On-Farm Tree Diversity and Ecosystem Services at two Seasonally Dry Forest Sites of Nicaragua

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Introduction

The Mesoamerican Seasonally Dry Tropical Forest (MSDTF) is under severe threat of degradation and deforestation. Landscapes now consist of fragmented, patchy forest remnants characterizing most of today's highlands in the MSDTF. Despite the need for conservation attention, the dry forest biome is underrepresented in scientific research as opposed to the rainforest[1]. The potential of *circa situm* conservation (farm-based tree diversity) is emerging in conservation theories. It relies on the help of farmers to protect natural regeneration on degraded agricultural land and the use of agroforestry systems[2].

Objectives

Botanical part: Quantitatively assess levels of tree species diversity and vegetation structure currently present under *circa situm* conservation across two sites in the dry forest.

Sociological part: Determine how current level of tree species diversity on farms can be increased in dry forest remnants through the lens of farmers' perceptions, preferences and requirements

Sites

Two study sites La Danta in the Dept. of Chinandega and Terrabona in Matagalpa, both in the fragile MSDTF corridor along the pacific side of Nicaragua, were selected to represent the variability of the dry forest biome.

Fig. 1 Location of study sites
Source: http://www.infoplease.com/atlas/country/nicaragua.html

Methods

Tree inventory

From a database of 265 plots (area 0.1 ha), seven land-uses were created from highly tree-dense secondary forest to least tree-dense intensively human managed land. Comparison of vegetation structure and species composition between land-uses across the two sites were performed with analytical indicators of tree diversity.

Farmers' perception

30 semi-structured interviews were performed with farmers (15 in Chinandega - 15 in Matagalpa). Farmers were selected by stratified random technique considering farm size. Two focus group discussions were held per site with farmers.

Fig. 2 Interview with a female farmer

Results and Discussion

Differences in tree cover arose from the analysis of the two sites:

- Higher average tree species diversity in dense forest and cropland of Matagalpa
- Higher basal area in pasture of Chinandega despite equal tree density noted across sites
- Equal basal area in croplands across sites despite less tree density observed in Chinandega
- Patterns of tree diversity suggested that surveyed communities in Chinandega were ahead of those in Matagalpa in the use of agroforestry and silvopastoral systems.

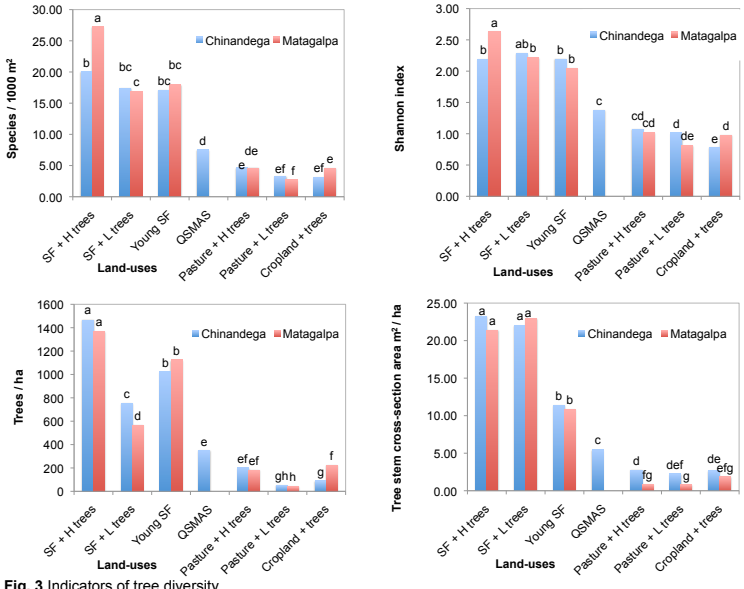

Fig. 3 Indicators of tree diversity

Key
SF + H trees: **High** tree **density** secondary forest (> 15 m^2 ha^{-1} basal area and >1000 trees per ha)
SF + L trees: **Low** tree **density** secondary forest (> 15 m^2 ha^{-1} basal area and <1000 trees per ha)
Young SF: **Young** secondary forest (< 15 m^2 ha^{-1} basal area)
QSMAS: Quesungual system
Pasture + H trees: Pasture with **high** tree **density** (> 80 trees per ha)
Pasture + L trees: Pasture with **low** tree **density** (< 80 trees per ha)
Cropland + trees: Cropland with trees

Fig. 4 Typical Quesungual system based on of slash and mulch of tree branches

- Exacerbated tree species dominance of pioneer species in cultivated land-uses contrasted with a high number of underrepresented species scattered in the landscape.
- Farmers favor multi-purpose species on cultivated land-uses, thus fostering the conservation of key ecosystem services rather than tree species diversity *per se*.
- More endangered species (listed in the IUCN red list) were present in Matagalpa while interviews revealed that logging bans indirectly restrict planting by farmers at both sites.
- Informal red list of endangered species formulated by farmers was found essential in helping to prevent declining species.
- 60% of farmers consider protecting trees from natural regeneration more effective than planting to restore and preserve the MSDTF.

Tab. 1 Potential locations to increase tree diversity
(In order of suggestions by respondents)

Chinandega	Matagalpa
Crops 33%	Live fences 27%
Live fences 27%	Along streams 27%
Pasture 20%	Pasture 20%
Along streams 20%	Patio 20%
Patio 20%	Coffee 13%
	Crops 7%

A farm size analysis revealed that small farmers are disposed to increase tree diversity in patio, live-fences, and along water streams mostly, whereas larger farmers prefer pastures and water streams.

Tab. 2 Farmers' challenges / needs to increase tree diversity on farm
(In order of importance)

Seeds: Cost, distance from seed provider, problems with seed collection knowledge
Saplings: Distribution by extensionists on few occasions
Wire: Protecting trees against cattle browsing
Tools: Adequate equipment for tree work
Finance: No right to sell timber products **Motivation**: Little government incentives to protect trees
Workshops: Skills on association of trees with crops
Land: Competition for sunlight too high for smallholders **Water**: No irrigation, seasonality
Labor: More trees, more work
Time: Farmers focus on cash crops

The main limitations and needs expressed by farms of all sizes are in seeds, saplings, wire, and financial incentives especially for small farms.

Conclusion

Altered agricultural fields are not deprived of tree cover but face challenges in keeping the species diversity of the original forest. *Circa situm* conservation can complement *in situ* conservation initiatives in the MSDTF of Nicaragua. Considering the discrepancies in vegetation structure and composition within the MSDTF realm and farmers' opinion, conservation strategies should not neglect the specificities of sites and farm sizes in their intervention.

References
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