

Tropical cloud forest restoration in the Clavijero Botanical Garden: from an abandoned pasture to a secondary forest to a Sanctuary

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The Clavijero Botanical Garden (CBG, central Veracruz, Mexico) of the Instituto de Ecología (INECOL) has maintained and managed a remnant of tropical montane cloud forest (TMCF), known as the Cloud Forest Sanctuary, since 1975. In this presentation, we show the results from an ecological restoration project that began in 2011, when a recently abandoned pasture was added as part of the CBG. For this, we describe the passive (i.e., undisturbed) and active (i.e., multi-species plantations) restoration practices conducted in the pasture and the outcomes of these up to date. We compared biomass production and vegetation structure results to the Sanctuary's young secondary forest and the old-growth forest (i.e., the reference site). To identify the potential barriers for recovery of the abandoned pasture, we first gathered the site baseline information: 1) history of land use, 2) landscape matrix, 3) temporal and spatial variability of abiotic (climate) and biotic characteristics (vegetation structure, floristic composition, soil macroinvertebrates, presence of vertebrates), and 4) soil seed banks and seed rain. Then, we experimentally determined the role of the exotic grass (*Cynodon plectostachyus*) in suppressing seed bank expression. After four years, the differences between active and passive restoration plots are evident: the active plots show clear signs of forest species recovering, whereas in the passive plots exotic grass persists.

In addition to this project, we have set a regional ecological restoration project in different elevation and land-use scenarios in 28 sites in the central Veracruz TMCF. We have also established enrichment plantations; one of these sites is located in the Sanctuary's secondary forest. The JBC has played a major role in this regional project as it has provided thousands of plants of the 26 species planted in the restoration areas. This is a clear example where the Botanic Garden has been of crucial importance to ecological restoration in Veracruz through research, development of propagation protocols (> 60 native tree species), management, and outreach to society.