

COURSE REPORT

Ecological Restoration Strategies in Agricultural Landscapes of Panama

Province of Herrera, Panama
September 9, 2014

A field course organized by:
The Environmental Leadership & Training Initiative (ELTI) and Peace Corps Panama



Background: As a result of its geological history, Panama possesses an extraordinary biodiversity. Being the last part of the Central American isthmus to emerge from the sea some 3.5 million years ago, the country became a natural bridge that has allowed the exchange of living organisms from North and South America. However, due to an economic model and policies that promote the transformation of the forest into cultivated land and pasture for cattle ranching, Panama has lost much of its forests and associated biodiversity. As Panama's forests are degraded, so does a wide range of ecosystem services of great importance for mankind. While the situation of forest degradation in Panama is severe, it can be reversed if corrective actions are taken. These solutions must

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integrate production with conservation in the form of integrated landscape management, introducing changes in land-use that are more consistent with forestry and agroforestry practices. Landscapes need to combine forest management elements such as; the protection of remaining forests, watershed restoration and native species reforestation with agroforestry and sustainable livestock systems. These production systems based on the incorporation of trees and intensifying natural processes, offer a variety of advantages. Understanding the fundamentals underlying forest ecology and the use of tropical forests in productive systems is essential to sustainably manage the provision of ecosystem services in highly fragmented landscapes.



Despite the new interest in conserving and restoring tropical forests, this information has not been effectively transmitted to the individuals who influence or directly make land use decisions. Therefore, since 2007 ELTI has been facilitating conferences and training courses in order to provide different stakeholders with the knowledge and tools on how to conserve and restore forests and biodiversity. Training community-based extension agents on these themes is an effective strategy to transmit appropriate land management information, as extensionists serve as a locally-based resource and work directly with landowners for a minimum of two years.

Objectives: The objective of this course was to reinforce the extension agent's knowledge of ecosystem services, forest ecology, the causes and effects of environmental degradation and the range of ecological restoration strategies for productive landscapes. The individual objectives were to:

- Provide an overview of the drivers of Panama forest degradation and teach extensionists how it has affected the provision and regulation of ecosystem services in human modified landscapes.
- Provide a more in-depth understanding of forest ecology and forest stand dynamics.
- Demonstrate the appropriate methodology to diagnose the degradation level and restoration potential of an agricultural landscape by considering the site context and owner objectives.
- Demonstrate the steps of establishing silvopastoral and agroforestry systems.
- Demonstrate the process to reproduce native tree species via an overview of common tree species phenology and the construction and management of a small scale tree nursery.



Field-Course Format: The course took place as part of the week-long training that Peace Corps provides to improve the knowledge of their extension agents. The training was facilitated in a rural community of the Herrera Province in order to create a training setting that is realistic to extensionists. The content of the course was divided into four training modules, illustrated through one introductory lecture and then reinforced throughout the day during field visits and demonstrations. In addition, extensionists participated in two main field-exercises where they established and planted a native species reforestation plot and a small scale tree nursery. The specific training modules were as follows:

- **Module 1. Forest ecology, ecosystem services and the consequences of land degradation**

The first module presented a general introduction consisting of the following themes: 1) the context of Panama's forests and the drivers of degradation; 2) the ecosystem goods and services that originate from forests and importance for productive landscapes; 3) forest ecology and how forests are disturbed, regenerate and their successional pathways. These concepts were illustrated via an introductory lecture and then strengthened in a local remnant patch of forest. Particular focus was aimed at explaining how tree species characteristics and their successional guilds play a role in a forest's ability to regenerate naturally without human intervention. This concept was important to demonstrate that reforestation is not the only method for forest restoration.

- **Module 2. Ecological restoration strategies; options and opportunities**

The second module introduced participants to the array of restoration strategies that can be integrated into productive landscapes; 1) natural regeneration; 2) assisted natural regeneration; 3) reforestation; 4) agro-successional crops; 5) agroforestry; and 6) silvopastoral systems. Reforestation with native tree species were presented via the ELTI-PROENA propagation guide, to discuss identified as useful species for integrating into farms for the beneficial characteristics they provide to improve production and the integrity of ecosystem services.





- **Module 3. Diagnostics, design and implementation of silvopastoral and agroforestry systems**

The third module presented a simple diagnostic method to develop appropriate restoration strategies based on biophysical and socio-economic variables, such as: 1) ecosystem resiliency; 2) land use history; 3) landscape matrix and 4) landowner objectives; and 5) resource availability. Participants visited a local farm that had been selected as a case study to implement a restoration strategy. Considering the site context and the land owner's goals, participants discussed the various options to integrate tree species in the property. In addition, participants took part in a reforestation exercise that illustrated the different requirements in order to establish timber plantations and silvopastoral and agroforestry systems; site logistics, spacing requirements and measurements, appropriate species mixtures, planting-hole depth, fertilizer application and weeding and pest control.

- **Module 4. Steps for developing and establishing a small-scale tree nursery**

The fourth module focused on providing the participants with a hands-on experience of building a small-scale nursery. First, a general overview was provided about the tree nurseries that they reviewed; objectives and goals, conditions for construction and nursery design. In addition, sapling production activities were thoroughly discussed; seed collection (orthodox versus recalcitrant), seed storage, seed treatment (scarification), collection of wildlings, substrate preparation, nursery bag filling, transplanting and maintenance. Participants helped to construct a raised seed-germinator bed, apply seed treatments and plant 12 different seed types as well as how to select and mix adequate substrate for transplanting seedlings into nursery bags.

Instructors and Coordinators: The course was facilitated by ELTI's Neotropical Training Program Panama Coordinator Jacob Slusser. Jacob introduced the concepts of ecosystem services, forest ecology, drivers of forest degradation and practical restoration strategies in lecture format, but also reinforced these themes during the field trips to various local farms. Peace Corps provided all logistical support and acquisition of materials for the field exercises.



Participants: This course was developed for Peace Corps extension agents. These extensionists serve as local resources in their respective communities assisting land holders and local groups to design, plan and implement environmental conservation and restoration practices.

Course Follow-up: Participants were engaged throughout the training and benefited from the opportunity to receive advanced practical training in developing ecological restoration strategies. Many of the participants inquired about ELTI conducting community visits to facilitate field-based courses on restoration themes. In addition, participants showed great interest in connecting community counterparts with future field-courses conducted at ELTI's Permanent Training Sites. From discussions with participants, it was clear that information regarding sustainable practices and forest restoration are not reaching interested land owners in their communities. This highlights the need and interest for further training courses in the region and future ELTI field courses at the Azuero Permanent Training Sites will be offered to participants and their community counterparts.

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