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Agroforestry coffee plantations in Peru, San Martín- a double dividend for biodiversity and farmers?

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Introduction

Background

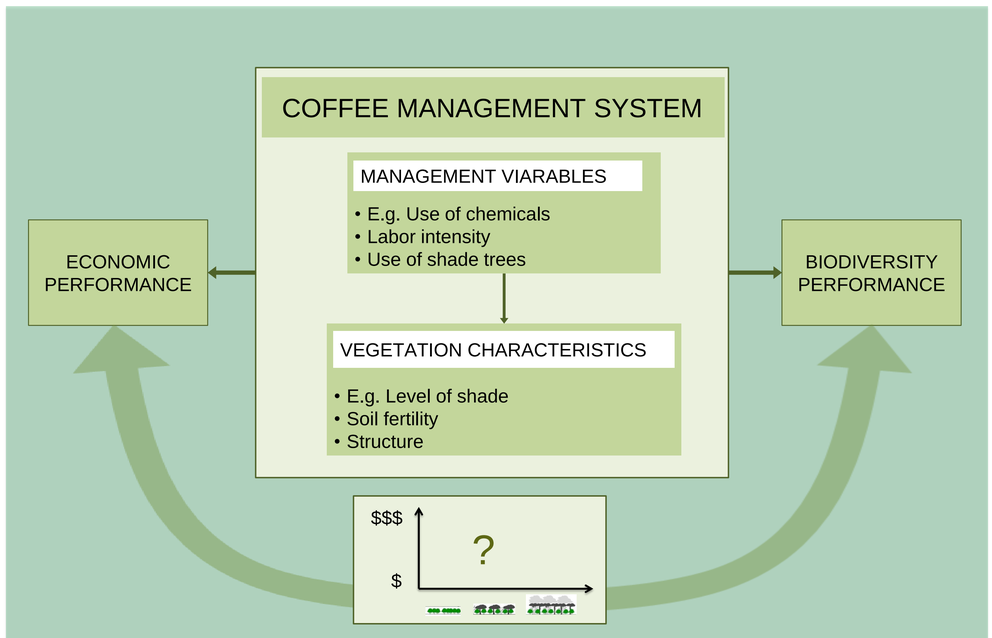
Tropical coffee agroforestry is seen as a promising approach to reconcile biodiversity conservation and food production as it holds the potential to increase overall productivity, resilience and sustainability, and meanwhile provides a refuge for biodiversity (Philpott et al. 2007; Perfecto et al. 2005). There is a variety of coffee systems, from unshaded high-input monoculture to diversified low-input shaded coffee plantations (Moguel and Toledo, 1999). Each of these systems has it's own trade-off in terms of biodiversity performance and economic performance. Empirical data on these trade-offs is however lacking, as multidisciplinary studies quantifying both biodiversity- and socio-economic performance are rare.

Aim

In this study we aim to quantify these trade- offs by conducting a study on small-scale coffee plantations in Peru designed to identify opportunities for increased resilience and sustainability.

Method

Four types of small-scale management systems were identified in the research area with the help of local experts: 1) traditional; 2) organic; 3) sustainable and 4) conventional. We conducted interviews amongst 138 farmers to collect socio-economic data and are in the process of collecting data on biodiversity and vegetation structure on the same plantations. Our final database will include information on: I) vegetation characteristics, e.g. canopy closure and DBH; II) costs, e.g. labour and chemicals; III) benefits, e.g. coffee yield and income from other products; IV) management characteristics, e.g. use of chemicals and weeding; and V) tree and butterfly biodiversity, with natural forest as reference.



Preliminary results

Plantation characteristics

	Structure	Density (coffee trees/ha)	Plantation size (ha)	Certified	Use of chemicals
Conventional (n=27)	Unshaded Monoculture	3707	3.0	No	Not restricted
Sustainable (n=29)	Shaded	3924	2.4	Yes - UTZ, RA	Restricted, but some chemicals allowed
Traditional (n=27)	Shaded/ sun	4392	3.2	No	Not restricted
Organic (n=55)	Shaded/ Sun	3854	2.2	Yes - Organic, Fair trade	Only organic


Shaded organic coffee plantation


Unshaded conventional coffee plantation


Shaded traditional coffee plantation

Preliminary results

Socio-economic and biodiversity performance

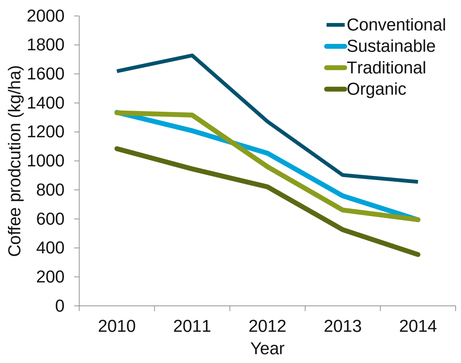


Figure a. Average coffee production in kg/ha from 2010- 2014

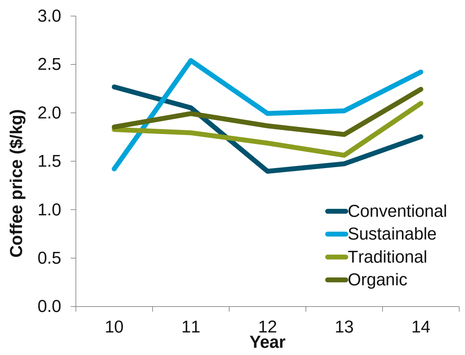


Figure b. Average coffee price in $/kg from 2010- 2014

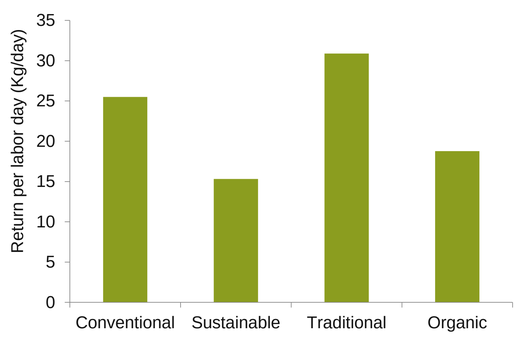


Figure c. Average return on labor days expressed as Kg of coffee returned per worked day. Labor costs represent a significant part of all costs associated with production of coffee.

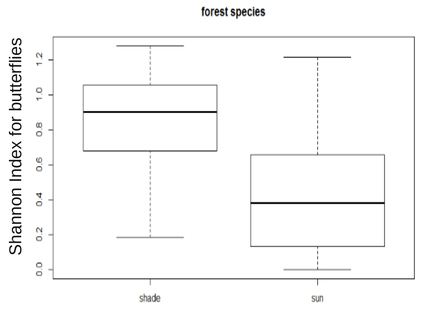


Figure d. Shanon Index for butterflies for forest habitat preferring species. Boxplot shows differences between sun plantations and shade plantation, P<0.05.

a. Overall, conventional systems showed an higher yield and organic the lowest. All plantation systems showed a significant decline in yield over the last few years, which is mostly assigned to the coffee leaf disease known as coffee rust. All plantations were affected equally, indicating the importance of factors as climate and pests and diseases.

b. The data show large fluctuations in coffee price which is in accordance with world coffee price fluctuations. On average, sustainable plantations received the highest coffee price, while conventional plantations received the lowest average coffee price. Certification premiums and quality coffee beans could explain this variation.

c. Return on labor is highest for traditional plantation systems and lowest for sustainable systems. Note however that this only refers to coffee yield, as income from other products such as timber is not yet taken into account. This is expected to increase income in particular for sustainable and organic plantations.

d. Shanon Index for butterfly species diversity and abundance for forest habitat species was significantly higher in shaded systems, suggesting that shaded plantations have high potential to conserve biodiversity. Note: this data was collected in a different area but with same method.

Conclusion and further research

These preliminary results show that there are trade-offs within a plantation management systems, such as between management intensity, coffee yield, coffee price and biodiversity. Therefore there is a need to identify these trade-offs to fully understand production systems.

After collecting biodiversity data, we will combine the economic performance data with the biodiversity data to gain better insight in their trade-offs. This information can guide future research and certification schemes.

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Perfecto, I. et al., 2005. Biodiversity, yield, and shade coffee certification. Ecological Economics
Philpott, S.M. et al., 2007. Field-testing ecological and economic benefits of coffee certification programs. Conservation biology