

Timber from organic cacao agroforestry systems, an additional source of income for farmers in Bolivia

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Introduction

Cacao (successional) agroforestry systems offer a wide range of ecosystem services and values to producers [5, 3] and enable a higher independence from the main crop [4]. Both systems, agroforestry (AF) and successional agroforestry (SAFS) include shade trees, however SAFS are generally more diverse, with a higher shade tree density and a stratified structure [2]. Here we present results on timber trees on smallholder cacao farms, differentiating AF and SAFS.

Methods

To assess the standing timber volume and value, a tree inventory was conducted in 2017 on 18 cacao AF and SAFS plots in Alto Beni, Bolivia. Tree species, diameter at breast height, marketable tree height and tree quality were registered. The tree value was calculated by volume, quality and with the species' reference prices for processed timber from ABT (2017, [1]). Farmers and experts were interviewed to identify the challenges for the timber production in these agroforestry systems.

Results & Discussion

The trees had an age between 9-21 years, but some trees were also between 2-40 years. A total number of 2'941 trees were counted, thereof 19% *Swietenia macrophylla* (476 USD/m³), which makes it the most popular out of 28 timber species. Other very common species were *Myroxylon balsamum* (12%, 274 USD/m³), *Amburana cearensis* (12%, 254 USD/m³) and *Centrolobium ochroxylum* (9%, 249 USD/m³) (fig. 1). The 4 most common timber trees belong to the top 5 most valuable species on all plots.

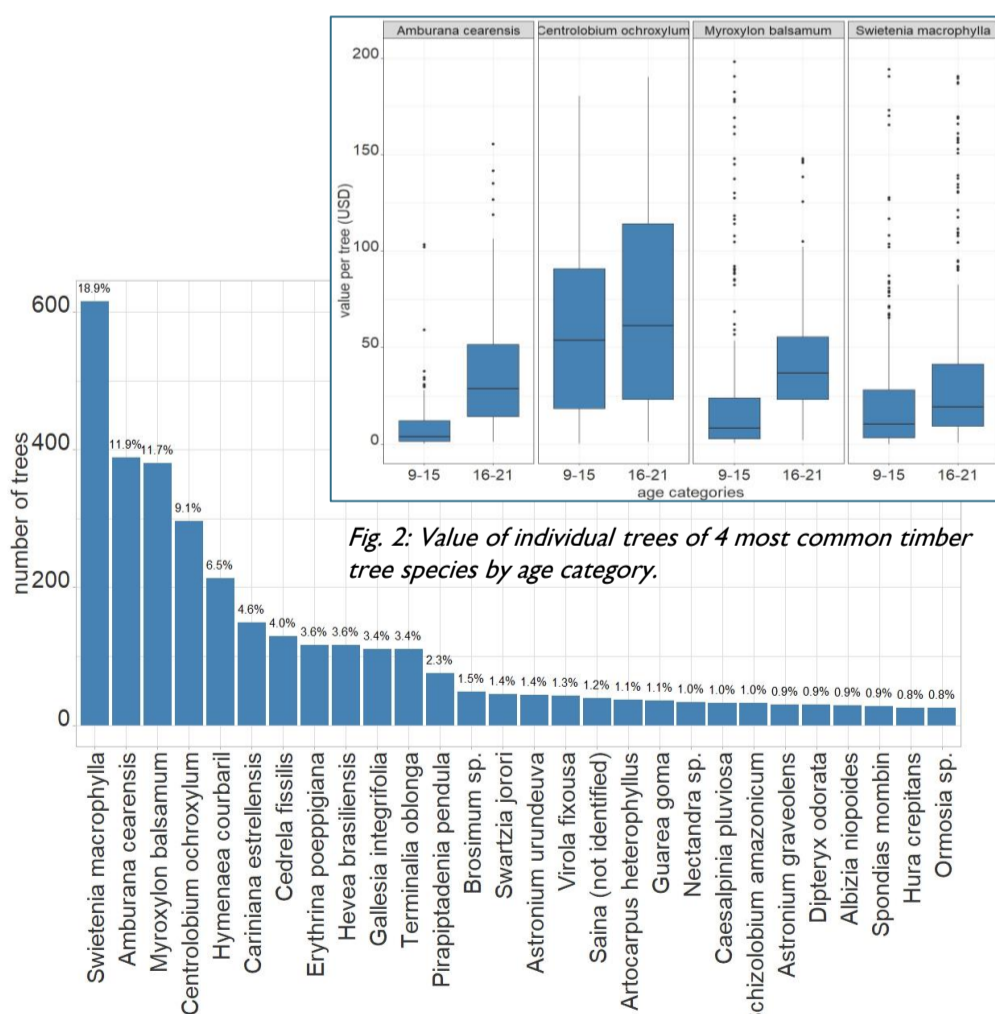


Fig. 2: Value of individual trees of 4 most common timber tree species by age category.

Table 1: Comparing SAFS and AF plots on timber tree parameters

	AF	SAFS	Factor AF – SAFS
Average timber tree density (trees/ha)	75	314	4.2
Standing timber volume m ³ /ha	24	51	2.1
Timber tree species/ha	14.7	16.9	1.2
Standing timber value (USD/ha)	5'516	9'565	1.7

SAFS plots had a factor 4.2 higher timber tree density, 2.1 higher timber volume, 1.2 more species per ha and 1.7 higher standing timber value per ha than AF plots (table 1). The standing timber on SAFS plots had an estimated average value of 9'565 USD/ha vs. 5'516 USD/ha on AF plots (fig. 3). Local experts estimated a loss of 40% in timber value (not included in the results), due to processing the timber in the field by chainsaw for easier transportation.

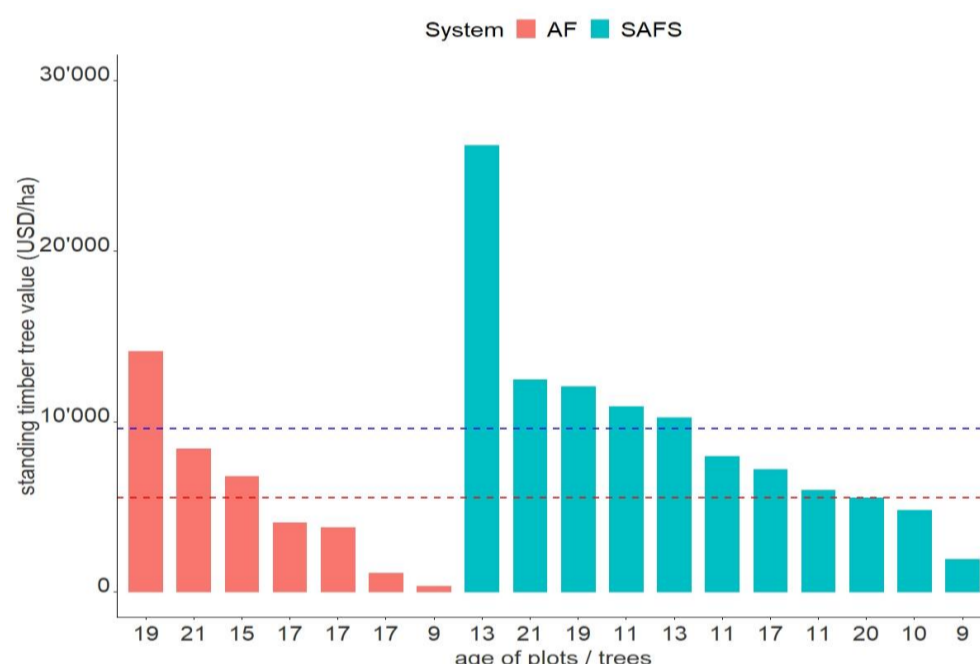


Fig. 3: Timber tree value per area (USD/ha) by plot (age of the plots/trees on x-axis) and system (AF, SAFS). Red dashed line: mean timber value per ha in AF (5'516 USD/ha), blue dashed line: mean timber value per ha in SAFS (9'565 USD/ha).

The producers favored valuable timber tree species, and with *S. macrophylla* the most valuable is also the most common (fig. 2). If a faster revenue is desired, the fast-growing *C. ochroxylum* may be advisable. The variation in timber quality suggests, that a good practice in timber management is essential to achieve high revenue. In plots with high density of trees, regular shade tree pruning and optimization of plantation layout is key to increase cocoa yields.

Conclusions

Farmers are challenged with logging and pruning of timber trees as well as with the legal requirements in the timber business. With the aim to increase farmer's income from timber trees we suggest the following measures at three levels: (1) improving plantation layout (density, layout, species) and tree management (criteria for logging and pruning selection) to increase quality and value of timber; (2) to support a more professional timber logging and processing to decrease losses and (3) to create service providers for pruning, logging, sawing, registration of trees and logging permits to facilitate timber business for smallholders.

Fig. 1: Quantity and percentage per timber tree species on all cocoa plots

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