Environmental Leadership & Training Initiative

COURSE REPORT

Ecological Restoration of Eroded Land: Seminar and Field Course

Santander, Colombia
March 21–25, 2023

A field course organized by:
Environmental Leadership & Training Initiative (ELTI), Yale School of the Environment
Center for Research on Sustainable Agricultural Production Systems (CIPAV)

Gully undergoing restoration at Nirvana-Clavellinas Nature Reserve.

Background: This course was the fourth offered by ELTI in the Colombian department of Santander and the third in the Nirvana-Clavellinas Nature Reserve. In 2017, the Leadership Program supported alum Melisa Ayala in offering the first seminar and two field workshops on stabilization of highly eroded land at Universidad Industrial de Santander (UIS). The following year, Melisa Ayala and Mauricio Carvajal (ELTI alum and researcher at CIPAV) received Leadership Program support to offer a second version of the seminar

Juan Fernando Martínez applying biodynamic compost.

The gully at Nirvana-Clavellinas is a restoration laboratory where several techniques and plant species are being tested.

and field course in Zapatoca. The 2018 field course provided the opportunity to initiate restoration of an eroded historical trail in Nirvana-Clavellinas reserve. The seminar and field course were offered in 2019 as a formal ELTI training event. After a four-year hiatus, the 2023 course gave participants and trainers an opportunity to analyze the results of the restoration treatments applied in the 2018 and 2019 field courses and to complement the soil bioengineering and planting activities with new structures and restoration treatments.

The training event started on March 21 with a free seminar offered at UIS, which aimed to raise awareness about the complex socio-ecological problems created by erosion, and to broaden the knowledge of participants on the nature-based solutions available to restore unstable and eroded land. The presentations were based on CIPAV's experience in recovering highly eroded sites through soil bioengineering techniques and high-density planting.

The field component of this training event took place on March 22-25 at Nirvana-Clavellinas Nature Reserve, a site of the Colombian Andes training landscape, located in Zapatoca (Santander).

Course Objectives:

- Increase awareness of socio-ecological problems related to erosion and land degradation and nature-based approaches to address these conditions
- Strengthen local capacities for ecological restoration of eroded and unstable land
- Introduce principles and practical aspects of ecological restoration, soil bioengineering, and revegetation of eroded land with native plants
- Implement a model for erosion control at the Nirvana-Clavellinas Nature Reserve

A mesh to capture water from fog, planting nitrogen-fixing trees, and direct seeding of native plants contribute to the gully's recovery

Low-cost biomechanical structures improve water infiltration and accelerate soil formation.

Course structure

Seminar (March 21)

The open seminar at UIS was coordinated by ELTI alums Melisa Ayala (researcher, Grupo de Estudios en Paisajes Socio-Ecológicos [PASOECO] [Study Group on Socioecological Landscapes]) and Dr. Björn Reu (associate professor, UIS and coordinator, PASOECO research group). PASOECO voluntarily supported seminar logistics and announced the training opportunity at various universities, regional government agencies, and NGOs and through social media.

The seminar's morning session introduced principles and methods applied to stabilize and restore highly eroded areas. Zoraida Calle (Colombia coordinator, ELTI) spoke on the characteristics of healthy soil and explained principles that guide restoration of eroded land. Mauricio Carvajal then explained the roles of social participation, soil bioengineering techniques, and high-density planting.

During the afternoon session, Mr. Carvajal and Ms. Calle presented several case studies. Juan Fernando Martínez, ELTI alum and owner of Nirvana-Clavellinas, explained the reserve's integrated approach to conservation, restoration, sustainable land use, and human development. The seminar closed with an open discussion of personal, institutional, and policy-related actions needed to scale up the restoration of eroded land with bioengineering techniques.

Low-cost biomechanical structures improve water infiltration and accelerate soil formation.

Course participants mix seeds with compost for a direct seeding exercise.

Field course (March 22––25)

Wednesday, March 22: Participants traveled from Bucaramanga to the town of Zapatoca and took 4WD vehicles to a rural area, close to Nirvana-Clavellinas. The field course began with a guided walk to the reserve, during which the trainers explained the causes of severe erosion and other forms of land degradation in this Andean landscape. The walk included an analysis of a gully outside the reserve that illustrates the baseline condition of the site of the 2018 and 2019 field courses.

Thursday, March 23: Juan Fernando Martínez explained the main features and activities of Nirvana-Clavellinas Nature Reserve, and Melisa introduced the biogeography of this unique area in the Eastern Colombian Andes. Juan Fernando and his collaborator, Bernardo Serrano, coordinated a practical exercise in which participants learned to prepare biodynamic compost, which they consider the most essential tool in accelerating soil recovery.

The participants and trainers walked to the upper part of the gully undergoing restoration and analyzed factors that caused the erosion of the historic trail, water flows, and vegetation within and around the gully. The walk was an opportunity to discuss concepts such as reference ecosystems, restoration goals, and land rehabilitation in the context of severely eroded forest landscapes.

With an understanding of the events and processes that shaped the gully, the group analyzed the results of restoration treatments applied by the participants in

Assisted natural regeneration exercise in the area surrounding the gully.

the 2018 and 2019 field courses: assisted natural regeneration around the gully, direct seeding of nitrogen-fixing plants, planting seedlings and saplings, filling cavities with cut bracken, mulching and covering soil with litter, applying green manure to enhance soil properties, establishing vegetation strips across the slope, and installing biomechanical structures for erosion control. By comparing baseline photos with the current condition of the main gully and its surroundings, participants and instructors were able to evaluate the performance of different plant species in the gully's challenging environment and observe how some species facilitate the establishment of other native plants.

Thursday afternoon to Saturday, March 23–25: Participants were divided into three groups that worked with different trainers during four-hour sessions Thursday afternoon, Friday morning, and Friday afternoon. With Mauricio, each group learned the practical aspects of high-density planting and how to assemble soil bioengineering structures. With Zoraida, participants conducted site and vegetation analyses and collected seeds and seedlings. Juan Fernando explained the reserve's agroecological restoration approach and biodynamic agriculture techniques applied to produce high-quality vegetables. Melisa supported the three groups with her detailed knowledge of native plants. All groups conducted practical exercises, and all participants had the chance to take part in all activities.

Course participants and trainers.

Participants: Course instructors were Zoraida Calle, Mauricio Carvajal, Juan Fernando Martínez, and Melisa Ayala. The seminar was open to UIS students and faculty, field course participants, and the general public. The 60 participants included students, farmers, and representatives of environmental authorities and local NGOs.

The 18 participants in the field course included biologists, foresters, restoration practitioners, farmers, community leaders, college teachers, and a social worker from different regions of Colombia.

Outcomes and follow-up: Highly eroded areas are rarely prioritized for restoration due to their high intervention cost and presumed low conservation value, as well as the lack of knowledge about restoration techniques to accelerate the recovery of these sites. This course provided a group of restoration practitioners with the tools necessary to incorporate gullies and eroded land into their sustainable land use and restoration projects.

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