SAVING TROPICAL FORESTS

Tropical forests throughout the world are rapidly vanishing, but a few intrepid botanists are trying to learn about and save some of those that are left

BY JOAN AREHART-TREICHEL

*"It was a perfect white night, as they call it. All green things seemed to have made a month's growth since the morning. The branch that was yellow-leaved the day before dripped sap when Mowgli [*the wolf boy*] broke it. The mosses curled deep and warm over his feet, the young grass had no cutting edges, and all the voids of the Jungle boomed like one deep harp string touched by the moon.. . ."*

So wrote the English novelist Rudyard Kipling in *The Jungle Book,* in 1894.

Unfortunately the vast, lush, emerald rain forests immortalized by Kipling are rapidly dwindling, whether they're in Asia, Africa or South America. The culprits? Insatiable raw material demands from the industrialized world coupled with mounting populations in the developing countries. These factors lead to increased pressures on the forests to provide cash, food and fuel. This depressing scene was reviewed at the recent annual meeting of the American Institute of Biological Sciences in East Lansing, Mich., at a symposium entitled "Perspectives in Tropical Botany." The research will be puublished next year in the ANNALS OF THE MISSOURI BOTANICAL GARDEN.

Doughty botanists in various countries are attempting to study tropical forests (no mean feat when research involves scaling trees 60 to 70 meters, or several hundred feet, high), in hopes that their efforts will help salvage some of these aesthetic, economically valuable and irreplaceable ecosystems, or at least lead to sane management rather than total razing of the forests.

What evidence is there that tropical forests throughout the world are rapidly disappearing? Testimony from various botanists who have been researching these forests for some years makes the point: P. B. Tomlinson of Harvard University declares that "this is an area of universal concern." P. S. Ashton of the University of Aberdeen in Scotland asserts that "we have to work with these trees as they may be gone in a few years' time." Daniel H. Janzen of the University of Pennsylvania in Philadelphia says with a grimace, "We are already studying contemporary dinosaurs."

Raven

Only one-sixth of the plant species in the tropical forest understory have been identified.

Still more disturbing data come from Ghillean T. Prance of the New York Botanical Garden in the Bronx: "Thousands of acres of rain forests along the Amazon are being cleared each year to provide new roads, charcoal for steel mills and cattle pastures." And even more depressing statistics are offered by P. H. Raven of the Missouri Botanical Garden in St. Louis: "Thirty-six percent of the tropical forests in South America and 63 percent of those on the Indian subcontinent have already been removed, the tropical forests in the Philippines may be gone in the next 5 to 10 years, and those in Indonesia in the next 15 to 20 years."

These and similar Cassandras, however, are trying to learn about the tropical forests in hopes that their discoveries might help save at least some of them for posterity.

For instance, Carl F. Jordan of the Venezuelan Institute of Scientific Investigation in Caracas and his colleagues know that long-term agricultural attempts in the Amazon River region have failed because the mineral soil is sandy and has few nutrients. They asked how lush rain forests manage to thrive in such impoverished soil, and tried to find the answer by studying a tropical forest site between Venezuela and Brazil that represents much of the Amazon River basin.

They found a startling explanation, Jordan reports. Tropical forest vegetation in that area of the world forms an incredibly thick root mass (15 cm to 30 cm thick), which rapidly absorbs nutrients from rotting vegetation. As a result, only one-tenth of one percent of the nutrients leach below the root mass into the mineral soil. Still another reason that the forests do so well in such soil, the researchers have found, is that lichens and mosses growing above the root mass also fix nitrogen from the air and scavenge nutrients from rain.

Additional tropical forest research reveals an incredible diversity of tree species in some tropical forests and a marked paucity in others. Ashton has found as many as 300 different tree species among 1,000 individual trees in a five-acre forest region in Malaysia. Jordan reports even greater species diversity for Central and South America.

What is the explanation for such diversity? There have been no drastic changes in Malaysian geography during tens of millions of years, Ashton says, so Malaysian tree diversity may reflect a uniquely long period of uninterrupted evolution. However, he has found that the levels of potassium and phosphorus are low in the soil where these trees grow, and that where trace element levels are high, tree diversity is consistently low. So soil composition appears to influence whether a Malaysian forest will contain many or only a few tree species, Ashton concludes. Jordan, in contrast, reports that soil composition of trace elements cannot explain the vast tree diversity in Central and South America. "The soils there are fertile with high levels of potassium and phosphorus," he says.

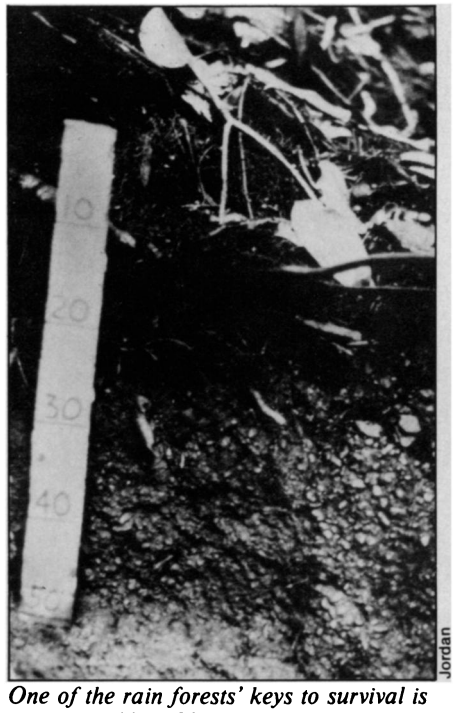
Ongoing taxonomy (species collection and identification) shows that tropical forests also contain a wealth of different plant species in their understories. And only one-sixth of all these plants have been identified so far, Raven stresses. Prance estimates that there are about 90,000 species of flowering plants, 50,000 species of fungi and 5,000 species of ferns in New World tropical regions; 30,000 species of flowering plants, 20,000 species of fungi and 1,000 species of ferns in African tropical regions; and 35,000 species of flowering plants, 20,000 species of fungi and 6,000 species of ferns in Southeast Asian tropical regions.

But not all plants do well in the tropical forest undergrowth. Janzen has found that there are only 1.3 plants in flower for every kilometer through the Malaysian undergrowth compared with 30 plants in flower in the Costa Rican tropical forest. This he attributes to poorer soils in Southeast Asia and to the peculiar natural history of the dominant Malaysian rain forest trees. Janzen has also found few flower-visiting birds, bees and butterflies in Malaysian tropical forests. This he attributes to the paucity of flowering plants there.

However valuable such disparate insights into the tropical forest ecosystem are, of course, they hardly provide a holistic picture of how it works. Nor do they provide easy answers to its preservation or management. Obviously, much more information needs to be collected about the tropical forest before scientists can obtain such a picture or provide practical guidance.

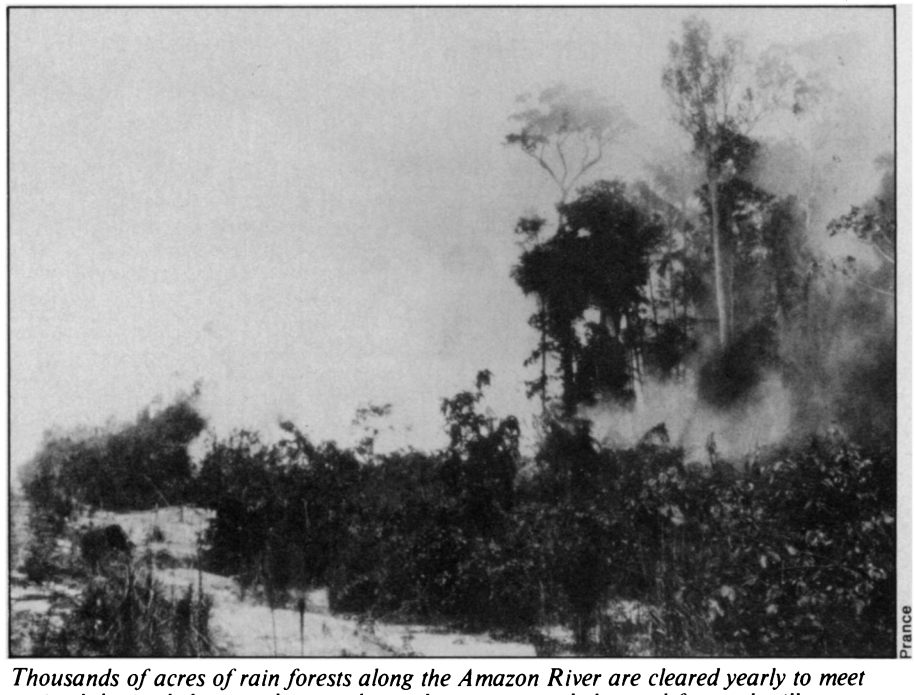
For instance, Ashton says that botanists need to learn more about the breeding habits of those trees that make up such diverse tropical forests. Yet obtaining such information is physically challenging, to say the least. Ashton and his colleagues are currently using a boom, winch and chair to hoist themselves into 130 foot-high trees in Southeast Asia in order to obtain the fruits necessary for breeding studies. Prance states that botanists need to collect more plant specimens and their fruits from tropical forests. They need to collect more liquid as well as conventional dried materials, and more and better aquatic plant, palm and bamboo specimens. Also needed, he adds, is research into the photosynthesis, nitrogen fixation and hybridization of such plants. Still another neglected research area, Janzen points out, is plant-animal interactions in the tropical forest. (If it's tough climbing a mammoth tree to study its reproduction, imagine the challenge of studying the life style of a snake climbing that tree!)

If such information is going to help save tropical forests, botanists from the developed countries will need to share their information with developing host countries, the above researchers concur. They also agree that if research is going to take place in time to save tropical forests, botanists from the developed countries have a moral responsibility to help botanists in developing countries meet the challenge. A prime example of such cooperative research is that in which Jordan is participating. Botanists from the United States and West Germany are working with Venezuelan botanists. Their joint efforts are being conducted like the tropical forest biome studies of the International Biological Program, which ended in 1977 (SN: 9/8/73, p. 156). □



One of the rain forests' keys to survival is producing 10 to 30 cm-thick root masses.

Ashton's colleague Chan Hung Tuck uses boom and chair to reach a giant tree top.



Thousands of acres of rain forests along the Amazon River are cleared yearly to meet societal demands by providing roads, cattle pastures and charcoal for steel mills.