

Clues for Tropical Forest Restoration

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The conversion of high diversity tropical forest into agricultural lands, particularly pastures for cattle grazing, has contributed to the high rate of species extinction. To conserve the biodiversity of these ecosystems, areas of primary forest must be protected, but many protected areas are now islands in landscapes dominated by agricultural lands, secondary forests, and urban development. Given that less than 5% of the area of most countries is protected, we no longer can focus only on these pristine areas. We also must better understand how to manage wisely the matrices of secondary forests and agricultural lands that surround these reserves, reducing the pressure on primary forest and providing habitat for many species.

In an effort to identify clues on how to restore tropical forest, this special section includes papers presented at the international conference "Tropical Restoration for the New Millennium" in May 1999. The conference was sponsored by The International Institute of Tropical Forestry, the Society for Ecological Restoration, the University of Puerto Rico, and the International Union of Forestry Research Organizations. Although few studies have been designed to restore high diversity tropical forest, many projects have described the vegetation dynamics and soil processes in abandoned agricultural and pasture lands. These studies can provide insights into how to accelerate the regeneration process by determining the major barriers to forest recovery and identifying solutions that are economically feasible and practical at large spatial scales.

Matthew Slocum identified logs and fern patches as important microsites for the establishment of woody seedlings in lowland forest in Costa Rica, presumably because there is less competition with grass species than in other sites. Rotting logs were also important microsites for seedling establishment in a study by Chris Peterson and Bruce Haines in premontane forest in

Costa Rica. J. K. Zimmerman et al. showed that low seed dispersal into abandoned lands could be a major barrier to forest recovery and that more than 90% of the seeds that arrived and established were wind dispersed. In montane forest of Costa Rica, K. D. Holl et al. also identified the lack of seeds and competition with grass as major barriers. In their paper, they emphasize the importance of taking a holistic view of the recovery process because seed predation, low seed germination, low nutrients, high light, and herbivory can also affect forest recovery. J. M. Posada et al. demonstrated that low level grazing and natural establishment of weedy shrubs could greatly reduce grass cover and facilitate the establishment of montane tree species in the Andes of Colombia. Bryan Finegan and Diego Delgado evaluated a 30-year-old abandoned pasture, and found that the two dominant species were wind dispersed and the structural and floristic characteristics of the site were very heterogeneous. T. M. Aide et al. described the woody vegetation recovery in a chronosequence of 71 abandoned pastures and found that, after approximately 40 years of recovery, density, basal area, aboveground biomass, and species richness were similar to those of old growth forest sites (>80 yr). Although the species richness recovered rapidly, the species composition was quite different. In a literature review, W. L. Silver et al. determined that reforestation of abandoned lands can lead to high levels of above- and belowground carbon fixation, which could have important implications for mitigating carbon dioxide emissions.

Although there is much interest in the protection and restoration of the biodiversity in tropical forests, funding for restoration is often very limited. This limited funding is reflected in the small temporal and spatial scales of these studies and in their concentration in only a few areas of the tropics. Nevertheless, the important role of tropical secondary forest as carbon sinks, as demonstrated in the Silver et al. manuscript, may lead to new sources of funding for tropical restoration projects in the future.

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