Name Date Class

SECTION 1 Enrichment

Tropical Rain Forests

There is a climactic region on Earth that covers only 2 percent of its surface yet supports more than half of its plant and animal life. This region is the tropical rain forest. Although different types of rain forests exist in different climates, tropical rain forests receive four to eight meters of rain each year and are located in hot, humid climates near the equator in Africa, South and Central America, and Asia.

World's Largest Habitat

The world's largest habitat of plant and animal life is the Amazon rain forest in South America. It spreads across 40 percent of the total area of Brazil, covering an area of 6,000,000 square kilometers. Millions of species of plants, insects, birds and other life forms, including jaguars, manatees, red deer, and monkeys, live in this region. Many of the species in the region have never been recorded or studied. Of those plant species that have been documented by scientists, many have proved to be very beneficial to humans. A significant percentage of modern medicines come from plants that grow in tropical rain forest regions. Rain forests are also important because they recycle water, oxygen, and carbon.

Shrinking Forest

The humidity, heat, and heavy rainfall of the region create lush vegetation. The trees have broad leaves that form an upper canopy high above the forest floor. Trees that grow in the rain forest include species of myrtle, laurel, palm, rosewood, mahogany, and cedar, to name just a few. Because of the value of mahogany and cedar as lumber, the need for farmland, and the growing population in Brazil, the Amazon rain forest has shrunk drastically in recent decades. Since the 1990s parts of the Amazon rain forest have been protected from further destruction. In other parts of the world, the battle between those who want to protect the rain forest and those who want to exploit its resources continues.

1. Where are tropical rain forests located?

2. Explain how rain forests play an important role in controlling Earth's climate. Why do you think this natural recycling is important?

3. Do you think rain forests should be protected or should they be used for their resources? Explain.

4. Why has the Amazon rain forest shrunk in recent years?

Name Date Class

Problem Solving

Dying Frogs Give Ecological Clues

Activity 7

In the late 1970s and early 1980s, frogs began to disappear in Australia. It was an epidemic that spread from southeast Queensland up the coast. In 1989, Australia found out it was not alone. At the First World Congress of Herpetology (biologists who study amphibians and reptiles are known as herpetologists), scientists shared stories and realized that frogs were dying in alarming numbers. To date, two amphibian orders, 14 families, and 93 species have been affected.

The nearly 5,000 species of amphibians, including frogs, are said to be nature's warning flags. Their deaths, say scientists, are cause for concern. Because amphibians are more sensitive to changes in the environment, changes in their numbers might be a sign of a more serious environmental problem.

Frog Fungus

Researchers have identified a possible cause, a chytrid fungus. The fungus, which lives in the superficial layer of the frog's skin, coats the belly and underside of the legs. Scientists can't always see the fungus on frogs. Sometimes it turns bright red, but usually it just sits there, waiting to kill.

The fungus is fatal only to adult frogs. Tadpoles are not affected. They can, however, carry the disease. Scientists believe the fungus attacks the keratin protein in frogs. Because tadpoles have keratin only in their mouths, it doesn't affect their breathing ability. After metamorphosis, keratin becomes part of the frog's whole body. Frogs breathe and take in water through their skin, particularly their undersides. As the fungus spreads, it kills them either by suffocating them or by releasing a toxin.

Is there more than one cause?

The fungus probably is not the only thing causing frogs to die throughout the world. Climate changes, pollution, and increased ultraviolet radiation due to the thinning of the ozone layer each might have an effect. However, frogs in protected areas, like rain forests and zoos, are dying, too.

In the United States alone, the fungus has infected amphibians at the Bronx Zoo, the Philadelphia Zoo, and the Shedd Aquarium in Chicago. In Yosemite National Park, three of seven native frog and toad species have disappeared. Deaths in parks, zoos, and wetlands are more likely the result of a global problem like fungus, rather than a local problem like water pollution.

Of all the places in the world facing this problem, Australia remains the hardest hit with 46 species infected so far. Worldwide, scientists continue their research. Much more needs to be done, including confirming that the fungus is, indeed, the cause of the declining frog population. Scientists also want to gain a better understanding of the life cycle of the fungus and its ability to spread. They also want to work with DNA to identify how many strains of the fungus exist. Until then, conservation methods are being put in place in an effort to maintain what's left of the frog population.

Applying Problem Solving Skills

1. How might the frog fungus be spreading to remote and protected areas like rain forests, wetlands, and zoos?
2. What kinds of conservation efforts might be used to help maintain the frog population?

Name_____ Class_____ Date _____

Who Should Pay for the Cost of Preserving the Tropical Rain Forests?

Tropical rain forests, woodlands drenched with over 80 inches of rainfall each year, once formed an almost continuous belt around Earth between the Tropics of Cancer and Capricorn. Millions of years ago, these forests covered 16 percent of the land. Now they cover only 6 percent. Tropical rain forests are disappearing rapidly—at the rate of 40 million acres per year. Why should this matter? Rain forests are part of the intricate web of life on Earth and their destruction will have consequences for everyone.

The Nature of Tropical Rain Forests Tropical rain forests abound with unique and beautiful plants and animals found nowhere else. At least 50 percent of all species live in these forests. About one quarter of the world's medicines contain ingredients from tropical plants. For example, doctors use the rosy periwinkle to treat lymphocytic leukemia in children, quinine from the bark of the *Chinchona* plant to prevent and treat malaria, and curare, also from tree bark, during heart surgery. Countless other tropical plants found in rain forests have yet to be chemically analyzed. Only a mere 1 percent of tropical plants have been examined so far.

Forests are an important stabilizing feature of Earth's land surface. They absorb carbon dioxide, release oxygen, and help to regulate the water cycle. Forests are part of the intricate web of life that acts within the ecosystem. Destroying forests, especially tropical rain forests, threatens the future of the biosphere.

Paradise Lost? Destruction of the rain forest has occurred for a combination of social, economic, and political reasons. Rapid population growth has forced some people in economically challenged nations to utilize the land covered by the rain forests to grow food. Many virgin forests have been cleared to make room for agriculture. Unfortunately, the fragile tropical soils cannot sustain crop growth for more than a few years. When the farmers move on to clear another section of the forest, their old fields are used by ranchers to graze cattle. Ranchers use the land for another seven to ten years, until the soil is hard-packed, weed-ridden, and useless.

Logging also destroys tropical rain forests. In the process of cutting commercially valuable trees, loggers may destroy 30 to 60 percent of the other trees in the forest. The removal of so many trees causes fertile topsoil to run off in the heavy rains that characterize tropical rain forests. The logging industry also builds roads that allow access to land deep inside the forest, which is later cleared for crops.

Rain forests are often destroyed by slash-and-burn techniques, where the forest vegetation is cut down and burned to clear the land for cultivation. In the burning process, the carbon stored in the plants is released as carbon dioxide. Normally, carbon dioxide allows energy from the sun to pass through the atmosphere to the Earth's surface, but it also keeps some of the reflected energy from escaping back into space. This "greenhouse effect" helps to regulate Earth's temperature. When excess carbon dioxide and other greenhouse gases are released into the atmosphere, the "greenhouse effect" may increase and cause global warming. Global warming could shift climate patterns, disrupt crop production and water supplies, and threaten coastal areas with rising sea levels.

Although the ash from burned trees enriches the nutrient-poor topsoil, it only helps for a few years before the nutrients are used up. Rain forest soils are typically poor in nutrients because 95 percent of the nutrients are bound up in the forest itself.

Forests play a crucial role in Earth's recycling of carbon. Plants and soil hold triple

Name_____ Class_____ Date _____

the amount of carbon that the atmosphere contains. When trees are cleared, they are no longer able to remove carbon dioxide from the atmosphere.

Approaching a Solution Nations that allow clear-cutting of their rain forests are struggling to survive economically. People who are poor and hungry are using their natural resources in an effort to survive. It may be important to help developing nations thrive economically while working to maintain the ecological balance in all areas on Earth.

Various proposals are being considered to provide economic incentives for preserving rain forests. People can be taught to farm more effectively, so they avoid destroying more of the forest than necessary. Conservation International, in Washington, D.C., has pioneered "debt for nature" swaps, whereby the international debts of a country are canceled in return for their protection of tropical rain forests. Conservationists are also trying to identify and preserve pristine areas that are particularly rich in plants and animals, so that other parts of the forest can be cultivated.

People are exploring many other ideas that can help to preserve the tropical rain forests without imposing economic hardship on the local societies. One such idea is the creation of communally owned logging organizations to provide people with an economic stake in the forest's health. These organizations would supervise logging practices to ensure that harvested trees are removed carefully, minimizing the destruction of other plants. Because rain forests are an important source of medicinal plants, commercial drug manufacturers are also becoming involved. One major pharmaceutical company pays people who live in the forests to harvest the plants. Native peoples are also encouraged to harvest natural forest products carefully. For example, cashews and Brazil nuts are valuable crops, and their cultivation encourages careful maintenance, rather than wholesale destruction, of the forest. By providing economic incentives, saving the tropical rain forests can work for everyone.

REVIEW *On the lines provided, answer the following questions.*

1. What are "debt for nature" swaps? How can they be used to encourage the protection of tropical rain forests?

_____

_____

_____

2. How are the rain forests an integral part of Earth's ecosystems?

_____

_____

_____

_____

_____

CONSIDER THIS *On a separate piece of paper, answer the following questions.*

1. Why shouldn't developing countries be expected to shoulder the burden of protecting tropical rain forests alone?
2. What can you do to help protect tropical rain forests?