

# Puerto Rico's Rainforest



**Dr. Mark Nelson Institute of Ecotechnics, UK & USA,  
Thrity Vakil, Tropic Ventures Education & Research Foundation, Puerto Rico**

## Overview

The period of economic and cultural change in Puerto Rico, from the 1950s to 1990, resulted in the largest event of forest recovery anywhere in the world. A host of socioeconomic policies and factors motivated people to abandon agricultural lands and activities and move from forested to urban areas and/or immigrate to the United States, while an increase in industrial production also drew people towards urban areas. As a result, Puerto Rican forest cover gradually increased from a low of about 7% in the late 1940s, to 35% in 1985. The island is currently about 57% forested, mostly by young secondary forest (that has re-grown following a major disturbance).

The forest of Puerto Rico's Las Casas de la Selva—or “Las Casas”—is the setting of an experimental sustainable forestry and enrichment project established in 1983, and supported by Earthwatch since 2000. Under Dr. Mark Nelson, the project goal is to develop ecologically sustainable approaches to timber production on land that is unsuited to long-term agricultural use. Puerto Rico's secondary forest is approaching a stage of recovery that could support sustained removal of useful timber from selected areas and, significantly, the opportunity to develop silvicultural methods (the care and cultivation of trees) that can improve the value of timber stands. These kinds of techniques can increase growth rates and the amount of marketable wood produced, while minimally impacting the local ecology.

If successful, the work could encourage similar practice in other forest areas, resulting in sustainable, productive use of forest resources throughout Puerto Rico. It may be applicable for

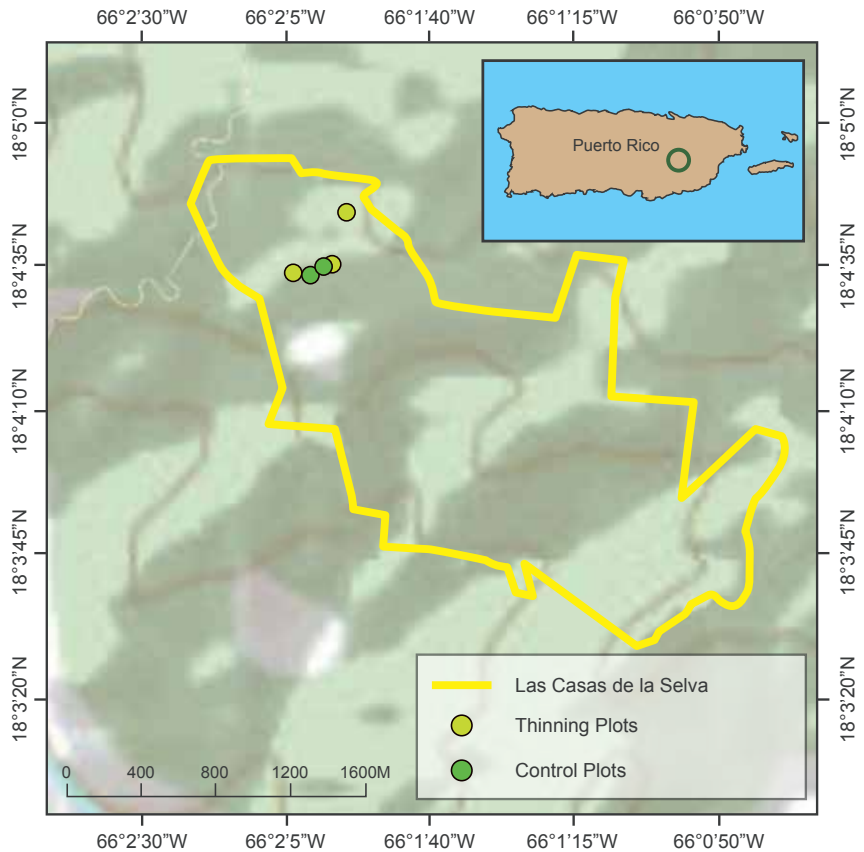


Figure 1: Map showing plots in the “Las Casas” forest where researchers are investigating thinning techniques on trees. Faster growth could help facilitate sustainable harvesting of the trees.

*Puerto Rico's secondary forest is approaching a stage of recovery that could support sustained removal of useful timber from selected areas.*

secondary rainforest in other tropical countries as well. Understanding how forest ecosystems function, how human societies relate to the natural environment, and how interaction can be mutually beneficial, can lead to a meaningful balance between the needs of a healthy, natural ecosystem and society.

The project objectives are:

- To examine the success of thinning techniques in our current plantings of mahoe and mahogany —both high value trees—and to examine the effectiveness of liberation thinning—removing trees to reduce competition for resources, particularly

light as the trees mature —based on maturation and volume of tree crops in secondary forest areas

- To conduct herpetological studies to identify which species of reptiles and amphibians are present; to determine the population density, population fluctuations, microhabitat use, and the effects of forest management on the herpetofauna of the forest
- To inventory, describe, and photograph the macrofungi. To create material which will aid in future fungal studies



Figure 2: The Puerto Rican crested anole (*Anolis cristatellus*). Herpetological studies gather information about anole ecology, and how anoles are affected by human activity in the forest.

### *Earthwatch's work could encourage similar practice in other forest areas, resulting in sustainable, productive use of forest resources throughout Puerto Rico.*

- To evaluate the availability and abundance of non-timber forest products that are of economic importance on the property, starting with vines (a source for fiber used in weaving and handicrafts)

## Outcomes

In 2010, Earthwatch fielded seven teams at Las Casas. Volunteer activities included measuring trees, counting lizards and frogs, tagging and identifying vine species, and helping set up new experimental plots for planting different tree and shrub species.

**Tree thinning:** In December 2007, two adjacent quarter-acre plots of line-planted mahogany were set up to begin a long-term study evaluating whether thinning techniques are effective at increasing mahogany growth rates. Less well-known species within the plots were also harvested during this process. Faster growth could help facilitate the sustainable harvesting of the trees. Initial measurements were

taken on all mahogany trees that were selected to remain in the plots. These measurements included tree diameter at breast height (1.3 meters), total height of the trees, commercial height of tree, commercial diameter, canopy diameter, and canopy class.

In March the following year, 19 mahogany trees were thinned in one of the quarter-acre plots, leaving the adjacent plot to serve as a control. That December, a second reading was taken on all trees in both the thinned plot and control plot, totaling 56 trees. In 2009, scientists began a second study to evaluate the effectiveness of thinning on mahoe growth rates and Earthwatch volunteers set up and measured a quarter-acre plot containing a total of 110 mahoe trees. Measurements taken were the same as those conducted for the mahogany trees.

To continue the research in the 2010 field season, a second set of readings were taken on these mahogany trees, and at the end of the year Earthwatch

volunteers collected a third set of readings on the thinned and control plots. They will continue to be monitored for a minimum of five years.

**Herpetology:** While the baseline anole (the *Polychrotidae* Family of lizard) population study is not yet complete, all the data collected so far indicate that the yellow-chinned anole (*Anolis gundlachi*) and the St. Thomas anole (*A. stratulus*) are the most commonly found at Las Casas. The former species prefer shaded canopy cover, and the latter prefer areas with less (but still some) forest cover. The two species known to use open habitats of grass and small shrubs—the sharp-mouthed lizard (*A. pulchellus*) and the Krug's anole (*A. krugi*)—tend to be found only in areas without forest cover, such as along the forest road. The garden lizard (*A. cristatellus*) and Emerald anole (*A. evermanni*) were rarely seen in the forest, and are more common around the human settlements. The study will continue to yield information about seasonal population fluctuations, and the relationships between the different species, their predator/prey interactions, habitat preferences, and how they are affected by human activity in the forest.

Additional herpetological surveys—an anole microhabitat survey, leaf litter



*Understanding how forest ecosystems function, how human societies relate to the natural environment, and how interaction can be mutually beneficial, can lead to a meaningful balance between the needs of a healthy, natural ecosystem and society.*



Figure 3: Scientists at Las Casas are documenting and describing fungi, in order to create material that will aid in fungal identification for future studies in biological monitoring and ecological roles.



Figure 4: Several species of economically important vine, such as medicine vine (*Hippocratea volubilis*) are studied to assess the rate at which they could be sustainably harvested.

survey, and nocturnal transect survey—have only recently been implemented, so there is not yet enough data to draw conclusions. However, during the leaf litter survey in 2010, Earthwatch volunteers observed the Puerto Rican galliwasp (*Diploglossus pleei*) and a species of gecko—Gaige’s least gecko (*Sphaerodactylus gaigae*)—not previously known to exist at Las Casas. Further surveys will be necessary so the team can understand the significance of this finding.

**Macrofungi:** The team is studying macrofungi to increase knowledge about forest nutrient cycling, understand and better manage forest ecosystem functions, and to assess fungi as bioindicators of climate change. They aim to discover which species of macrofungi are found in different areas of Las Casas, and to document, describe, and photograph them. To date, 44 fungi have been identified, and a further 22 identified to genus. There have been few fungal surveys conducted in Puerto Rico. By identifying fungi, scientists will

be able to create material that will aid in fungal identification for future studies in biological monitoring, fungal fruiting patterns, and ecological roles.

**Vines:** Researchers conducted a vine study to assess the rate at which the forest’s economically important vines could be sustainably harvested. Vines are traditionally used in Puerto Rico as weaving materials for baskets, hats, hampers and other decorative items—products which are used by micro-enterprises and can be an important source of employment in local communities. Knowing more about the place of such assets in the ecosystem could become a significant element in an overall plan for sustainable forest management. Volunteers measured the growth of liana seedlings (lianas are long-stemmed, woody vines that “climb” up besides trees to reach the sunlight above the canopy), which had been staked and measured in 2009. The study concluded in the summer of 2010 with one year of growth data being gathered on three liana species: *Securidaca virgata*, *Marcgravia rectiflora*, and *Schlegelia brachyantha*. Initial growth rates of *S. virgata* seedlings varied widely. In the nearly two-month period between June and August 2009, one liana died and eight showed one centimeter or less of growth, with many showing a decrease in length. Of the five individuals that showed significant growth, three grew between 4 and 7 centimeters, one grew 10.5 centimeters, and another grew an amazing 25.5 centimeters. The average increase in length across all individuals was 4.19 centimeters. No growth rate data is available yet for *M. rectiflora* or *S. brachyantha*.

**Recent Publications**

Nelson, M., Silverstone, S., Burrowes, P., Joglar, R., Robertson M. and Vakil, T. (2010). The Impact of Hardwood Line-Planting on Tree and Amphibian Biodiversity in a Secondary Wet Tropical Forest, Southeast Puerto Rico, *Journal of Sustainable Forestry* **29(5)**:503-516

Nelson, M., Silverstone, S., Reiss, K.C., Vakil, T. and Robertson, M. (Submitted) Enriched secondary subtropical forest for sustainable timber production, *Bois et Forets des Tropiques*.