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Vegetation-Based Indicators for Assessing Ecosystem Services of Cacao Agroforestry Systems, Buffer Zone of Abiseo River National Park, Peru

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Abstract

This research aimed to identify vegetation structural attributes capable of performing as indicators for the assessment of support and provision services of the cacao agroforestry systems. This was done by setting up a comparison between the cacao agroforestry systems, the cacao plantation, and the natural forest in the buffer zone of the National Park ‘Rio Abiseo’, in the Peruvian amazon. The comparison was carried out under the assumption that structural attributes of the vegetation, such as the tree diversity (richness and evenness) and composition, forest structure (DBH, height, vertical layers, shrub and herbaceous cover, and diversity and composition of saplings) and coarse woody debris (snags, logs, and litter depth) can be indicative of supporting and provisioning services. The supporting services were focused on the provision of suitable habitat for the jaguar (*Panthera onca*) and the San Martin’s titi monkey (*Callicebus oenanthe*) while the provisioning services focused on the average monthly income (USD per ha) from cacao production. The structural attributes were measured and compared in modified Whittaker plots (0,1 ha) set in the cacao agroforestry systems (19 plots), cacao plantations (21), and natural forests (20). A principal component analysis and a constrained correspondence analysis (with a permutation test) were used to compare different systems. These analyses allowed the identification of the presence of a shrub cover, the layer of trees between 16 and 20m tall, the presence of snags, the average tree height, and the layer of trees between 5 and 15m tall, as significant vegetation structural attributes for the assessment of the ecosystem services in the different systems. These attributes can guide the decision-making process in the buffer zone of the National Park to assure habitat provision, particularly for the endemic species of titi monkey of San Martin. At the same time, it can assure the sustainable production of cacao and the livelihoods of human communities that depend on the ecosystem services of the buffer zone of the National Park Rio Abiseo.

Keywords: Cacao agroforestry systems, ecosystem services, indicators, National Park Rio Abiseo, Peruvian amazon