

COURSE REPORT

Field Course in Tropical Dry Forest Restoration in Human Dominated Landscapes

ELTI Focal Training Sites
District of Pedasí, Province of Los Santos
March 18-23, 2018

A field course organized by:
The Environmental Leadership & Training Initiative (ELTI)
and the Association of Livestock and Agrosilvopastoral Producers of Pedasí (APASPE)



Photo: Gillian Bloomfield.

Students conducting a rapid carbon and timber assessment in the mature forest plot.

Background: The tropical dry forest, the most endangered ecosystem in the tropics, is extremely threatened by the dominance of extensive conventional cattle ranching, especially in the Azuero Peninsula of Panama. The destruction of forests has degraded the provision of ecosystem services such as; water, soil fertility, and biodiversity, which are necessary to support livelihoods. With

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an erratic annual rainfall and a dry season lasting from five to six months, the region's extreme climate variations compound the stresses of unsustainable land use practices and make efforts to restore the ecosystem particularly challenging. Nevertheless, advances in forest restoration and sustainable ranching have been shown to enhance production and ecosystem services in cattle ranching landscapes. In order to transfer this knowledge to future professional practitioners, ELTI has developed a "hands-on" field-based training course that teaches the theory and practice of forest restoration.

This training was offered to Master's degree students from the Yale School of Forestry and Environmental Studies (Yale F&ES), enrolled in the "Tropical Forest Restoration in Human Dominated Landscapes" spring seminar. Over a period of six days, this course provided the practical basis to understand tropical dry forest ecology, degradation and forest restoration strategies in a complex human dominated landscape with diverse cultural and socio-economic contexts that drive land management. This field-based course was facilitated in ELTI's Focal Training Sites in Azuero, which convey ecological principles through its interpretative trail network and demonstration sites. In addition, participants interact with land-owners during visits to their model farms and learn firsthand about their motives for land management decisions.

Course Objectives: The overall goal of the course was to provide a practical, field experience to students to complement a seminar course on tropical dry forest restoration taken at Yale F&ES, as well as demonstrate the types of restoration strategies that can be integrated into agricultural landscapes to restore forest cover, ecological function and sustain production.

Content: The course was divided in three training modules, illustrated through introductory lectures, field-based demonstrations, and group exercises facilitated by ELTI staff and APASPE members, as follows:

Module 1: *Tropical dry forest ecology and ecosystem services*

Module 2: *Deforestation, degradation and the effects on the integrity of ecosystem services*

Module 3: *Forest restoration strategies for tropical dry mosaic landscapes*

Field-Course Format: This course took place over six days at ELTI's Focal Training Sites in the tropical dry forest, located in the Province of Los Santos in the Azuero Peninsula. These sites demonstrate the varied biophysical and socio-economic contexts of different types of land use: (1) the Achotines Forest Reserve, a mature tropical dry forest; (2) the Madroño property, a young secondary forest regenerating on old cattle pasture; (3) IDB Forestal, a native species tree plantation that incorporates cattle grazing in the understory; and (4) the APASPE model farms, which are privately-owned by members who have established silvopastoral and agroforestry systems, home gardens, and riparian forest restoration. The following activities occurred throughout the week:



Day 1: Course participants arrived at the Achotines Tuna Laboratory and were given an introduction to the laboratory and a tour of the installations. After introductions, Saskia Santamaría (Neotropics Training Program Associate) facilitated a brief review of ELTI and the objectives of the course. Jacob Slusser (Neotropics Training Program Panama Coordinator) delivered a lecture on tropical dry forest ecology and stand development. After dinner, Mirjam Kuzee, Forest Landscape Restoration Assessment Coordinator for the International Union for the Conservation of Nature (IUCN), presented on landscape restoration and monitoring via the Restoration Opportunities Assessment Methodology (ROAM).

Day 2: Jacob led a field trip on ELTI's interpretive trail network, within the Achotines Forest Reserve, where participants visited six different demonstration areas to discuss: tropical dry forest species identification, species functional characteristics, successional guilds, forest regeneration and successional phases, and hydrological cycles in riparian areas. Students worked in groups to conduct soils assessments on macro-fauna, structure, texture, infiltration, and pH, in order to compare differences between a ridge top and lowland forest. In addition, the students conducted a rapid forest inventory within the mature forest, in order to quantify numerous ecosystem services in a baseline forest.

Afterwards, students returned to the classroom to analyze the data recorded in the field and presented on the different indicators, including; diversity, carbon, soil/hydrological condition, timber volume and non-timber forest products (NTFPs) value of the forest. The session ended with open discussion about the day's activities.



Day 3: After breakfast and a review of the day's activities, Jacob presented on the social and economic history of deforestation and degradation drivers of tropical dry forests. While the presentation focused on general degradation factors, Jacob introduced the riparian assessment guide that the students would utilize to conduct a rapid assessment of degraded and intact riparian areas.

Students then traveled to the town of Los Asientos and visited a farm with degraded riparian areas, due to conventional cattle ranching practices. Students were tasked with utilizing the riparian assessment guide to conduct measure-

ments of: (1) soil health; (2) riparian buffer width; (3) stem density within riparian buffer; and (4) particle size count. With these data, groups utilized the assessment guide to assign a degradation index for their section of the stream as well as corresponding interventions to improve forest cover. Students then visited an intact riparian buffer zone with more than ten meters of continuous forest cover on each side. Groups compared the riparian assessment indicators in this area to the degraded zone, indicating a great difference in the provision of ecosystem services. In the evening, groups reviewed their rapid assessments of the riparian areas and presented on their findings and recommendations to limit degradation for each index type.

Day 4: The course now began focusing more directly on forest restoration strategies for tropical dry forests. Jacob delivered a lecture about the range of passive to active forest restoration strategies, highlighting many of the restoration activities being conducted by local landowners. Jacob especially focused on silvopastoral and agroforestry systems, which are strategies that have proven successful for local ranchers to maintain their traditional livelihoods and improve ecosystem health.

The students first visited the Madroño Property, a young secondary forest which is naturally regenerating on old cattle pasture. During the visit, students learned about secondary forest succession and the important role of land-use history and legacy structures for influencing successional pathways. Beyond natural regeneration, the most passive and economical approach to forest restoration, students also visited demonstration areas that illustrated assisted natural regeneration (ANR) techniques, including; (1) protection from external disturbances; (2) reducing competition to facilitate desired species; and (3) enrichment planting.



After learning about passive forest restoration strategies, students visited the IDB Forestal Property, which has utilized native species reforestation to restore forest cover on a former cattle ranch. After learning about the property's history, owner's objectives and management strategies within different plots, students conducted measurements within the plantations in order to quantify productivity, forest carbon, economic value and species diversity. In the evening, students analyzed and presented their data from the day's activities and discussed the trade-offs of the range of restoration strategies for different owner objectives.

Day 5: This day focused on the forest restoration strategies utilized by local ranchers. Jacob delivered a lecture on the role of community-based farmer organizations and forest restoration, specifically discussing the history and restoration activities of the APASPE sustainable rancher's association.

Students then spent the day meeting with the association board members and visiting three different APASPE model farms. The owners of these farms integrate diverse forest cover while maintaining production in pastures via the use of living fences, natural regeneration of trees in pastures, restoration of riparian areas, intensive SPS, mixed forage banks, grazing within forest plantations, and agroforestry. During the visit, APASPE members shared their experience of transforming conventional cattle ranches into silvopastoral systems and the resulting improvement of ecosystem services and increased on-farm production.

The day also focused on restoration of riparian areas. Although sources of water are critical for ranchers, they are often degraded due to deforested buffer zones and open riparian access to cattle. In the field, students visited cattle aqueduct systems that utilize water banks, reserve tanks, and solar powered pumps to provide clean water. Water delivery systems are a crucial alternative to cattle freely utilizing riparian areas as a source of water. Therefore, these systems help conserve gallery forests and water sources as well as facilitate the division of pastures for more productive intensive rotational systems.



After a traditional lunch with APASPE members, students visited a farm that had suffered high levels of degradation due to conventional cattle ranching practices. At the farm, they worked in groups to conduct a rapid assessment utilizing the forest restoration conceptual model, learned during the course. Groups presented their plans to the owner of the farm, who provided feedback and agreed to implement the most promising plans. That evening, the students shared a final dinner with invited APASPE members to continue discussion of restoration themes in a relaxed social atmosphere.

Day 6: After breakfast, the students were introduced to the final exercise of the course, where groups represented varying objectives of potential (fictional) buyers of the sample property. Each group was required to conduct a rapid assessment, develop a restoration analysis based on the buyer's restoration objective (timber, biodiversity, forest connectivity or production) and provide the buyer with different strategies to meet their goals. After developing their plans, each group presented their restoration strategy, according to their individual objectives. The exercise reinforced the importance of making decisions based upon well-researched, site-specific biophysical and socio-economic information before implementing a restoration strategy.

A discussion period was provided to cover final comments and questions from the students. Many discussed the challenges of conducting restoration in human-dominated landscapes due to the social and economic complexities. They highlighted the APASPE farmers as an inspiring example since they have illustrated how forest restoration can be integrated with traditional livelihoods and restore ecosystem services. Also mentioned, was the importance of empowering local landowners with knowledge to become land stewards and their ability to influence others. The course concluded after participants completed the course evaluation and were presented with certificates of completion.



Students pose for a photo after being awarded their course certificates.

Instructors and Coordinators: The course was facilitated by ELTI's Neotropical Training Program Staff: Jacob Slusser (Panama Coordinator) and Saskia Santamaría (Program Associate), with assistance from Gillian Bloomfield (On-line Program Coordinator), who helped to facilitate field-based exercises and classroom discussion. Saskia introduced the ELTI program and the course objectives to the participants. She also helped facilitate course exercises, logistics and photography during the course. Jacob delivered introductory lectures and field demonstrations and led classroom discussion. In addition, course collaborators: Belgis Madrid, Zoilo Vergara, Odielca Solís, and Dolores Solís of APASPE facilitated field trips to the model farms.

Participants: The course was offered to Master's degree students from the Yale School of Forestry and Environmental Studies, who were enrolled in Dr. Mark Ashton's seminar course 683b entitled, "Tropical Forest Restoration in Human Dominated Landscapes."

This event was possible thanks to Arcadia, whose Environmental Conservation grants support programmes that protect and enhance biodiversity, and provide field training and academic research.