How to Reconstruct a Rain Forest

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Techniques to facilitate the recovery, of old-growth tropical rain forests have been widely theorized but are rarely tested through on-the-ground scientific investigation, due in large part to the logistical challenges of such an undertaking in these complex ecosystems. How ecological processes shape the countless different pathways of species composition observed in recovering forests is critical to reforestation design, as it forms the basis for counteracting obstacles to the restoration of diversity. In a first attempt at addressing this challenge, we tested the independent and combined effects of: a) distance to old-growth forest, b) availability of old-growth seeds, c) competition with secondary forest understory plants, and d) accessibility by seed predators on resultant patterns of old-growth seedling establishment in a 15 year-old secondary forest of the Ecuadorian Chocó.

Our results revealed remarkably clear patterns that have now held constant for six years of seedling censuses. Constraints to old-growth seedling establishment arose almost exclusively at the seed stage either via failure to disperse or predation by rodents, while competition with other understory plants and distance to old-growth forest did not play limiting roles. The benefits of adding seeds outweighed the constraints imposed by seed predation, and led to marked increases in the number of old-growth seedlings and old-growth species. These findings suggest that secondary forests may house a tremendous number of unoccupied seedling 'niches,' and that the majority of old-growth forest species are well adapted to fill them provided that they arrive.

Amy Rogers censusing seedlings.

Why Secondary Forests?

Along the pathway of tropical forest succession, secondary forest is by far the lengthiest stage. While pre-canopy 'pioneer vegetation' is shaded out by a young forest canopy in as little as five to ten years, secondary forest can be comprised by several distinct phases, each of which takes from 30–70 years to turn over. If there is a phase of tropical forest recovery that needs accelerating, this is it. Furthermore, secondary forests now represent a rapidly escalating proportion of tropical deforested lands due to current urbanization trends. Recent estimates indicate that for every 6–7 hectares of old-growth forest cut in the tropics, one hectare reverts back to secondary forest via succession. Nonetheless, our knowledge of secondary forest regeneration ecology remains in its infancy.

Why reforestation?

Deforestation is only part of the equation in today's rapid loss of tropical forests. Isolated forest tracts undergo a self-perpetuating cycle of ecosystem decay that continues long after the last chain-saw has been set down. Caused by 'edge effects' that lead to habitat degradation from the outside-in, size-related reductions in gene pool diversity, and inadequate habitat for top predators, this cycle poses an equal and perhaps more complex threat to forest preservation than deforestation itself. Tropical ecologists now agree that there are only two measures capable of reversing this trend: the rejoining of isolated forest tracts via wildlife corridors and the creation of 'buffer' zones at forest perimeters. Both of these measures are fundamentally dependent upon the reconstruction of functioning forest habitat through reforestation.

The Pinchot Institute's Mache-Chindul Program

Our research focuses on the processes inherent to secondary forest succession that limit widespread recruitment of old-growth forest species. The fundamental goal of this research is to facilitate the development of ecologically-based reforestation practices that directly counteract obstacles to forest succession (i.e. 'assisted natural regeneration'), accelerating the establishment of old-growth forest. Investigations are based in the 119,000-hectare Mache-Chindul Ecological Reserve, one of two remaining expanses of Ecuador's Chocó rain forest—an internationally recognized conservation priority due to extraordinary levels of both endemism and deforestation pressure. These findings are providing preliminary indicators of successional potential and trajectory in the region's secondary forests, along with the first baseline ecological data for reforestation practices specific to the Chocó. We are currently focused on three specific lines of research: 1) in secondary forest, jump-starting the continued growth of established old-growth seedlings by manipulating available light levels in different forest strata, 2) in pioneer vegetation, finalizing a strategy that employs balsa as both an economic engine for reforestation and a means to accelerating canopy closure, 3) in 'altered' or heavily logged forest, conducting inventories of seedling and sapling communities to assess the need for intervention and develop appropriate methodologies. An additional, upcoming component of our work within the reserve will be purely socioeconomic in nature, focused on facilitating the development of community-run cacao cooperatives as a sustainable alternative to deforestation.

Clearing to light forest-floor seedlings.

Inside the Institute

Leigh Lindstrom Joins Pinchot as Communications Coordinator

Leigh Lindstrom recently joined the staff of the Pinchot Institute as the Communications Coordinator. Leigh plays the lead role in providing information about Pinchot Institute programs to a variety of audiences, through both print and electronic media. She also serves as the key contact for Pinchot Associates, and other donors and contributors to Pinchot Institute Programs. Leigh has expanded the social media outlets for the Institute, and keeps the friends and supporters of PIC updated on Facebook and LinkedIn. She has a Masters degree in Environmental Law and Policy from Vermont Law School, and received her B.A. in Social Ecology from the University of California, Irvine, where she was a Regent's Scholar. Prior to coming to the Pinchot Institute for Conservation, Leigh worked in environmental education and outreach for the Catalina Island Conservancy, the Irvine Ranch Conservancy, and the Sea and Sage Audubon Society.