.

9. Place one section on the side of the other, adding a small dot of glue to hold them together, until all eight have been used.

10. Before the glue dries, place the toothpick inside the last leaf section to give the leaf strength.

11. Cut 2 circles from the #3 pattern . . . one from green paper and one from lightweight cardboard.

12. Glue together and let dry.

13. Carefully cut a slit in the circle about 3/4 inch.

14. Insert the leaf stalk bottom, with the toothpick, into the slit.
Bromeliad (Vriesa Spendens)
BROMELIAD (TRIBEA SPENDENS) (3)

Leaf
Cut 8
Fold on dash line

Leaf
Cut 10

Cut 1 from 4x6 card
Cut 1 from green paper

Base

Flower holder
Cut 1 from a 4x6 card
Cut 1 from green paper

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Activity Xc

Passion Flower (Passiflora)

Objective: To artistically construct one of the rain forest's most unique flowers.

Conceptual Framework: 1, 7

Materials: Passion flower pattern
Toilet tissue holder
Black construction paper 2 1/4 X 5 1/4
White construction paper 6 1/4 X 3
Red or pink or orange construction paper 4 1/2 X 6 1/2
Green construction paper
Scissors
Glue
Crayon, colored pencils, or chalk

Subjects: Science
Art

Time: 1-2 days

Procedure:
1. Cut out of black construction paper 1 #1 fringe pattern.
2. Cut fringe to 1/4 inch of the base.
3. Fold fringe gently inward so tips meet.
4. Bring base ends together and secure with a dot of glue or tape.
5. Cut out of lime green paper a pistil using the #2 pattern.
6. Glue the lower part of the pistil to the designated part of the black fringe (see fringe pattern).
7. Press pistil inward so it will come up through the fringe.

8. Run a thin line of glue all the way along the inside of the tube.

9. Place the black fringe inside the tube so the base of the fringe is even with the upper tube edge.

10. Cut out 1 white fringe of pattern #3.

11. Cut fringe carefully to base line.

12. Using a magenta or purple crayon, colored pencil, or chalk, color in a half inch of the fringe starting from the base.

13. Fold fringe outward along base line (colored part up).

14. Using glue (or tape) wrap the fringe around the tube making the line where the fringe is folded back, even with the tube.

15. Cut out 2 red, pink or orange leaves of the #4 pattern.
16. Gently crease each leaf so that the edges are up.

17. Crease leaves outward from the base.

18. Using glue (or tape) wrap one leaf pattern around tube under fringe. Place pattern on top of fringe pattern so tube does not show.

19. Do the same with second leaf pattern making sure to alternate leaves.

20. Cut out 2 or 3 medium green leaves of #5 pattern.

21. Crease leaves as you did before.

22. Crease leaves outward as you did before.

23. Attach leaves in the same way as before, alternating them.
Passion Flower (Passiflora)
Act. Xc (Cont.)

PASSION FLOWER -

(4)

#3

Pistil
Cut 1

Stamen

< Baseline - Cut fringe to this line
Cut 1

< Baseline - Cut fringe to this line
Cut 1

#1

# 3

# Nancy Brinkley, 1995
PASSION FLOWER
(5)

Leaves

Baseline
Cut 2

Baseline
Cut 2/3

#4

#5

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Activity Xd

Rafflesia

Objective: To artistically construct the world's largest flower.

Conceptual Framework: 1, 7

Materials:
- Rafflesia pattern
- Brown construction paper
- Crayons, colored pencils, or chalk yellow
- Cotton ball (one per student)
- 2-3 round toothpicks
- Scissors
- Glue

Subjects: Science, Art

Time: 3 days

Procedure: Because of the coloring involved in making this flower, you may want to take several days to make this flower.

Also, this is a more difficult flower to make. This is an excellent project for the student who needs a challenge or who is very adept with his/her hands.

1. Using brown paper cut out 5 sepals from the #1 pattern.

2. Either trace or draw freehand the sample shapes onto the sepals using a white crayon, colored pencil, or chalk.

3. Bring the two straight edges together, gluing to the dash line. Set aside to dry. Repeat to all sepals.
4. Glue the eight sepals together at each corner forming a five-sided shape.

5. Using brown paper, cut 1 center bottom from the #2 pattern. The lines of the pattern will have to be extended on the actual drawing paper.

6. Fold the 5 sections inward on base line.

7. Fold the 5 sections inward again on the dash line.

8. Run glue near the edge of the bottom, and glue onto the sepal bases.

9. Take a cotton ball and spread it out.


11. Poke them through the cotton and twist.

12. Color the tips red.

13. Using brown paper, cut out 1 center top from the #3 pattern.

14. Draw and color the same pattern on this section (not the flaps).

15. Cut out the center section.
16. Small vertical cuts should be made to the solid line.

17. Gently fold down.

18. Fold 5 flaps down.

19. Fit this top piece on top of the bottom section.

20. A line of glue will be needed at the point where the top meets the sepals. Set aside to dry.
Act. Xd (Cont.)
Rafflesia

Cut 5 sepals

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Act. Xd (Cont.)

Rafflesia

Cut 1
Center bottom

baselines
Act. Xd (Cont.)

RAFFLESIA

(6)

#3

base line

Cut out

Cut 1

Center Top

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Background for Teachers -

Decomposition in the Rain Forest

If you could walk through a rain forest, you would notice that the floor of the forest is quite clean. You would not see piles of dead leaves, branches, or dead animal bodies about. At first it would seem strange that a place that is always moist does not smell dank and rotten. This is because there is a very fast rate of decomposition or a breaking down of dead matter.

On top of the thin layer of soil is a layer of humus, or compost, manufactured from the dead bodies of millions of trees and other plants, and animals. Leaves fall to the ground, trees topple, and animals die. Very quickly fungi and bacteria begin the process of breaking down the dead matter. Animals of all sorts start to eat any such food that comes their way. Beetles, ants, termites, and other insects munch their way through anything that might remain (Nichols 1990). Almost 70 percent of the animals that exist in a rain forest are the above-mentioned decomposers (Collins 1990).

All living plants and animals require three things to survive . . . food, moisture, and warmth. All these are supplied in abundance in a rain forest. Within an hour of anything dying they are well on their way to being broken
down. A week later there is usually nothing to see of it,
unless it is a large tree (Collins 1990).
Objective: The student will observe decomposers and identify the important role they play in the rain forest. They will categorize organisms found in the decaying matter.

Conceptual Framework: 5, 6, 9

Materials: Decomposing logs (enough for each table group) or Household plants that have died or dead plants from nurseries (frequently if told what you are using the dead plants for they will save them) Microscopes Hand lenses/magnifying glasses Drawing paper Chart paper

Subject: Science

Time: 1-2 days

Procedure: 1. Have students bring in decaying pieces of wood or plants from around their house. Teachers should have a supply on hand.

* Keeping these items either in a covered aquarium or plastic bag is a good idea so none of the creatures living in or around the decaying sample will get out into the classroom.

2. Review vocabulary:

*Decomposition - a process by which millions of organisms break down dead matter such as plants and animals into smaller parts and return those parts in the form of nutrients back to the soil to be used again by plants.
Act. VI (Cont.)

*Decomposer - an organism such as fungus, bacteria, ants, termites or beetles that break down dead matter and return it to the soil in the form of nutrients.

*Compost - a pile of dead matter being broken down by fungi and bacteria.

3. Examine decaying material with microscopes that are set up in stations around the room. Decaying material would be displayed on slides. Some students can be using the microscopes while the rest of the class can use hand lenses or magnifying glasses.

4. Draw what is observed.

5. Either with a partner or with a table group, categorize what was found, either by size, shape, or color, placing findings on a large chart that can be seen by the whole class.

6. Conclude by having a discussion on what the groups observed, and do they show understanding of the decomposer's role and importance in the rain forest.

What are some of the organisms you observed on the dead matter?

Were there many organisms or just a few? Describe.

Besides this dead log, what other kinds of dead matter could you find in a rain forest? (plants, animals)

What happens when a leaf falls to the ground or a tree topples over or an animal dies in the rain forest? (Decomposition begins almost immediately.)
Act. VI (Cont.)

What do you think would happen if there were no fungus or bacteria or animal decomposers in the rain forest (or anywhere)?
(Dead leaves, trees and animals would pile up/nutrients would not be put back into the soil.)

Why does the soil in the rain forest depend on decomposition?
(The soil is poor and needs the nutrients from decomposition for growth.)
Background for Teachers -
Greenhouse Effect/Global Warming

Scientists speculate that the earth's climate may be changing because of something called the "greenhouse effect." The "greenhouses" that most of us are familiar with are buildings made especially for plants. Flowers and vegetables can grow when the temperature outside is below freezing.

The walls of a greenhouse are made of glass or clear plastic. The sun's rays warm the air, the soil, and everything else inside the greenhouse. The heat inside is then trapped and creates an ideal environment for growing plants.

Our planet earth is very much like a greenhouse. The layers circling the planet allow the sun's rays to pass through them (like the glass) and then trap the heat.

Closest to the earth is the troposphere layer which extends out about 7 miles. This layer contains the air we breathe and in which clouds form and thunderstorms and other types of climate occurs. The second layer, the stratosphere, extends about 30 miles above the earth's surface and is much less dense than the troposphere. It is best known to contain the (good) ozone layer. This good layer can be poisonous to humans and other animals if near the earth's surface; but in the stratosphere forms a
protective layer that protects all living things on earth. The mesosphere is the third layer of the earth's atmosphere and extends about 50 miles above the earth. The final layer is the thermosphere and its outer edges are about 600 miles above the surface (Johnson 1990).

The earth's greenhouse is made of gases which are clear and invisible. Rays of sunlight are changed to heat when they strike the earth's surface. Extra heat passes out into space unless it is blocked by gases in the atmosphere (Stille 1990).

The earth's natural greenhouse gases include noticeable quantities of water vapor, carbon dioxide, methane, nitrogen, oxygen, hydrogen, helium, xenon, and neon (Johnson 1990). Other gases are present but in much smaller amounts.

Carbon dioxide is the earth's main greenhouse gas. It is taken out of the air by green plants and is returned to the air when the plants die or are eaten. This right balance that is formed provides a good support climate for all living things. Too little carbon dioxide would make our earth too cold for living things, while too much carbon dioxide would make it too hot.

For many years now, human activities have been adding more gases into the atmosphere unnaturally. Cars, coal-burning factories, electric power plants and agriculture have sent up large amounts of carbon dioxide. Manufactured
gases called CFC (chlorofluorocarbons) come from air conditioners, refrigerators, plastic foam containers and spray cans.

The destruction of tropical rain forests is also adding to the greenhouse effect (Stille 1990). Millions of acres of trees that take in natural carbon dioxide are being burned, and then releasing that same carbon dioxide into the atmosphere in great quantities.

Many scientists believe that if we keep sending greenhouse gases into the atmosphere global warming will occur. Summers would be hotter, ice caps would melt . . . raising the ocean level . . . thus, causing coastline flooding, farming would be affected and patterns of rainfall would change (Stille 1990).

We must find and use forms of energy that do not give off carbon dioxide. Some of these energy forms include safer atomic energy and the use of solar energy, antipollution devices and high efficiency car engines, recycling, and fast food restaurants using containers that are not plastic foam boxes.

Stopping the destruction of tropical rain forests would also slow the greenhouse effect.
Activity XII

Greenhouse Effect

Objective: The students will understand the concept of the greenhouse effect; and relate this to the excessive burning of trees in the rain forest and the release of carbon dioxide.

Conceptual Framework: 12

Materials: Teacher-made posters
Candle
Match
Small plate
Aquarium (6 small ones)
Plastic covering (large enough to cover top of aquarium)
Tape
Thermometer
Picture of Venus and Mars
Picture/drawing of a greenhouse

Subject: Science

Time: 1-2 days

Procedure:

1. Begin by introducing necessary vocabulary (See sheet at end of activity):
   * global warming
   * greenhouse effect
   * (good) ozone layer
   * ultraviolet light
   * pollution
   * greenhouse gases
   * CFC (chlorofluorocarbons)
   * carbon dioxide
   * fossil fuels
   * stratosphere

2. Show a picture of Venus and its dense atmosphere that traps the sun's heat. The surface of Venus has a temperature of 850 degrees Fahrenheit.

   Show a second picture, of Mars, and its thin atmosphere. The surface here is cooler because heat escapes at night. In fact, its temperatures can be as low as -191 degrees Fahrenheit.
3. Present Poster 1 that shows our Earth's atmosphere. Emphasize the stratosphere layer because that is where the good ozone layer is contained.

POSTER 1

LAYERS OF ATMOSPHERE ABOVE THE EARTH

(For more information, see Background for teachers.)
4. Present Poster 2 that shows the many different gases in the atmosphere. Some of the names may be familiar to the students (neon, krypton, helium). Emphasize that these greenhouse gases in the lower atmosphere are good. Also emphasize that we cannot live without the combination of oxygen and carbon dioxide.

This layer of protective ozone shields the earth from the ultraviolet rays of the sun.
5. Present Poster 3 that shows how the sun's rays coming through the atmosphere reflect off the earth's surface and clouds, and then return to outer space.
6. Poster 4 shows many things on earth that give off carbon dioxide and other pollutants that are trapped in our atmosphere.

- Burning fossil fuels (cars, trucks, airplanes)
- Factories
- Electrical plants
- Barbecues
- Forest fires
- Volcanos
- Refrigerators
- Air conditioners
7. If possible pass out 1 small aquarium to each table group, along with a piece of plastic, tape and a thermometer. The aquarium represents the earth.

* Place the thermometer inside the aquarium. Read and record the temperature.

* Cover the aquarium with the plastic (acts as the layer of gases) and tape around the edges to seal. Poke a few holes in the plastic. (The holes let some of the heat escape.)

* Place the aquariums in the sum.

* Record the temperature every 15 minutes during class. At the end of class compare the temperature readings.

8. Now place a new piece of plastic, with no holes in it, over the tank. This is like having a large quantity of greenhouse gases in the atmosphere.

* What effect does this have on the temperature of the aquarium?
9. Poster 5 shows the consequences of global warming when and if it occurs.

How does the burning of trees in the rain forest affect global warming?
Greenhouse Effect Vocabulary

Greenhouse effect. The process by which gases in the earth's atmosphere absorb heat energy radiating from the surface and then reradiate some of that heat back toward earth. As a result, a certain amount of heat energy is prevented from escaping immediately into space. This "trapped" heat keeps the planet's surface comfortably warm, but as the concentrations of greenhouse gases in the atmosphere increase, the greenhouse effect is strengthened and the average global temperature rises.

Global warming. An increase in the average temperature near the earth's surface caused by the strengthening of the greenhouse effect.

(Good) Ozone Layer. A layer of ozone gas in the stratosphere that shields the earth from most of the ultraviolet radiation coming from the sun.

Ultraviolet light. Waves of radiant energy coming from the sun. Most of this high-energy radiation is absorbed by the ozone layer in the stratosphere.

Pollution. The contamination of soil, water, or the atmosphere by the discharge of noxious substances.


CFC (Chlorofluorocarbons). Synthetic chemicals made up of different combinations of chlorine, fluorine and carbon.

Carbon dioxide. A colorless, odorless gas that occurs naturally in the atmosphere and plays an important role in the lives of plants and animals. Currently, carbon dioxide is the most important greenhouse gas.

Fossil fuels. Fuels like coal, oil, and natural gas that were formed from the remains of plant material deposited during the earth's Carboniferous period.

Stratosphere. The second layer of the earth's atmosphere, extending to about 30 miles above the surface of the earth.
Background for Teachers –
Cattle Ranching – Fast Food Beef

After World War II a whole new field of technological development began. People were able to travel to the moon, cure diseases that had been killing people for centuries, go from one place to another in minutes, and use machines to cut and dig at an incredible speed.

Once the technology had been developed many big companies saw the advantages of an immediate increase of profits. Money was borrowed from banks and people were sent to remote parts of the world (rain forests) to seek out their commercial values (Collins 1990).

The first and most obvious advantage was the timber found. Roads had to be built to enable vehicles to get deep into the jungle. Once a tree was felled it was dragged by vehicles to the nearest road, tearing large holes in the jungle behind it. The local people then burned off all the now dead scrub and found that they had, for the first time, limitless field in which to grow crops.

They soon learned that the crops did not grow well in this soil even though there had once been an enormous jungle there. They even mixed the ash into the soil. The ashes had minerals and nutrients that were stored in the plants before they were burned. However, the crops soon used up the nutrients, winds arrived and blew away the top soil, and
the heavy rains washed burned nutrients, soil and newly planted crops down to the nearest river (Silver 1993).

After a few years of unsuccessful attempts at cultivating crops the poor peasant moved on to try again somewhere else. To try and try again only brought the same results. The land simply did not have the necessary components to grow crops.

Now (30 years ago), enters the era of the fast food establishments. They became instantly popular with children and teenagers (Nichols 1990). Today, 30 years later, they are still expanding and have turned up in the most unlikely parts of the world.

The companies supplying this fast food could not keep up with the demand at one economic price. To solve this problem, aid grants from the World Bank and special tax advantages by governments were given to Central America and Brazil to produce beef for domestic consumption and export to the North American and West European fast food markets (Collins 1990). The land to be used would be that which was already cleared for crops. The cattle's dung was used to fertilize the soil. DDT and other pesticides were brought in from countries banning them and sprayed on the grasses to keep the insect population in check.

The combined herds of Nicaragua, Honduras, Guatemala, and Costa Rica doubled to 9.5 million head of cattle between
1960 and 1980. During the same period, a quarter of the forests in these countries was cleared, and the process is continuing even faster today (Collins 1990).

Even the grasses that are grown for cattle raising cannot sustain themselves for more than five years. Thus, even the ranchers have to move on.

The deforested land has been farmed poorly. Instead of growing food crops for the local people, much of the land is feeding beef cattle for export. Costa Ricans now eat less beef than ever before, while the people in the United States gobble fast food hamburgers by the ton (Forsyth 1988). This will continue so long as the demand for this product is still there.
Activity XIII

Letters to Fast Food Restaurants

Objective: Students will write letters to fast food restaurants requesting information about the source of their meat. Since the land in many rain forests is being cleared for ranching, and the meat being raised is sold to the United States, the students will be learning if this meat is reaching the fast food restaurants in our area.

Conceptual Framework: 10

Materials: Fast food restaurant addresses, Envelopes, Stamps

Subject: Language Arts

Time: 2 days

Procedure: 1. The format of a letter should be reviewed here. The letter should contain at least three paragraphs.
   * introducing themselves
   * telling why they are writing (their concerns)
   * a request for information

2. A sample letter can be put on the overhead to go over the requirements.

3. Students choose the restaurant they want to write. Make sure all restaurants are written to so there is only one to each particular restaurant.

4. The rough draft of the letter is edited by the original writer. Emphasize the correct use of capitals, periods, paragraph indenting, margins, and spelling.

5. Students can then exchange with a partner and have them edit for the same points as mentioned above.
6. The original writer should then make the necessary corrections.

7. The teacher may want to look the letters over before the final copy.

8. The student makes final corrections, and writes the final copy using their best handwriting.
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<th>Company</th>
<th>Address</th>
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<tr>
<td>Carl's Jr. Corporate Headquarters</td>
<td>9269 Utica Ave. Suite 120 Rancho Cucamonga, CA 91730</td>
<td>Administrative Assistant</td>
</tr>
<tr>
<td>Burger King World Headquarters</td>
<td>P.O. Box 520783GMS Miami, Florida 33152</td>
<td>Consumer Relations</td>
</tr>
<tr>
<td>Jack-in-the-Box Corporate Headquarters</td>
<td>100 N. Barranca West Covina, CA 91791</td>
<td>Marketing Dept.</td>
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<td>McDonalds</td>
<td>4370 LaHoya Dr. Suite 800 San Diego, CA 92122</td>
<td>Marketing Dept.</td>
</tr>
<tr>
<td>In-and-Out Burger</td>
<td>13502 E. Virginia Ave. Baldwin Park, CA</td>
<td>Consumer Relations</td>
</tr>
<tr>
<td>Taco Bell Corporate Headquarters</td>
<td>17901 Von Karman Dr. Irvine, CA 92714</td>
<td>Human Relations</td>
</tr>
<tr>
<td>Sizzler (Forbco Management)</td>
<td>3030 Old Ranch Parkway 100 Seal Beach, CA 90740</td>
<td>Public Relations</td>
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</tbody>
</table>
Subway Sandwiches
325 Bic Dr.
Melford, CT 06460

Attn: Research and Development

Yoshinoya Restaurants, Inc.
991 Knox Strip
Porrenca, CA 90502

Attn: Purchasing

Chili's Grill and Bar (Brinker, Inc.)
6820 LDJ Freeway, Suite 200
Dallas, TX 75240

Attn: Purchasing Food and Beverage

Baker's Burgers
1875 Business Center Dr.
San Bernardino, CA 92408

Attn: Purchasing

A and W Restaurant
17197 N. Laurel Dr.
Suite 500
Labonia, MI 48152

Attn: Purchasing

The Green Burrito
23 Corporate Plaza
Suite 240
Newport Beach, CA 92660

Attn: Mike Thomas, Purchasing

Little Caesar's Pizza
9380 7th St.
Rancho Cucamonga, CA 91730

Attn: Mark Ledesma, Purchasing
Little Caesar's Pizza  
9380 7th St.  
Rancho Cucamonga, CA 91730  
Attention: Purchasing  

Dear Sir/Madam:  

I am a sixth grade student at the Margarita School in Montclair. For the past two months our class has been studying the rain forests of the world.  

We learned recently that there is a lot of agriculture being done in the rain forests. Land is cleared for corn and cattle. We read that about 90 percent of the beef used in the United States comes from Central America. Most of this meat is used by fast food restaurants. We would like to know what your source of meat is at Little Caesar's Pizza.  

Along with the above requested information, we would also like to know other nutritional facts about the food you use.  

Sincerely,  

Student's Name  
Address
Tropical Plants for the Classroom

Today many of the house plants sold in nurseries, grocery stores, and variety stores were originally grown in a tropical rain forest. Special care of these plants is needed whether they are grown in the home or brought into the classroom. These plants do not undergo any seasonal changes of temperature and light. They received uniform daylight all year long. They tend not to tolerate the direct sunlight and sometimes dryness of the house or classroom. Their growth slows down and may even stop during the darker seasons.

The following plants can be found in a variety of places; however, the prices given here are from the Nurseryland Nurseries on Foothill in Cucamonga. There are other Nurseryland Nurseries around the area, but this is the only one with cut-rate prices.

Venus's Hair (Adiantum Capillus-Veneris)
- Found: Subtropical
- Needs: Warm, humid sheltered spots
  - Bright filtered light
  - Roots always slightly moist
  - Spray foliage daily
- Cost: $4

Urn Plant (Bromeliad) (Aechmea fasciata)
- Found: Brazil
- Needs: Direct exposure to sunlight
  - Organic acid soil
  - Water plentifully (rain water is excellent)
Alocasia metallica
Found: Malaysia
Needs: Warm, moist surroundings
Dim light
Water regularly, but sparingly with tepid water during growth
Spray leaves daily
Cost: 6" pot - $6.44

Bird's Nest Fern (Asplenium nidus)
Found: Tropical Asia, Tropical Australia, Polynesia
Needs: Complete shade - little light
Room temperature
Water plentifully during growth season
Spray foliage
Cost: 6" pot - $6.44

Wax Begonia (Begonia semperflorens) (cultorum)
Found: Brazil
Needs: Bright but filtered light
Peat and sand soil in equal parts
Cost: 4" pot - $2.49

Angel's Wings (Caladium bicolor)
Found: Central America
Needs: Moist environment
Bright light but not direct sunlight of drafts
Cost: 6" pot - $6.44

Periwinkle (Catharanthus roseus)
Found: Madagascar
Needs: Plenty of light and several hours of direct but not too strong sunlight
Water plentifully but do not let it collect in pot
Cost: 4" pot - $2.49
6" pot - $4.59

Parlor Palm (Chamaedorea elegans)
Found: Mexico/Guatemala
Needs: Bright but not direct sunlight
Room temperature
Prefers moist surroundings
Spray foliage frequently
Water plentifully during growing season
Cost: $29.99
Croton (Codiaeum variegatum)
Found: Indonesia
Needs: Bright light
Room temperature
To raise humidity, place pot in a bowl with wet gravel
Spray foliage and clean it frequently
Water abundantly in spring and summer
Little water when plant is not flowering
Cost: 6" pot - $6.44

Spotted Dumb-Cane (Dieffenbachia maculata)
Found: Brazil
Needs: Average light
Room temperature
Plenty of moisture
Pot should be set in a holder filled with wet gravel or damp peat
Water sparingly during growth season
Winter watering even less
Cost: 6" pot - $6.44

Corn Plant (Dracaena fragrans)
Found: Tropical Africa
Needs: Bright but filtered light
Room temperature
Plenty of humidity
Water plentifully during growing season
Little water during resting season
Cost: 10" pot - $69.99

Weeping Fig (Ficus benjaminia)
Found: Philippines
Needs: Bright but filtered light
Room temperature
Organic soil, peat and sand in equal parts
Water normally but allow soil to dry out in between waterings
Cost: 6" pot - $6.44
Larger - $29.99

Scarlet Star or Orange Star (Bromeliad)
Found: Central America
Needs: Bright but filtered light
Warm, moist surroundings
Spray plant with lime-free water
Fill central funnel with water
Orchids

Found: Central/South America
Needs: Bright but indirect sunlight daily
        Plenty of moisture
        Spray 1-2 times a day
        Water soil moderately and let surface dry
Cost: $7.99 - $24.44

Climbing Philodendron (Philodendron scandens)

Found: Central America
Needs: Bright indirect light
        Room temperature
        While growing wet soil thoroughly but let it dry out between waterings
Cost: 6" pot - $6.44

African Violets

Found: Originated from a Central African species
Needs: Bright light (artificial light) for the whole year
        Room temperature
Cost: $1 - $2.49

Snake Plant/Mother-in-law's Tongue (Sansevieria Trifasciata laurentii)

Found: Tropical Africa
Needs: Bright light and direct sun
        Room temperature
        Water moderately
Cost: 6" pot - $6.44

Umbrella Tree/Octopus Tree (Schefflera Actinophylla)

Found: Papua New Guinea, Indonesia
Needs: Bright light but not direct sun
        Room temperature
        No drafts
        Water moderately
        Main stem needs support
Cost: Dwarf 6" pot - $6.44

Bird of Paradise (Strelitzia Regina)

Found: Central and South America/Tropical Africa
Needs: Bright light
        Room temperature
        Water during growth season
        Let surface dry out before watering again
        Less water in dormant state
Cost: 10" pot - $29.99
African Evergreen (*Syngonium Podaphyllum*)
- Found: Central America
- Needs: Bright but filtered light, Room temperature, Spray foliage, Water moderately
- Cost: 5 gal. pot - $19.99

Flaming Sword (*Bromeliad*)
- Found: Venezuela, Guiana
- Needs: Bright light, Room temperature, Water regularly during growth season, Place pots in wet gravel during winter to prevent soil from drying out
Additional Plant Projects

Passion Fruit (*Passiflora edulis*)
Wash and dry seeds. Then sow them. Do not cover. Spouting takes 12 to 14 weeks. Teacher can start these prior to study of the rain forest so growth will already have started.

Avocado (*Persea americana*)
Remove pit from flesh of fruit and stick the broad end 3/4 to 1 inch deep into potting soil. Keep the plant in bright places all year long. Keep uniformly damp. Teacher needs to start this long before study begins.

Papaya (*Carica papaya*)
Wash seed and sow. Cover it lightly with soil. Invert a plastic bag over pot. The seed will germinate after several days. Keep plant warm in bright light and a humid environment all year long. Only water moderately.

Date Palm (*Phoenix dactylifera*)
Soak date pits from packaged dates in warm water for two or three days. Push pits about 3/4 inch deep into soil. The seeds sprout after 2 to 6 months. Keep plant in a light to sunny spot all year long and warm in summer. Water moderately.

Ginger (*Zingiber officinalis*)
Lay the rhizone flat on the soil with the eye pointing upward and just cover lightly. Put in a shady, warm place. The first shoots appear after two months. Keep plant in bright light, warm, and always slightly damp from spring till fall. In fall let it die back. In the winter keep the rhizone in its pot at room temperature and begin watering it again in spring. Cover the rhizone in its pot at room temperature and force it again in spring.
Related Children's Literature

Fiction

Jordan, Martin and Tanis. *Jungle Days Jungle Nights*  
Grisewood and Dempsey, 1993  
Illustrator: Martin Jordan  
Summary: Describes some of the mammals, reptiles, and insects that are active, either during the day or night, in the jungles of South America. The illustrations are excellent.

Jordan, Martin and Tanis. *Journey of the Red-Eyed Tree Frog*  
Simon and Schuster, 1992  
Illustrator: Martin Jordan  
Summary: A tree frog whose home is threatened by destruction of the rain forest makes a long journey to the heart of the Amazon jungle, encountering many animals along the way, to consult with the Oracle Toad for advice. Excellent illustrations.

Seuss, Theodor. *The Lorax*  
Random House, 1971  
Summary: Dr. Seuss skillfully tells the story of deforestation and pollution in rhyme. This is a good book with which to begin a study of the rain forest.

Bosse, Malcolm. *Deep Dream of the Rain Forest*  
Harper Collins 1993  
Summary: While on an expedition with his uncle in the jungles of Borneo in 1920, fifteen year old Harry Windsor is captured by Bayang, a young Iban tribesman, who believes that Harry possesses the power to help him and an outcast Iban girl on their quest for the meaning of a mysterious dream prophecy. A good adventure story that the teacher could read to the whole class.

Aardema, Verna. *Anansi Finds a Fool*  
Dial Books, 1992  
Illustrator: Bryna Waldman  
Summary: Anansi's home is in west Africa. Lazy Anansi seeks to trick someone into doing the heavy work of laying his fish trap, but instead he is fooled into doing the job himself. Beautiful watercolor illustrations.
Cherry, Lynne. *The Great Kapok Tree*  
Harcourt Brace Jovanovich, 1990  
Illustrator: Lynne Cherry  
Summary: A man with an ax goes to the rain forest and begins to cut down a kapok tree. He soon grows tired and falls asleep. The many different animals that live in a great kapok tree appear and try to convince him of the importance of not cutting down their home.

Cannon, Janell. *Stellaluna*  
Harcourt Brace, 1993  
Illustrator: Janell Cannon  
Summary: Stellaluna is a baby fruit bat that falls headfirst into a bird's nest. She is raised like a bird until she is reunited with her mother.

Diop, Birago. *Mother Crocodile*  
Delacorte Press, 1981  
Illustrator: John Steptoe  
Summary: This is an Ouofo folktale from Senegal, West Africa. Mother Crocodile tells stories of the past to the little crocodiles. They think she is crazy until they learn otherwise.

Peet, Bill. *Capyboppy*  
Houghton Mifflin, 1966  
Illustrator: Bill Peet  
Summary: A young boy, Bill Peet, is fascinated with unusual animals. He acquires a capybara from the Amazon rain forest. As the baby animal becomes older, domestic problems begin to occur. As with so many animals taken out of the wild, they eventually end up in a zoo.

Steig, William. *The Zabajaba Jungle*  
Harper Collins, 1987  
Illustrator: William Steig  
Summary: A boy named Leonard goes on a fantastic adventure in the Jabajaba jungle. He must slash at hanging vines, encounter squawking birds and numerous insects, befriend a big butterfly, deal with hissing snakes, be dragged off by a bunch of mandrills, and brought before their forest judge who wants to know why he is there.
Kipling, Rudyard. *The Cat That Walked By Himself*
Child's Play, 1990
Illustrator: Teresa O'Brien
Summary: The cat finds his place at the hearth of an early man and woman in the rain forest, by performing certain services. Even though belonging to a family he does so without losing his independence.

Cobb, Vicki. *The Place is Wet*
Walker Publishing, 1989
Illustrator: Barbara Lavallee
Summary: A fictional trip is taken to the Brazilian rain forest. The story focuses on the land, ecology, people, and animals of the rain forest. It is presented as a place where there is so much water that some houses need to be built on stilts.

Lavie, Arlette. *The Tower*
Child's Play, 1990
Illustrator: Arlette Lavie
Summary: In the face of an ecological disaster in the rain forest, a leader comes down from his seat of power to find lasting values and policies for a better life in which everyone can share.

George, Jean Craighead. *One Day in the Tropical Rain Forest*
Harper Collins, 1990
Illustrator: Gary Allen
Summary: A young Indian boy, Tepui, must find a way of saving his home, a rain forest in Venezuela, from a caravan of bulldozers and trucks arriving from Caracas to level the forest. A scientist and Tepui take the challenge to find a nameless butterfly. Excellent story.

Sis, Peter. *Komodo*
Greenwillow Books, 1993
Illustrator: Peter Sis
Summary: A young boy who loves dragons goes with his parents to the Indonesian island of Komodo in hopes of seeing a real dragon. The story includes factual information about the Komodo dragon.

Baker, Jeannie. *Where the Forest Meets the Sea*
Greenwillow Books, 1987
Artwork photographers: Philip Mandalidis and David Blackwell
Summary: On a camping trip in an Australian rain forest with his father, a young boy thinks about the history of the plant and animal life around him and wonders about the future.
Yolen, Jane. *Welcome to the Green House*
G. P. Putnam's Sons, 1993
Illustrator: Laura Regan
Summary: The mysterious world of the rain forest and the life found there are made very vivid in this book. Skillfully chosen words and beautiful illustrations help one to see this hot greenhouse, and to hear the full range of exotic sounds.

Nonfiction

Koral, April. *Our Global Greenhouse*
Franklin Watts, 1991
Photography: Magnum Photos
Summary: The book discusses the origins, possible results, and prevention of the environmental problem known as the greenhouse effect.

Johnson, Rebecca L. *The Greenhouse Effect*
Lerner Publications, 1990
Photography:
Summary: Once again, a book that discusses what the greenhouse effect is, research that is being done to find the causes, and what, if any, will be the impact on our planet.

Stille, Darlene R. *The Greenhouse Effect*
Children's Press, 1990
Photography: World photographers
Summary: This is an excellent "first" book that describes the causes and effects of the greenhouse effect and how it might be stopped.

Rauzon, Mark J. *Jungles*
Doubleday, 1992
Photographer: Mark Rauzon
Summary: *Jungles* explores the geography of the jungles around the world. It explains the layers of the forest and what species of animals are found in each. The people of the jungle also play an important part. They have lived there for thousands of years while the jungle has provided them with all the necessities of life. It explores the future of the jungles and the fact that people must be educated as to their importance.
Hoy, Ken. *Land Life*
Ideals Children's Books, 1990
Illustrator: Mike Peterkin
Summary: A wonderful pop-up book that takes you on a trek across the world to visit the tropical rain forests and other biomes.

Sterry, Paul Dr. and Dr. Michael H. Robinson, *Rain Forest: Nature Search*
Reader's Digest Association, 1992
Illustrators: David Holmes, Neil Bulpitt, Eva Melhuish, Karen Johnson
Summary: A "must" for the classroom. Equipped with a magnifying glass, the students can search each page for hidden creatures from the rain forest. The book has its own little holder for the magnifying glass.

Ganeri, Anita. *Exotic Rainforest*
A Golden Book, 1992
Illustrator: Robert Morton
Summary: Starting with a definition of a rain forest, the book then refers to the importance of the geographical features. A variety of plant and animal species is described along with their uncertain future. The people of the rain forest are briefly noted as well as how they have lived in the forest for a very long time without destroying it.

Singer, Marilyn. *Exotic Birds*
Doubleday, 1991
Illustrator: James Needham
Summary: The book introduces the characteristics of such exotic birds as the harpy eagle, hoatzin, the scarlet macaw, the golden-hooded manakin, the yellow-ridged toucan and the yellow-crowned parrot.

Lewis, Scott. *The Rainforest Book*
Living Planet Press, 1990
Illustrator: Mercedes McDonald
Summary: This is an easy-to-read handbook that will give valuable information about the rain forests' amazing diversity, the threats to their survival, and ways we can preserve them for future generations.
Silver, Donald. *Why Save the Rain Forest*
Simon and Schuster, 1993
Illustrator: Patricia Wynne
Summary: An informational book that explains what a rain forest is and where they are found, the dangers they face, and the importance of protecting their plant and animal life.

Robinson, Howard F. *Wonders of the Jungle*
National Wildlife Federation, 1986
Photographer: Victor H. Waldrop
Summary: Many scientists with firsthand experience in the rain forests of the world were contacted in order to put this very informative book together. Good resource book for young classroom scientists.

Pearce, Q. L. *Piranhas and Other Wonders of the Jungle*
Simon and Schuster, 1990
Illustrator: Mary Ann Fraser
Summary: This book gives a good survey of the exotic plants and animals that live in the world's rain forests.

Cunningham, Antonia. *Rainforest Wildlife*
Osborne Publishing, 1993
Illustrator: Ian Jackson and David Wright
Summary: This particular series takes a close look at the animals and plants of the rain forests of the world and explains how each species is adapted to life in its own environment.

Gallardo, Evelyn. *Among the Orangutans*
Byron Preiss Publications, 1993
Summary: This is the story of Birute Galdikas, a prominent expert on the behavior of orangutans in the wild.

Taylor, Barbara. *Rain Forest*
Dorling Kindersley, Inc., 1992
Summary: This book examines the variety of life found in the rain forest, including the flying gecko, poison dart frog, and the curly-haired tarantula.

Willow, Diane. *At Home in the Rain Forest*
Illustrator: Laura Jacques
Summary: The location is the Amazon rain forest. The text emphasizes the interrelatedness of all life forms. This visual journey observes the flora and fauna that are found in the different layers of the forest.
Averous, Pierre. *Animals of the Tropics*
Silver Burdett, 1989
Illustrator: Isabelle Molinard
Summary: This book introduces the physical characteristics and habits of a variety of animals that live in hot climates.

Sattler, Helen Roney. *The Book of Eagles*
Lothrop, Lee and Shepard, 1989
Illustrator: Jean Day Zallinger
Summary: This informative book discusses the physical characteristics, behavior, and life cycle of eagles, such as the harpy, the Vulturine fish eagle, the Wallace hawk eagle, and the Philippine eagle.

Siy, Alexandra. *The Brazilian Rain Forest*
Dillon Press, 1992
Photographers: Frank Wadsworth, Richard Laval, Berne Broudy, Margaret Cymerys, and Paul Harp
Summary: This is an excellent book for young readers. It describes the numerous plants and animals living in the Brazilian rain forest and their ecological and economic importance.

Brooks, Felicity. *Protecting Trees and Forests*
Usborne Publishing, 1991
Illustrators: Steven Kirk, Peter Chesterton and Peter Bull
Summary: Young readers will enjoy reading the fascinating facts and looking at the realistic illustrations of how to protect natural habitats such as the rain forests.

Wood, John Norris. *Nature Hide and Seek: Jungles*
Alfred A. Knopf, 1987
Illustrators: Kevin Dean and John Norris Wood
Summary: Many of the fascinating creatures that live in the rain forests of the world are hidden in the five splendid full-color jungle scenes in this book.

Hamilton, Jean. *Tropical Rainforests*
Blake Publishing, 1990
Photographers: Frank Balthis, Hans and Judy Best, John Chellman, E. R. Deggener, Michael Fogden, Francis Gohier, Steven Holt, Breck Kent, Frans Lanting, Richard LaVal, Wayne Lynch, Kevin Schafer, Dr. Nigel Smith, Larry Ulrich, Doug Wechsler, and Belinda Wright
Summary: Excellent close-up pictures of animals and flowers found in the rain forest make this a very enjoyable book for young readers.
Uchitel, Sandra. *Endangered Animals of the Rain Forest*  
Price Stern Sloan, 1992  
Illustrator: Serge Michaels  
Summary: The tropical rain forests are characterized in this book which examines the plight of endangered animals and discusses how readers can help save these species by saving threatened habitat.

Stidworthy, John. *Chimpanzee*  
Silver Burdett Press, 1988  
Illustrator: Gill Tomblin  
Summary: The book tells the story of the life of one particular chimpanzee over a single year. The story is written and illustrated as if the chimp had been watched through the year.

Pearce, Q. L. *Camouflagers*  
Price Stern Sloan, 1991  
Illustrator: Marilee Niehaus  
Summary: Around the world, all types of animals exhibit extraordinary ways of camouflaging themselves to hide from predators or to stalk prey.

Dorros, Arthur. *Rain Forest Secrets*  
Scholastic, Inc., 1990  
Illustrator: Arthur Dorros  
Summary: This book gives a close-up look at rain forests. It stresses the importance of the rain forest and how its biodiversity is very unique.

Chinery, Michael. *Rainforest Animals*  
Random House, 1992  
Illustrators: David Holmes and Bernard Robinson  
Summary: Introduces animals of the rain forest and how they live, including the howler monkey, toucan, and deadly arrow-poison frog.

Forsyth, Adrian. *Journey Through a Tropical Jungle*  
Silver Burdett, 1988  
Summary: Presents in text and photographs some of the plants and animals, and people that live in the tropical rain forest of Costa Rica.

Baker, Lucy. *Life in the Rainforests*  
Scholastic, 1990  
Summary: Beautiful colored photographs offer an exciting introduction to the rain forests of the world. You will read about the animals, people and plants that live in this unique environment.
Wexo, John Bonnett. *Zoo Books: Gorillas*  
Wildlife Education, 1991  
Summary: A brief insight to the life of the lowland gorilla.

Elwood, Ann. *Zoo Books: Chimpanzees and Bonobos*  
Wildlife Education, 1990  
Illustrator: Walter Stuart  
Summary: This is a brief account of the African chimpanzee, his physical characteristics and his habits.

McLaughlin, Dr. Charles A. *Zoo Books: Orangutans*  
Wildlife Education, 1990  
Illustrator: Davis Meltzer  
Summary: Studies have been made of the orangutans that live in Sumatra, Borneo, and a few other Southeast Asian countries. This book briefly gives information regarding a study made on them.

**Coloring and Activity Materials**

Kricher, John and Gordon Morrison. *A Field Guide to Tropical Forests*  
Houghton Mifflin, 1991  
Illustrator: Gordon Morrison  
Summary: A wonderful array of plants and animals from the tropical rain forests that can be colored and used in a variety of ways.

Dudley, Bettina. *Forests: A Fact-Filled Coloring Book*  
Running Press, 1989  
Illustrator: Helen I. Driggs  
Summary: Many forests are represented in this book, including the cloud forests of the tropics, the mangroves, and the fern forest.

Butterfield, Moira. *Amazon Rainforest*  
Ideals Publishing, 1991  
Illustrator: Paul Johnson  
Summary: A fascinating book that explores the diversity of life in the Amazon jungle, wildlife habitats, endangered species, animal diets, and the history and possible demise of the Amazon rain forest. An additional four pages of colorful press-out model pieces allow children to construct their own rainforest.
Save the Rainforest (An educational coloring and activity book)
Landoll, Inc., 1992
Summary: You can color, explore a map, do a word search, learn about the rain forest people, work a maze, or learn about the animals.

Esslinger, Jessica. Los Angeles Zoo: Endangered Species
Creative Company, 1988
Illustrators: Cynthia Belcher, Brian Stone and Sher Sester
Summary: There are many appropriate activities in this book that could be used when studying the rain forest.

Johnson, Jinny. Rainforest Wildlife
Reader's Digest, 1993
Illustrators:
Summary: An activity package that includes an interesting text about life in the rain forest, a model to put together, a poster, puzzles, and a checker's game.

Teacher Resource Books

Nichol, John. The Mighty Rain Forest
David and Charles, 1990
Photography:
Illustrator: Oonagh O'Toole
Summary: This is an excellent book that describes the complexities of the great rain forests, how they function and their importance in the world. The author has an interesting way of writing.

Silcock, Lisa (editor). The Rainforests: A Celebration
Chronicle Books, 1990
Photography: Helen Gilks
Summary: You cannot read this important book without wanting to explore the wonder and diversity of the world's rain forests while making a commitment to their protection.

Collins, Mark (editor). The Last Rain Forests
Rodale Press, 1990
Photography: Andi Spicer
Summary: The Last Rain Forest is an authoritative and comprehensive book. It has over 200 full color photographs and maps, a guide to the people, flora, and fauna of the richest habitats on earth.
Denslow, Julie Sloan and Christine Padoch (editors). *People of the Tropical Rain Forest*. University of California Press, 1988
Summary: An interesting and indepth study of the native peoples of the rain forests of the world.

Summary: Michael Goulding has written four books on the Amazon, and has explored more than 25 of its river systems from mouth to source. He presents the flooded forests in all their magnificence and alerts us to the areas that are being threatened and destroyed.

Dwyer, Augusta. *Into the Amazon*. Sierra Club, 1990
Summary: Augusta Dwyer writes passionately about the Amazon and its vanishing way of life. It is a personal narrative of the people, including Chico Mendes, and a disturbing account of the devastation that government policies, greedy industrialists, and international exploitation have wreaked upon an area of the world that is key to the planet's survival.

Summary: This is a collection of essays from 24 leading authorities in a variety of fields . . . all of which are committed to finding alternatives to rain forest destruction.

Videos

You Can't Grow Home Again (Children's Television Workshop, Box HV, One Lincoln Plaza, New York, New York 10023; or call 1-800-321-7511)

Rain forest (National Geographic: Vestron Video, P.O. Box 4000, Stamford, CT 06907; or local video stores)

Tropical Kingdom of Belize (National Geographic: Vestron Video, P.O. Box 4000, Stamford, CT 06907; or local video stores)

Jungle Book (Walt Disney: Local video stores)
Fern Gully: The Last Rain forest (Fox Video, P.O. Box 900, Beverly Hills, CA 90201; or local video stores)
REFERENCES


