Selective Logging Causes Widespread Destruction Of Brazil's Amazon: Study

October 21 2005

Selective logging - the practice of removing one or two trees and leaving the rest intact - is often considered a sustainable alternative to clear-cutting, in which a large swath of forest is cut down, leaving little behind except wood debris and a denuded landscape.

But a new satellite survey of the Amazon Basin in Brazil reveals that every year unregulated selective logging of mahogany and other hardwoods destroys an area of pristine rainforest big enough to cover the state of Connecticut.

The survey, published in the Oct. 21 issue of the journal *Science*, was made possible because of a new, ultra-high-resolution satellite- imaging technique developed by scientists affiliated with the Carnegie Institution and Stanford University.

"With this new technology, we are able to detect openings in the forest canopy down to just one or two individual trees," says Carnegie scientist Gregory Asner, lead author of the Science study and assistant professor, by courtesy, in the Stanford University Department of Geological and Environmental Sciences.

"People have been monitoring large-scale deforestation in the Amazon with satellites for more than two decades, but selective logging has been mostly invisible until now."

The Amazon Basin contains the largest contiguous rainforest on Earth--a

vast region nearly as big the continental United States that includes portions of Brazil and seven other South American countries.

Conventional satellite surveys reveal that, in an average year, an estimated 5,800 square miles of Amazon forest (roughly the size of Connecticut) are burned or clear-cut to make way for cattle ranching, farming and other development. But when selective logging is factored in, that figure increases two-fold, Asner and his co-workers found.

"This was totally surprising to us and alarming to our colleagues, especially those interested in conservation, climate change and the ability of governments like Brazil to enforce environmental laws," he notes.

A large mahogany tree can fetch hundreds of dollars at the sawmill, making it a tempting target in a country where one in five lives in poverty. "People go in and remove just the merchantable species from the forest," Asner says.

"Mahogany is the one everybody knows about, but in the Amazon, there are at least 35 marketable hardwood species, and the damage that occurs from taking out just a few trees at a time is enormous. On average, for every tree removed, up to 30 more can be severely damaged by the timber harvesting operation itself. That's because when trees are cut down, the vines that connect them pull down the neighboring trees."

Previous studies have shown that in logged forests, light penetrates to the understory and dries out the forest floor, making it much more susceptible to burning.

"That's probably the biggest environmental concern," Asner says.

"But selective logging also involves the use of tractors and skidders that rip up the soil and the forest floor. Loggers also build makeshift dirt

roads to get in, and study after study has shown that those frontier roads become larger and larger as more people move in, and that feeds the deforestation process. Think of logging as the first land-use change."

Logging also has a significant impact on the food web, Asner says, noting that nearly a third of the planet's land species inhabit the Amazon rainforest--from insects to jaguars and everything in between. "Studies constantly show declines in primate and other mammal populations following selective logging, and rates of forest re-growth indicate that full restoration of habitats are likely slow for large predators," the authors write.

Another concern is climate change. "When a tree trunk is removed, the crown, wood debris and vines are left behind to decompose, releasing carbon dioxide gas into the atmosphere," Asner says. "Sawmills often have an efficiency level of about 30 to 40 percent, so large amounts of sawdust and scrap also decompose into atmospheric CO_2."

An estimated 400 million tons of carbon enter the atmosphere every year as a result of traditional deforestation in the Amazon, and Asner and his colleagues estimate that an additional 100 million tons is produced by selective logging. "That means up to 25 percent more greenhouse gas is entering the atmosphere than was previously assumed," Asner explains, a finding that could alter climate change forecasts on a global scale.

Cryptic deforestation

While clear-cuts and burn-offs are readily detectable by conventional satellite analysis, selective logging is masked by the Amazon's extremely dense forest canopy. "We've been working for eight years to develop analytical techniques that can detect this very cryptic form of deforestation," Asner says. "Using satellite data, we developed a model that detects the physical changes to the forest. We started to have success

about three years ago at a scale of about 200 hundred square miles. This was the first solid, quantitative detection of logging-related damage to forest canopies."

By late 2004, the research team had refined its technique into a sophisticated remote-sensing technology called the Carnegie Landsat Analysis System (CLAS), which processes data from three NASA satellites--Landsat 7, Terra and Earth Observing 1--through a powerful supercomputer equipped with new pattern-recognition approaches designed by Asner and his staff.

"Each pixel of information obtained by the satellites contains detailed spectral data about the forest," Asner explains. "For example, the signals tell us how much green vegetation is in the canopy, how much dead material is on the forest floor and how much bare soil there is. Extracting those data has been a Holy Grail of remote sensing. With CLAS, we've been able to obtain a spatial resolution of 98 feet by 98 feet for the Brazilian Amazon Basin. That's huge."

CLAS technology

For the Science study, the researchers conducted their first basin-wide analysis of the Amazon from 1999 to 2002. "With CLAS, data analysis that used to take a year now can be done in hours," Asner says. "We can run the entire Amazon overnight. In fact, the 600 images produced for the study were analyzed by just three technicians in my lab at the Carnegie Department of Global Ecology."

The results of the four-year survey revealed a problem that is widespread and vastly underestimated, according to Asner. "We found much more selective logging than we or anyone else had expected--between 4,600 and 8,000 square miles every year of forest spread across five Brazilian states," he says.

To corroborate their findings, the researchers compared the satellite observations against on-the-ground field measurements of canopy damage following selective logging.

"We surveyed thousands of hectares of logged forest, mapping the precise location of each felled tree, skid, log deck, etc.," Asner explains. "We then measured the canopy damage at each of the 11,000 GPS [Global Positioning System] points to compare the satellite-based canopy damage to field-based canopy damage."

The results of the comparative analysis "proved that traditional analytical methods missed about 50 percent of the canopy damage caused by timber harvesting operations," Asner and his co-authors wrote.

The Science study was conducted in close collaboration with the Brazilian agricultural research agency , including co-author Jose N. Silva. "The Brazilian government has laws against these logging operations, but they can't enforce them over the enormous geography we're talking about," Asner says. "They can't have a cop on every corner, so our idea is to give them these results in hopes that it might help their law enforcement effort."

Other co-authors of the study are David Knapp, Eben Broadbent and Paulo Oliveira of the Carnegie Institution's Department of Global Ecology at Stanford; and Michael Keller of the USDA Forest Service and the University of New Hampshire. Research was supported by the Carnegie Institution at Stanford and NASA.

Copyright 2005 by Space Daily, Distributed United Press International

Citation: Selective Logging Causes Widespread Destruction Of Brazil's Amazon: Study (2005,

October 21) retrieved 3 May 2024 from https://phys.org/news/2005-10-widespread-destruction-brazil-amazon.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.