

Monitoring Fragile Ecosystems

Mapping the Recovery of a Tropical Rainforest after Logging

Tropical rainforests hold a wealth of natural treasures: timber, medicinal plants, fruits, nuts, rubber, chocolate, and other sustainable resources. Rainforests also produce oxygen that circulates around the globe. But sustainability, biodiversity, and the health of the planet's ecosystems are seriously threatened if uncontrolled exploitation destroys these forests.

Scientists have been studying how small areas of forest recover after various logging practices. These practices range from intensive (removing most trees) to selective (cutting only some trees and protecting future resources).

However, to understand forest recovery over larger areas, scientists need new approaches. Remote sensing offers useful techniques for this purpose. These techniques use sensors, such as instruments on aircraft and spacecraft, to collect information about distant forests.

This project uses remote sensing data to map the recovery of a natural rainforest in Costa Rica after it was selectively logged from 1999 to 2005. The research has two main goals: to better understand how a forest recovers from selective logging and to determine whether forest areas logged at different times can be distinguished on the basis of how they reflect light.

In addition to the remote sensing data, the research uses data from a geographic information system

(GIS). The GIS includes information about the geographic location and species of logged trees, the direction in which trees were felled, and the roads used to transport the logs.

The remote data, from satellites and aircraft, take the form of specialized, high-resolution images of untouched forest and forest logged at various periods. These images are like a stack of photographs in which each photograph captures only a specific wavelength of light. Researchers are studying these images to determine whether selective logging changed the way the forest reflects

light. If so, can these changes be used to determine when the forest was logged?

To handle the complex data from the remote images, this research will use new analytical tools from the field of machine learning, in which computers learn from experience and develop solutions to difficult or complex problems.

The use of remote sensing data, the analytical approaches, and the ecological interpretations from this project may support future research and forest management in this area and in other tropical rainforests.

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Typical Costa Rican rainforest canopy
subject to selective management