Environmental Case Study

Protecting Forests to Preserve Rain

How could cutting down trees in low-elevation forests affect tiny toads and beautiful birds on mountaintops many kilometers away? Recent climatological research in Costa Rica suggests a connection that may help solve a decade-old mystery. It may also suggest new conservation policies for the tropics as well as other parts of the world.

Monteverde, Costa Rica, is home to one of the world's best-known cloud forests. This lush mountaintop, continually bathed in fog and mist, is carpeted with a rich profusion of plants and is home to a host of rare birds, insects, and amphibians that inhabit the cool, moist forest. For decades, the Monteverde Cloud Forest Reserve has been an El Dorado for biologists and ecotourists eager to see the beautiful resplendent quetzal (Pharomachrus mocinno), Costa Rica's national symbol.

The reserve also is famous for the last known sighting of the glowing golden toad (Bufo periglenes), which disappeared abruptly in the late 1980s. Until 1987 the tiny toads congregated by the hundreds in rain pools on the cloud forest floor. In 1988, however, they were scarce, and the next year only a few, scattered individuals could be found. Since 1990 not a single golden toad has been seen anywhere in the world. What happened to them? No one knows for sure. Air pollution, waterborne contaminants, and diseases have been suggested as possible causes for their disappearance, but no conclusive evidence for any of these has been found. The forest itself still seems pristine and intact, having been protected from logging and grazing to preserve the watershed for lower-elevation villages.

Now scientists are realizing that mountaintops, like islands, may not be as isolated and independent as they seem. Satellite images show that the life-giving clouds that sustain Costa Rican mountain flora and fauna are disappearing, and the reason appears to be logging in far-distant lowlands. The clouds are formed as moisture-laden Caribbean winds sweep up the eastern slope of Costa Rica's central Cordillera de Tilarán range. When they reach high elevations, the winds cool and moisture condenses to form the fog and mist on which the biological community depends. Much of the moisture carried by the wind comes from the lowland rainforest over which it blows before reaching the mountains. When those forests are cut down, plant transpiration declines markedly. Furthermore, the pastures and croplands created by deforestation warm the air and dry it out even more.

After a century of logging and fires, only 18 percent of Costa Rica’s lowland forest east of the mountains remains untouched. As a result, the air reaching the mountains is drier than normal, and clouds that once covered the mountaintops are sparse or even completely absent some times in the year. The bottoms of the clouds also are at much higher elevations, and areas once bathed continually in mist and fog are now dry for days at a time. If breeding pools disappear, the golden toads can’t reproduce and the
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species quickly goes extinct. Similarly, if wild avocados, the quetzal's favorite food, fail to fruit because of dry conditions, the bird's survival may be threatened. If these trends continue, biologists worry that other rare and beautiful species that depend on the cloud forests may also disappear.

![Graph showing intact lowland forest and lowland forest harvested](image)

Although plants and animals within the Monteverde Reserve are protected from many types of abuse and misuse, we are discovering that park boundaries are not always enough to preserve a functioning ecosystem. Simply fencing a forest may not be sufficient to preserve it. Increasingly, we are recognizing that successful management of forests, parks, and reserves requires an understanding of the social, economic, and ecological context in which a reserve exists. In this chapter, we'll examine the strategies that have been used to conserve forests, rangelands, and areas of scenic beauty and biological importance.