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Herbaceous Species Cacao Production Systems: Biotic Homogenisation and Dynamics Over Time in a Long-Term Trial in Bolivia

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Abstract

The different types of cocoa production have an impact on the spontaneous diversity of the cropping systems. Plants, and specifically herbs, are one of the most susceptible groups to the transformation of forests into cropping land. We study the plant species of the herbaceous stratum in an experimental trial in Bolivia, where five production systems representing a gradient of management intensity were compared: two monocultures and two agroforestry systems under conventional and organic farming containing a planted cover crop layer, and a complex successional agroforestry system with no external inputs.

In a first study we explored the potential role of agroforestry systems and management intensity in diversity conservation and against biotic homogenisation. We did not find significant differences in species richness between production systems, but higher number of species was found in the successional agroforestry system. However, community composition did change following the management intensity gradient. In addition, we found that widely distributed species, including some exotic species, were associated to intensive management, i.e. monocultures and conventional systems with high solar exposure levels and/or glyphosate application. Conversely, successional agroforestry and organic systems harbored species with a geographical distribution range restricted to the Neotropics or South America. Accordingly, cocoa organic and agroforestry systems, could contribute to both biodiversity conservation and the minimisation of biotic homogenisation.

In a second study based on Braun-Blanquet samplings of herbaceous strata over seven years, we found that the differences in community composition were established at a very early stage and time had a minor role compared with the selective pressure of the production system. In the systems with more available resources (light, space) we registered higher number of new species, but the pool from which they come from depended on the production system.

So far we have found 171 different herb species in the trial. We have identified some species that could be used as cover crops if kept in the system under proper management, which could reduce the weeding efforts. We have also identified species selected and promoted by the use of glyphosate in the conventional systems.

Keywords: Agroforestry, biodiversity conservation, community composition, full-sun monocultures, organic farming

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