Tropentag, September 20-22, 2017, Bonn

"Future Agriculture:
Socio-ecological transitions and bio-cultural shifts"

Agroforestry-Based Restoration and Enhanced Resilience of Agricultural Production through Adaptation of Smallholder Farming Systems, Nicaragua

Mirjam Pulleman[1], Pablo Siles[2], Edwin Garcia[3], Carsten Marohn[4], Melanie Mason[5,2], Orlando Tellez[2], Elbis Chavarria[2], Emily Webster[6]

[1] *Wageningen University and Research, The Netherlands*
[2] *International Center for Tropical Agriculture (CIAT), Nicaragua*
[3] *International Center for Tropical Agriculture (CIAT), Honduras*
[4] *University of Hohenheim, Inst. of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), Germany*
[5] *University of Copenhagen, Agricultural Development, Denmark*
[6] *University of California, Dept. of Plant and Environmental Sciences, United States*

Abstract

Rural communities in the Dry Corridor of Central America are highly vulnerable to the consequences of soil and land degradation, and climate change. Smallholder farmers traditionally produce grain crops on steep hillsides through slash-and-burn agriculture, increasingly combined with small-scale cattle farming. Only 3% of the original forest cover remains. The ARA (Agroforestry for Restoration of Agroecosystems) project aims to restore degraded land, enhance agroecosystem productivity, profitability and resilience, and generate ecosystem services through agroforestry systems. Between 2008 and 2013 a platform of 25 on-farm experiments, representing three different communities in the Dry Corridor of Nicaragua, was established. The platform has served different objectives: (i) participatory adaptation of agroforestry systems; (ii) research to understand and quantify the impacts of agroforestry-based interventions on ecosystem services, including crop production, and farmer revenues (iii) training of farmers and technicians and knowledge sharing to facilitate out scaling. Agroforestry systems included Quesungual, a maize-bean system intercropped with trees and established through selective clearing and pruning of regenerated trees.

Five land use systems were established/selected on the participating farms: Traditional slash-and-burn maize-bean system (TCS), Quesungual Agroforestry (AFS), Secondary forest (SF), Naturalized pastures (NP) and Improved silvopastoral systems (SPS). Crop and forage production, soil fertility, soil erosion, C sequestration and biodiversity was monitored from 2013 to 2016. Results confirm that AFS and SPS can improve tree diversity conservation and carbon storage, while maintaining (maize) or increasing (bean) production. Collection of detailed soil, plant, microclimate and meteorological data allowed for the modelling of tree-crop interactions and land use scenarios to further evaluate impacts of Quesungual on ecosystem services. A detailed study on adoption rates and factors at the community level showed steadily increasing levels of adoption (up to 39 % of households in 2016). Strong support through capacity building was identified as a key factor to further enhance adoption. Despite increasing adoption rates and beneficial impacts of AFS and SPS on ecosystem services and production, further improvements in production systems are needed. A synthesis of key lessons from the project and reflections on future directions and research priorities will be presented.

Keywords: Adoption, agricultural productivity, agroforestry, Central America, ecosystem services, land restoration, Nicaragua, resilience, soil fertility

Contact Address: Mirjam Pulleman, Wageningen University and Research, KM 17, Recta Cali-Palmira, CP 763537 Palmira, The Netherlands, e-mail: Mirjam.Pulleman@wur.nl