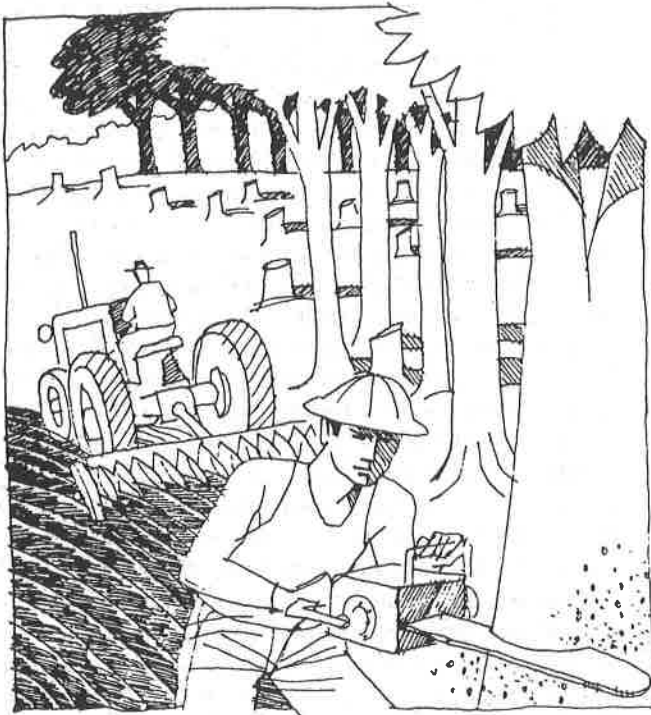


ENRICHMENT ACTIVITY**Societal Issue****Vanishing Habitats**

Charles Darwin's famous journey on the H.M.S. *Beagle* took him to the coast of Brazil in 1831. Darwin was filled with amazement at the great beauty and variety of life forms that he encountered in the tropical forests there. "Delight", he reported in his journal, "is a weak term to express the feelings of a naturalist who, for the first time, has wandered by himself into a Brazilian forest."¹

Had Darwin been able to return to Brazil 150 years later, his amazement might have had a very different source. His journal would likely have told the story of how these great forests have been remarkably transformed by human endeavor. This story, even now unfolding in Brazil, is only one of many such stories. Everywhere on this planet, human beings and other living things are experiencing the dramatic effects of change in their natural habitats. Some of these changes are so drastic that habitats are disappearing altogether. What are the causes of such change? How should we evaluate their effects?

Tropical Deforestation

The rather unwieldy term *deforestation* refers to the clearing out of Earth's forests. Ten thousand years ago, woodlands and forests covered about 6.2 billion

hectares of our planet's surface (1 hectare equals 10,000 square meters). Since then, scientists believe that area to have decreased by fully one-third to approximately 4.2 billion hectares. The cutting down of vast amounts of forests in western Europe began during the 1500s. This process was stimulated by the development of industry and agriculture. By 1789, the amount of land covered by forests in France had declined from 80 to 14 percent. In recent years, scientists have become particularly concerned about the severe deforestation problem in the tropics.

Consider two remarkable facts about the tropical rain forests of the world. First, they are the natural habitat for more than half of all of the plant and perhaps as many as three-quarters of the animal species on Earth. Second, these forests are currently disappearing at the rate of more than an acre each second. As you count to ten, an area equivalent to that of ten football fields is being destroyed.

Destroyed by whom, and why? These forests grow in hot, wet regions near the equator, mostly in countries in Africa, Asia, and Latin and South America. Increasingly, the people of the tropics have turned to the forests for their livelihood. Wood from trees is used as a basic fuel and for building shelters. But the land that the trees occupy is often considered to be as valuable as the trees themselves. Forests are cleared away for use as farmland, either for growing crops or for raising cattle. Continuous planting depletes the soil's nutrients. Farmers are then forced to find new land—and so need to clear more forest by means of cutting and burning.

Pressures from outside the tropical regions also contribute to deforestation. Indeed, timber and beef have become important exports for developing nations that are burdened by huge foreign debts. The demand for cheap beef in Europe, the United States, and Japan has accelerated the clearing out of many Latin and Central American forests for cattle ranching. Similarly, there is considerable consumer demand in nontropical countries for exotic tropical hardwoods. This has led to the destruction of vast areas of forest in Southeast Asia. Unfortunately, as the trees used for timber are cut down, up to 60 percent of the surrounding trees are also felled. These are not used commercially and so are wasted.

Deforestation in the tropics is rapidly outpacing reforestation. It is estimated by some experts that ten hectares of forest are being cleared annually for

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each hectare of trees planted. So the overall character of the natural environment is dramatically changing. At the same time, the equally dramatic effects of such change are only gradually being understood.

Consequences of Deforestation

Deforestation used to appear to have few undesirable side-effects. Now, though, it has become evident that this is not the case. The continual destruction of our forested lands, without adequate replacement of the trees, can have devastating consequences for Earth and its inhabitants.

The tropical rain forests serve many important environmental functions. One such function is helping to regulate the natural flow of water. Tropical rain forests receive half of all the rain that falls over land on Earth. However, the dense and multilayered tropical trees absorb large amounts of rainwater before it ever reaches the ground. The water is then gradually released into forest rivers and streams, allowing them to run cleanly and regularly. By the process of transpiration, trees also release water as water vapor into the atmosphere. So the forests actually help to regulate the climate by absorbing water and then circulating moisture. Loss of the forests means a loss of moisture, with the result being a much drier climate.

The root systems of the trees act to stabilize the soil. When deforestation occurs, this stability is lost, causing rivers to be filled with eroded soil. Sometimes the result can be life-threatening floods and mudslides. Indeed, severe mudslides in Rio de Janeiro during 1988 were caused in part by the extensive deforestation there. Crop-damaging droughts, too, can be linked to the destruction of tropical forests with the loss of the stable water transport system that they helped to provide.

The people living in the tropical regions suffer most immediately from the effects of deforestation. Local agriculture and the lumber industry have both profited from the destruction of the trees. Now they sometimes struggle to cope with the consequences of that destruction. Drought and flooding can be disastrous for the farmers. When trees are being harvested so much more rapidly than they are being replaced, wood shortages inevitably occur. So the killing of the forests can be "suicidal," with the consequence that the people do not have enough food to eat or fuel to burn.

Even far beyond the tropics, the effects of tropical deforestation may be increasingly felt. Tropical rain forests play a major role in the process of carbon

cycling worldwide. Not only does the forest vegetation absorb carbon dioxide (CO_2) but the trees and soil store many billions of tons of carbon. When the trees are cut or burned, large amounts of this carbon is oxidized and then released as carbon dioxide. If deforestation occurs much more rapidly than the trees can be replaced, there is a buildup of carbon dioxide in Earth's atmosphere. This results in a gradual global warming. In recent years, scientists have become very concerned about the long-range implications of this rise in atmospheric temperature for life on our planet. The burning of fossil fuels is the major cause of the buildup of carbon dioxide. Deforestation is the second most important contributor to the problem. Indeed, at present, deforestation adds more than 1 billion and perhaps as much as 2.5 billion tons of carbon to Earth's atmosphere each year. (Compare this figure with the approximately 5.4 billion tons produced by fossil fuel combustion.)

Of course, humans are not the only living things affected by this disruption of the tropical environment. It is estimated that there are millions of life forms in the tropics that have never even been identified and studied. Some are already extinct. Others are rapidly vanishing along with their natural habitats. Deforestation threatens the diversity of life on our planet. "It's as though the nations of the world decided to burn their libraries" one scientist has suggested, "without bothering to see what is in them."²

Different people have different beliefs about the extent to which humans are morally responsible for preserving nonhuman life. Even from a purely practical point of view, the loss of these tropical species may be unfortunate. For example, many of the medicines that we use contain ingredients obtained from wild plants and animals. Yet these tropical life forms are disappearing before their potential medical value can even be determined. Scientists may never have the opportunity to discover how many of these vast tropical resources might be employed for human purposes.

Saving the Forests

Of course, it is because humans have made use of the tropical forests' resources that deforestation has occurred in the first place. The task of saving the forests must involve wise management of these resources and careful long-range planning. Most importantly, effective reforestation programs need to be established in developing tropical nations. If trees are to be harvested or burned, they must also

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be gradually replaced. In addition, many more government-protected national parks could be established. They would help to limit the process of deforestation and to save many valuable life forms. Zoological parks could supply a controlled habitat where endangered species might be studied and preserved.

Since pressures from outside the tropics contribute to the environmental problems there, nations that lend economic support to developing tropical nations can play a role in saving the forests. Lending nations could provide economic incentives by supporting only those local industries that cooperate to preserve the forests. In addition, lending nations might help to find ways to reduce the burden of debt on these tropical countries. Recall that the sale of timber and beef exports is the typical way that some of these countries have coped with that debt. Yet timber and beef have been produced largely at the forests' expense.

Nature has supplied the forests with mechanisms for their own regeneration and for the maintenance of the environment. For example, some scientists argue that the long range effects of deforestation on global warming cannot be predicted. They suggest that as CO₂ levels in the atmosphere increase, the remaining trees might actually thrive and grow at a faster rate. In doing so, they would remove more CO₂ from the atmosphere, counteracting the warming trend. Burnt vegetation too, if left undisturbed, can often regenerate itself over long periods of time. Nevertheless, if humans are to continue to tap the forests' resources, some human effort will be necessary to ensure their survival.

Other Vanishing Habitats

The tropical forests represent one very important example of a vanishing habitat. There are many others. Some of these are aquatic habitats. Certain lakes and ponds, suffering the effects of both pollution and acid rain, are rapidly dying. That is to say, fish and other creatures are no longer able to live there. In some cases, aquatic vegetation cannot grow in lakes that have been severely polluted. Even bodies of water as vast as our oceans are being affected. Marine life is being forced to adapt, when it can, to dramatic changes in its ocean environment.

Another important phenomenon is desertification—the transformation of areas with flourishing vegetation into arid wastelands. Improper soil and water management are key factors in this process. Areas that suffer from extensive soil erosion and

poor irrigation can eventually become unusable for agricultural purposes.

In some instances, desertification can be linked to deforestation. Recall that forest vegetation plays an important role in nature's water transport system. It absorbs moisture and then slowly releases it, through transpiration, as water vapor. In addition, tree roots can stabilize soil and prevent erosion. The disruption of nature's water transport system is one of the causes of vast areas of fertile soil turning into arid deserts.

CONTENT REVIEW

1. What is a tropical rain forest? Where are most of these forests located?
2. Why are the tropical rain forests disappearing?
3. What are some of the important consequences of deforestation?
4. How is plant transpiration a key factor in maintaining the tropical climate?

CRITICAL THINKING

5. Why is deforestation a particularly severe problem in developing tropical nations? Why do you think that a country like the United States is better able to preserve its forests? (Comparing and Contrasting)
6. Geographically, people in the United States and Europe are far removed from the tropics. How are they still affected by continual tropical deforestation? (Predicting)
7. Do you think that humans have a responsibility to save the animal and insect species that are vanishing as their habitats are being destroyed? Explain your answer. (Making Ethical Judgments)
8. Recall what you have learned about photosynthesis. Explain why some scientists predict that the massive production of CO₂ by deforestation could serve to stimulate the growth of remaining trees. (Predicting)
8. Imagine that you have been appointed as the new Secretary of the Interior for a developing tropical nation. Your first task is to design a strategy to save the vanishing forests there. Outline the key elements of such a strategy. (Problem Solving)

