



# Biodiversity Conservation and Carbon Sequestration Services of Silvopastoral Practices (Matiguás-Río Blanco, Nicaragua)

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“Silvopastoral systems combine fodder plants such as grasses and leguminous herbs with trees and shrubs for animal nutrition and complementary uses. The main silvopastoral systems, include planting trees and shrubs in pastures; cut and carry systems, in which livestock is fed with the foliage of specifically planted trees and shrubs (‘fodder banks’); using trees and shrubs for fencing; and grazing livestock inside tree plantations. Windbreaks and pastures between tree alleys have been applied to a lesser degree”

-Murgueitio, 1999

## The Pilot Project

Extensive cattle grazing in Nicaragua has led to substantial biodiversity loss, landscape degradation, soil erosion, and water contamination. The Regional Integrated Silvopastoral Ecosystem Management Project (“Silvopastoral Project”) sought to reverse this trend and utilize direct payments for ecosystem services (PES) to encourage the adoption of silvopastoral practices in degraded pastures in Central and South America. The Silvopastoral Project was a World Bank-led collaboration between the UN Food and Agriculture Organization (FAO) and local Central and South American organizations. Financing was provided by the Global Environmental Facility (GEF). The Silvopastoral Project used a PES mechanism to encourage the adoption of silvopastoral practices at pilot sites in Nicaragua, Colombia and Costa Rica. This case study will focus on the Matiguás-Río Blanco, Nicaragua pilot project. The local non-governmental organization (NGO) responsible for organizing and

conducting fieldwork in this area is Nitlapan, a NGO affiliated with the Central American University.

Silvopasture is an agroforestry practice designed and managed to complement forage and livestock ranching with tree cultivation. Silvopasture provides, in addition to greater biodiversity, numerous on-site benefits, such as fruit, fuelwood, fodder, and timber; and indirect benefits, such as increased shade, which has been demonstrated to improve milk production. Silvopastures have also been shown to fix sizeable amounts of carbon, with most studies demonstrating that silvopastures can amass approximately 13 – 15 tons of carbon per hectare (tC/ha) annually as compared to 1 – 5 tC/ha in traditional pastures. Silvopastures also improve water infiltration, reduce surface runoff and soil erosion; however the hydrological benefits they provide are more difficult to quantify.

## The Scheme

The Silvopastoral Project aimed to increase the use of silvopastoral techniques through technical assistance and payments for ecosystem services (PES) schemes. An Environmental Services Index (ESI) was developed to provide payments to landowners that were proportional to the level of ecosystem services they provided. A list of land uses was prepared, and points were given according to the biodiversity conservation and carbon sequestration benefits.

Biodiversity and carbon sequestration points were allocated separately, however, were weighted the same.

For instance, converting degraded pasture to riparian forest obtained 0.8 biodiversity points

and 0.7 carbon sequestration points, giving a total of 1.5 ESI points. Participating landowners were then paid US \$ 75 per incremental ESI point they accumulated per hectare above the baseline level, with ESI points being measured annually. ESI points were calculated over the entire farm, and a switch to land uses that reduced or degraded ecosystem service provisions was grounds for contract termination; although in practice only minor infractions occurred and no contracts were terminated. To avoid perverse incentives, participating landowners were compensated US \$ 10 per ESI point for existing ecosystem services.

“Ensuring that these adopted land-use changes are sustainable is challenging. Short-term payments, such as those offered by the Silvopastoral Project, may sometimes be sufficient to ‘tip the balance’ towards adoption of the desired land use changes, but in most cases longer-term payments are likely to be required. This creates the challenge of finding suitable long-term funding sources to make such payments. The best opportunities for developing such long-term funding are likely to be found when the services being provided are private goods (as in the case of water), or where regulations create a market for public goods (as in the case of carbon, thanks to the Kyoto Protocol and regulations in some individual countries). Where these conditions do not hold, as is largely true for biodiversity services, use of PES will be much more difficult.”

-Stefano Pagiola *et al*, 2007

## Lessons Learned

The project began in July 2002, with the first annual payments made in July 2004 lasting through January 2008. Silvopastoral practices adopted ranged from minor land use changes, such as sowing improved grasses in degraded pastures, to very substantial modifications, such as planting high-density tree stands. Overall, the area of degraded pastureland in Matiguás-Río Blanco fell by 80% as a result of the Silvopastoral Project.

Land use changes resulting from this project show that a relatively small initial investment could “tip the balance” in favor of more environmentally friendly practices. Although the average per capita income in the Matiguás-Río Blanco area is below the poverty line (\$1 U.S. per day), many poor farmers were able to participate, and by some measures adopted environmentally

friendly techniques to a greater extent than better-off farmers. Despite the long-term benefits silvopastoral techniques provide to farmers, technical assistance and monetary incentives provided by the Silvopastoral Project were necessary due to the significant lag time between investment and returns; lack of access to credit in many areas; and initial transaction costs associated with pilot projects.

Important factors that were integral to the success of the project include: 1) an ESI index that accurately compensates landowners for the ecosystem services they provide 2) a payment method in which landowners are compensated upon the delivery of ecosystem services; and 3) a PES scheme that discourages leakage and perverse incentives.



*Degraded pasture -Matiguás-Río Blanco*



*Improved pasture with high tree cover - Matiguás-Río Blanco*

## Looking Forward

The goal of the Silvopastoral Project was not to merely offset adverse environmental impacts, but curtail these practices and internalize positive environmental services. Although the Silvopastoral Project led to the adoption of silvopastoral practices that resulted in positive environmental services, it is unclear how long

these will be maintained without long-term financing.

Currently, attempts to obtain funding from the biodiversity and carbon sequestration markets are underway, and proxies for the ESI index are being developed such that monitoring costs are significantly lowered.