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## **Interaction between household and field characteristics in generation of ecosystem services from coffee agro-ecosystem of Llano Bonito, Costa Rica.**

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Agro-ecosystems are major sources of ecosystem services (ESs). Coffee, originally a shade crop, is an important export cash crop for Costa Rica and other Latin America countries. Coffee grown under shades of diverse natural shade tree species (“rustic” systems) has potential to provide numerous ESs. However, coffee systems in Costa Rica have gone through transformation that involved sparse or absence of shade and intensive production systems with higher external input, favouring short term financial benefits over long-term generation of ESs.

The objective of the study was to understand how coffee producing households’ characteristics, related to decisions on resources endowments and management, interact with field characteristics to generate key ESs: yield and regulation of important coffee pests and diseases. We carried-out household and management surveys, measurements of coffee field characteristics and monitoring of ESs in Llano Bonito watershed, Costa Rica for the coffee production year 2013–2014. To understand household characteristics, resource endowments and key ESs management within coffee production systems, a structured questionnaire survey was employed to 40 sample households. 97 plots were sampled in coffee fields of surveyed households and measurements were carried out to characterise site, coffee, and shade tree, and to quantify coffee yield. These plots were further re-sampled and 69 plots were selected to monitor variations of locally important coffee pests and diseases along 4 time series. After the final coffee harvest, a second household level survey was carried-out to record coffee management practices for the sampled plot for the production year.

Households and fields were categorised into 4 and 3 categories respectively with the aid of Principal Component Analysis (PCA) and Agglomerative Hierarchical Clustering (AHC). Households were categorised based on their functional characteristics, which included their orientation to produce coffee and state of coffee management whereas fields were categorised based on their biophysical characteristics, which included their suitability for generating ESs. Features of each category and interactions between household and field

categories are summarised. The method shows how diversities of decision and biophysical contexts can be taken into account while assessing and promoting ESs from agro-ecosystems. The results demonstrate feasibility to evaluate variations in decision and biophysical contexts of agro-ecosystems for understanding ESs, and have potential to contribute to understanding and thus promotion of ESs.