
emphasis on traditional proofs. "Proofs are the only laboratory instrument mathematicians have," he says, "and they are in danger of being thrown out."

The "New" Tuberculosis

"A Plague Returns" by Mark Earnest and John A. Sbarbaro, in *The Sciences* (Sept.-Oct. 1993), New York Academy of Sciences, 2 E. 63rd St., New York, N.Y. 10021.

Along with the rise of acquired immunodeficiency syndrome (AIDS) and human immunodeficiency virus, there has been an unexpected resurgence of tuberculosis (TB) in recent years. The newspapers report ominously that today's TB is drug resistant. Yet all but "a minuscule fraction" of the 27,000 active TB cases today are treatable, note Earnest and Sbarbaro, of the University of Colorado Health Sciences Center. The chief problem—and danger to uninfected Americans—is that a large proportion of patients almost certainly will fail to take their prescribed medicines.

When the two front-line TB drugs (isoniazid and rifampin) are combined with one or two back-up medications, most patients can be cured within six to nine months. The problem that physicians face in treating the disease is that mutation by the TB bacillus can result in organisms resistant to one or more of the drugs. "Luckily," the authors write, "mutations of *M. tuberculosis* are rare: Only one of every 100,000 organisms descended from one bacillus is resistant to the action of isoniazid and just one in a million can withstand the effects of rifampin or streptomycin."

But the treatable victims themselves often fail to cooperate, Earnest and Sbarbaro note. "Studies in the past 40 years have consistently shown that 35 percent of all people—tuberculosis patients and otherwise—do not take the medications prescribed for them." That puts others in danger, since tuberculosis needs only an exchange of air to spread. (Each contagious person, on average, infects five other people before the disease is discovered.)

A TB patient whose doctor has correctly

prescribed three effective drugs may suspect that the three medications are causing his upset stomach. Without consulting the physician, he decides to take only one of the drugs. The patient may feel fine for a while, because the lone drug still kills vast numbers of the organism. But all the bacilli resistant to that particular drug "continue to reproduce, ultimately reaching numbers sufficient to recreate the classic symptoms of tuberculosis: progressively severe fatigue, weight loss, night sweats, and coughing." At that point, the patient reaches for one of the drugs he had stopped taking, but it is too late: By the normal process of genetic mutation, a whole new generation of organisms resistant to the new drug *and* the old one has emerged. By taking just one drug at a time, instead of all of the prescribed medications together, the patient has allowed a monster of resistance to emerge.

How can TB patients be made to take their prescribed medications? The use of newly developed combination pills will help, but they are not a cure-all, the authors say. What needs to be done, they contend, is what the Denver Health Department did as early as 1965. It assigned staff members "to bring high doses of the medications to the patients (or the patients to the medication)." That approach is not cheap, of course, but it may be essential, the authors say, if the plague of TB is to be beaten back again.

Tempest In The Tropics

"The Deforestation Debate" by Richard Monastersky, in *Science News* (July 10, 1993), 1719 N St. N.W., Washington, D.C. 20036; "Tropical Deforestation and Habitat Fragmentation in the Amazon: Satellite Data from 1978 to 1988" by David Skole and Compton Tucker, in *Science* (June 25, 1993), American Assoc. for the Advancement of Science, 1333 H St. N.W., Washington, D.C. 20005.

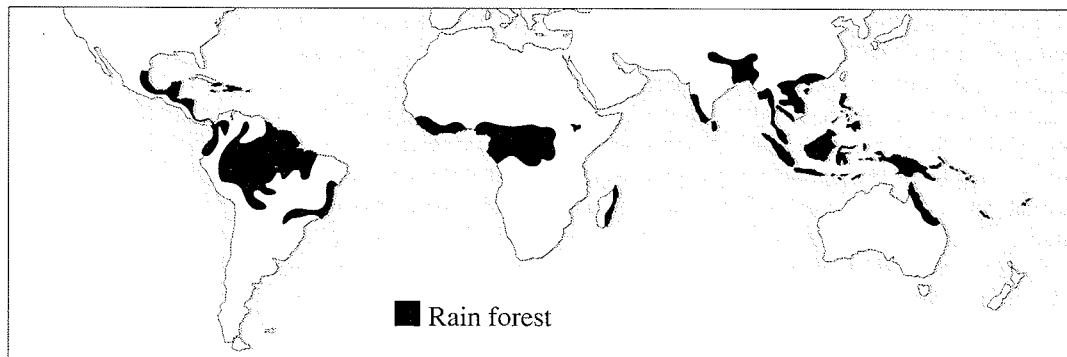
Deforestation became a household word during the late 1980s, when rock stars, movie actors, and other celebrities cranked up a crusade to save tropical woodlands, particularly in the Brazilian Amazon. Tropical forests are indeed important.

Although they occupy less than seven percent of the Earth's surface, they are home to at least half of all plant and animal species. Moreover, loss of forests increases the amount of carbon dioxide in the atmosphere, and thus might affect the planet's climate. But recent studies, reports Monastersky, a *Science News* writer, suggest that the extent of deforestation in the Brazilian Amazon has been much exaggerated. Nevertheless, the threat to biodiversity still may be considerable.

In 1988, Alberto Setzer of Brazil's National Space Research Institute (INPE) calculated that a whopping eight million hectares (or 19.8 million acres) of forest had been cleared during 1987 within the legally defined Brazilian Amazon (which includes only part of the country's tropi-

and the National Institute for Research on Amazonia, based in Manaus, Brazil, have measured deforestation another way, by mapping cleared areas on images taken by Landsat satellites. Studies that relied partly on that technique indicated that forest losses in the Brazilian Amazon averaged 2.1 million hectares per year between 1978 and 1989—about one-quarter of Setzer's original estimate for 1987. In 1989 and '90, losses average 1.4 million hectares.

The latest estimate is even lower. Skole, of the University of New Hampshire, and Tucker, of the National Aeronautics and Space Administration's Goddard Space Flight Center in Greenbelt, Maryland, compared 210 Landsat images covering the entire Brazilian Amazon in 1978 and 1988. They found that the deforested



The Brazilian Amazon, with more 3.5 million square kilometers of tropical forest, is the largest continuous region of such forest in world; next are Indonesia (1.1 million) and Zaire (1 million).

cal forests). Setzer and his team of researchers arrived at that alarming figure—which represented more than two percent of the forest—by using data collected by infrared sensors on a U.S. weather satellite to gauge the number and extent of fires in the region. They then assumed that 40 percent of the fires were on newly cleared forest. Their estimate, though challenged by other researchers, found its way into several well-publicized surveys of deforestation worldwide, including one by the Washington-based World Resources Institute. "Brazil emerged from the [World Resources Institute] study looking like the ultimate forest destroyer, responsible for roughly one-third to one-half of the global deforestation total," Monastersky notes.

In recent years, however, researchers at INPE

area grew from 7.8 million hectares in 1978 to 23 million a decade later, for an average annual loss of "only" 1.5 million hectares. Overall, they found, the "closed-canopy" forests of the Amazon shrank by six percent over the 10 years.

Unfortunately, there is bad news along with that relatively good news. Skole and Tucker found that the area of disturbed habitat *surrounding* cleared areas in the Amazon grew by more than four million hectares per year between 1978 and 1988. Vast areas of Amazon forest, although not being totally cleared, are being broken up or stripped of some of their trees. As a result, the threat to biological diversity is not all that much less than Alberto Setzer's faulty 1988 estimate of total deforestation led people to think.