

The Deforestation

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Estimates vary widely over the extent of forest loss

By RICHARD MONASTERSKY

As tales of burning forests captured headlines in the late 1980s, a string of rock stars, movie actors, and even ice cream makers joined the fight to save tropical woodlands, helping to transform the awkward term "deforestation" into a household word. But recent studies have produced markedly different estimates of the pace of clearing, raising questions about the accuracy of deforestation figures that have floated around policy circles in recent years.

While tropical forests are certainly vanishing at a disturbing rate, the widespread disagreement over deforestation estimates makes it difficult for government officials and scientists to assess the problem. That, in turn, hampers efforts to gauge the threat of related issues, such as habitat destruction and global warming.

Concerns about previous deforestation estimates emerged in the last few years as researchers from a number of countries looked into the problem, often using more reliable methods than before. Most recently, a study published in the June 25 *SCIENCE* confirmed suspicions that several earlier assessments had drastically overestimated the rate of forest destruction in the Brazilian Amazon basin, thereby inflating some global estimates.

The Brazilian case provides a dramatic example of how different researchers can arrive at markedly divergent conclusions concerning the extent of deforestation. In 1988, Alberto Setzer of Brazil's National Space Research Institute (INPE) used data collected by infrared sensors on a U.S. weather satellite to gauge the number and extent of fires within the legally defined Brazilian Amazon — an area that includes only part of Brazil's tropical forests. Assuming that 40 percent of the fires occurred on recently cleared forest, Setzer's team calculated that 8 million hectares of forest were cleared during 1987 within the legal Amazon — an almost unfathomable amount equal to 2.2 percent of the forest.

Although contested by other researchers, that alarming number found its way into several global deforestation estimates at the time. In particular, the Washington, D.C.-based World Resources

Institute (WRI) included Setzer's Amazon figure in a 1990 worldwide assessment. The high number for Brazil drove up WRI's global estimate for tropical forest loss, which was calculated at 16.4 to 20.4 million hectares per year.

Despite the controversy over the Brazilian estimate, WRI's global total seemed to agree with a provisional number issued by the United Nations Food and Agriculture Organization (FAO), which put tropical deforestation at 17 million hectares per year for the period 1981 to 1990 (SN: 7/21/90, p.40).

Brazil emerged from the WRI study and others looking like the ultimate forest destroyer, responsible for roughly one-third to one-half of the global deforestation total. That triggered a round of international finger-pointing, focusing criticism on Brazil for allowing such rapid clearing of the Amazon. Brazil, however, complained that the estimates were inaccurate and that deforestation rates had never reached such heights, says Jayant A. Sathaye, an energy and forestry analyst at the Lawrence Berkeley (Calif.) Laboratory.

More recent studies have backed up Brazil's claims. In the last few years, researchers at INPE and the National Institute for Research on Amazonia, based in Manaus, Brazil, challenged Setzer's fire-counting technique and began gauging deforestation by mapping cleared areas on images taken by Landsat satellites. Studies that relied partly on this technique indicated that deforestation within the Brazilian Amazon averaged 2.1 million hectares per year between 1978 and 1989 and 1.4 million hectares from 1989 to 1990.

The newest estimate for Brazil goes even lower. David Skole of the University of New Hampshire in Durham and Compton Tucker of NASA's Goddard Space Flight Center in Greenbelt, Md., studied some 200 Landsat images covering the entire Brazilian Amazon for 1978 and 1988, allowing them to map the extent of forest and cleared land for those two years. The images showed that deforested areas covered 7.8 million

hectares in 1978 and 23 million hectares in 1988, implying an average annual loss rate of 1.5 million hectares, Skole and Tucker report in their recent *SCIENCE* paper.

Conventional wisdom holds that Brazil's deforestation slackened dramatically after peaking in 1987, in part because the country's economy slowed, reducing the land speculation that had motivated people to clear forest for new farms or rangeland. If true, that standard theory could explain why Setzer and others found so much more deforestation going on at the peak period than others have seen in the last four years.

But Skole dismisses that explanation. "A lot of people are using it as a convenient excuse for being wrong," he contends. Although he, too, finds that deforestation rates have dropped in Brazil, he says the average for the late 1980s did not range much above 2 million hectares per year — not high enough to explain the earlier estimates.

If Brazil's actual rate of forest loss is so much lower than studies had previously suggested, how accurate are the various global estimates? Skole, for one, has little faith in the sea of numbers. "All of the published global studies do not use a systematic approach," he says. "They use secondary and tertiary sources, anecdotal reports, different time periods, different methodologies, different terminology. It's the state of affairs right now in deforestation monitoring. It's kind of a sad state of affairs, but people are using whatever resources they have, which are not adequate."

Before deforestation gained widespread attention in the late 1980s, most researchers relied on an estimate by FAO, which concluded in 1981 that tropical deforestation worldwide averaged 11.3 million hectares per year during the late 1970s. That number stood uncontested because it was the only figure available.

Since 1989, FAO has been working to update that global estimate. In 1990, it released a provisional figure of 17 million hectares of deforestation per year; but this March it lowered the global total to 15.5 million hectares per year for the period 1981 through 1990. K.D. Singh, leader of FAO's forestry assessment team in Rome, explains the change by saying that his organization's 1981 study overestimated the amount of forest remaining in the tropics at that time, a mistake that had inflated its 1990 estimate.

By all accounts, the latest FAO assessment represents the most comprehensive global study to date, having collected scattered data from individual countries or provinces and woven them together using a mathematical model based on information about forest conditions, population density, and ecological zones. Singh says his team has striven to find the best data available, although the quality and type of data vary from one region to

another. Some local and national governments have conducted forest surveys using satellite images, while others have used ground-based approaches for estimating deforestation.

The success of the FAO effort remains uncertain, however. Forestry researchers cannot yet check the new global assessment against other studies because FAO released only regional deforestation estimates and has not yet issued tallies for individual countries.

For instance, the FAO numbers reported in March include 6.2 million hectares of forest lost annually in tropical South America from 1981 through 1990. That region includes Brazil and six other nations. To some researchers, the South American total appears unrealistically high. If FAO chose the best data available

cannot respond fully to criticisms of the new deforestation assessment until FAO publishes its more complete report, which will include a breakdown of figures for individual countries. The report should come out in late summer, he says. Singh also hopes to submit the study to a panel of scientists for peer review.

Some researchers, however, wonder whether the FAO will delay releasing the long-awaited numbers, perhaps indefinitely, in hopes of avoiding the intense scrutiny that will descend on this study.

Ken Andrasko, chief of a forestry section in the Environmental Protection Agency's climate change division, suggests that deforestation studies have acquired political significance in the wake of last year's Earth Summit in Rio de Janeiro, where countries signed treaties

much more intact forest than other parts of the globe. According to FAO, the highest percentages of deforestation during the 1980s occurred in southeast Asia, Central America and Mexico, and West Africa.

Looking beyond the problem of absolute deforestation, experts say fragmentation and degradation of remaining forests also present substantial threats, especially to the diversity of plant and animal life in some of the most biologically rich habitats on Earth. Indeed, Skole and Tucker found that the area of disturbed habitat surrounding cleared areas grew by more than 4 million hectares per year in Brazil's Amazon, much faster than the pace of deforestation there. "Even though the rate of deforestation was much lower than previous estimates, the effect on biological diversity was much greater," says Tucker.

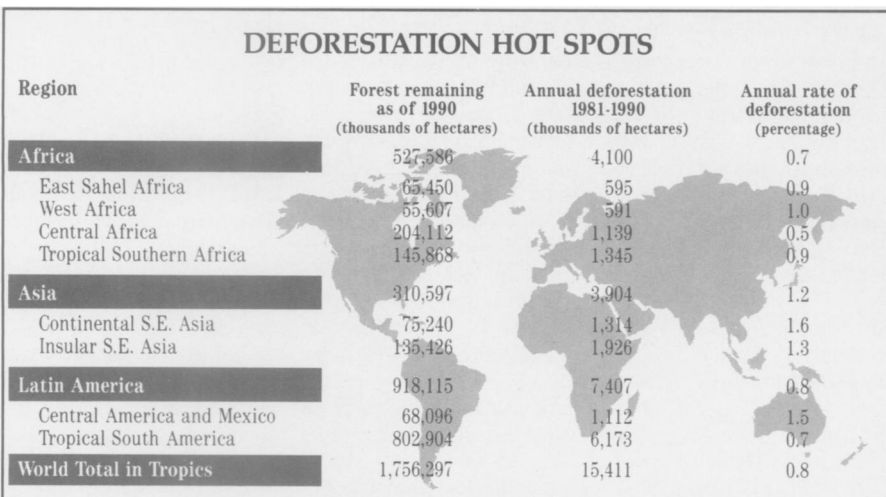
To address such concerns, the second phase of the FAO study will examine the extent to which people have broken up forest or removed trees without stripping an area bare. As part of this work, Singh's team has purchased high-resolution satellite images for 117 randomly selected regions corresponding to about 10 percent of the forest-covered land in the tropics. For quality control, his group also used these satellite images in the first phase of the study to improve its deforestation estimates.

Ideally, FAO would purchase satellite images for the entire tropical belt. But Singh says the organization cannot afford the thousands of images needed to cover the tropics.

An ongoing NASA project may help complete the picture. In a program called Landsat Pathfinder, NASA is funding the purchase of satellite photos covering some three-quarters of the world's tropical rainforest. According to Skole, a participant in the project, it will provide the most accurate assessment of deforestation to date. As with the Brazilian case, the research done with satellite data could show that past estimates have been inflated. But Skole says the new study may also uncover much more deforestation than had been suspected.

The NASA effort does have some critical limitations. Because it focuses mostly on tropical rainforest, it will not include all open forests and dry forests, which cover just as much territory as do rainforests. Moreover, the project is a one-shot deal, not to be repeated. Experts say periodic updates are needed, not only to assess the changing deforestation threat but also to gauge the resulting increase in concentrations of carbon dioxide.

Despite its drawbacks, however, the NASA project should finally provide a means of checking the global estimates. "I feel confident," says Skole, "that in the next two to three years, as our work comes forward, we will have a much better idea because we are applying a consistent method." □



Source: Food & Agriculture Organization

at the time (the Brazilian estimates of 2 million hectares lost annually in the legal Amazon during the 1980s), that would leave more than 4 million hectares cleared each year outside the Brazilian Amazon.

Where, then, is all that missing South American deforestation? That is precisely the issue raised by an international committee of researchers called the Intergovernmental Panel on Climate Change. In a 1992 report, the panel questioned FAO's South American estimate (which has since decreased slightly), saying, "This seems to ascribe a very high proportion (about 70 percent) of the total deforestation in South America in the late 1980s to the region outside the Brazilian Amazonia, even though this region accounts for very little of the total amount of forest on the continent."

But FAO's Singh says researchers have not appreciated the extent of South American deforestation in the open forest outside of the rainforest of the Brazilian Amazon. "This has been one of our main findings — that the deforestation outside the legal Amazon basin is quite high," he told SCIENCE NEWS. The open forest faces a greater threat because it is more accessible and because more people live there than in the rainforest, Singh says.

Beyond those hints, Singh says he

cannot respond fully to criticisms of the new deforestation assessment until FAO publishes its more complete report, which will include a breakdown of figures for individual countries. The report should come out in late summer, he says. Singh also hopes to submit the study to a panel of scientists for peer review.

"It's going to be increasingly difficult to publish those individual country [deforestation] estimates. If the number is higher or lower, it has very real political consequences now," Andrasko says.

That lesson was not lost on Brazil, which released its own deforestation data on the eve of the Rio summit. Such studies, as well as the one by Skole and Tucker, show that while Brazil may still be number one, it no longer sits in a category of its own, far and above every other nation on the list of forest destroyers.

Although the FAO did not provide estimates for individual countries, the data released earlier this year clearly indicate that tropical forests are shrinking worldwide. Indeed, parts of other continents are losing a greater percentage of their forests than is South America, which has