

Harmonizing production and biodiversity

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Cacao based agroforests, especially indigenous shade systems, are among the tropical agroecosystems that support the highest levels of biodiversity. These systems are part of complex landscape mosaics, managed by farmers through multiple strategies that have supported the livelihoods of rural communities for decades, if not for centuries.

In the Talamanca region of Costa Rica, researchers from the *Centro Agronómico Tropical de Investigación y Enseñanza* (CATIE) implemented a project that aimed to improve cacao production, thereby avoiding that farmers shift to other more profitable but less biodiversity-conserving crops. The three-year project involved around 300 small organic cacao farms managed by indigenous peoples. The interventions introduced to improve cacao production included: shade management through pruning and thinning; enrichment planting with timber and fruit trees; and introduction and grafting of improved cacao clones.

Based on thorough surveys, the project confirmed that the cacao agroforests harbour significant biodiversity, including 55 families and 185 species of plants, as well as many insect, bird, bat and mammal species. Biodiversity is highest in the more “rustic” tree diverse and multi-layered systems with about 55 - 60% shade cover, and lowest in simple agroforests with only two shade tree species and 35 - 40% shade cover. The diversity and abundance of wildlife is enhanced in more diverse and complex agroforests. A mix of native trees and fruit trees offers a greater range of food, and a combination of large trees and low shrubby vegetation offer more microclimates and therefore a greater variety of living conditions. Closeness to forest and watercourses also increases biodiversity. Most of these conditions, however, do not favour high cacao production.

Three years was not enough time to demonstrate whether the interventions enhanced cacao yields. However, productivity was found to be higher in the less diverse cacao agroforests and lower in the more complex systems, presenting a major challenge to researchers and managers: It appears that with the introduction of measures to enhance production, biodiversity levels may be sacrificed.

Looking at the data with an agroecological eye

One source of information that was untapped by researchers were the farm surveys conducted by the local farmers organization APPTA during their certification process. These surveys proved invaluable to investigate a key relationship in peasant agriculture: the relationship between farm size, diversity levels and productivity. We selected indicators that seemed relevant to the relationship between biodiversity conservation and productivity: cacao production per plant; shade management; pruning of cacao trees; tree diversity in cacao plots; canopy stratification; and presence of forest nearby. In each region we recognized types of cacao agroforests with varying levels of diversity: 1) Rustic or abandoned 2) Cacao plus fruit and timber trees 3) Cacao with 1-2 timber species 4) Cacao plus banana 5) Cacao plus banana and fruit trees and 6) Cacao and fruit trees.

One third of the 156 farms analysed were located in undulating landscapes near rivers. Another third were typical of hillsides and upland conditions, and the rest were in the valleys. The valley landscape can be considered less diverse than the upland and river areas. Most farms in the hillsides have an average size

of 42 hectares, where cacao occupies about 1.6 ha and the rest is devoted to a mosaic of agroecosystems and natural areas, including forest, fallow, pasture and annual crops, all managed by the farmer. In the valley areas, farm size is around four hectares, with cacao agroforests occupying about half of the total farm area. Most cacao agroforests showed low production levels, regardless of the production practices.

When studying the surveys, the following trends became visible:

- Highly biodiverse cacao systems do not necessarily exhibit low production values. The high biodiversity-low production relationship seemed more marked in the valley areas and less so in the hillsides and river margins, where most cacao plots close to forest patches showed medium production levels.
- Pruning does not seem to positively affect productivity, either because farmers do not prune well (timing, types of branches to be removed, etc) or because pruning must be done in conjunction with other practices (i.e. fertilization) that farmers do not follow.
- In the hillsides and river margin areas, a large proportion of farmers with plots smaller than one hectare showed medium production values, whereas in the valley this relationship was not detected. Given labour and cash constraints, this may indicate an optimal size for efficient production in these areas.

Conclusions

In order to increase cacao production while conserving biodiversity, the approach must transcend the cacao agroforests and embrace the total farming system. On the hillsides and river margins, farm designs should aim to maintain or enrich the whole farming system together with the surrounding environment, in a way that supports biodiversity and food security. This could include for example the reintroduction of the practice of growing beans, rice, corn, or cassava. It is also important to promote other income-generating activities such as honey, fish, wood for crafts, medicinal plants, and locally managed ecotourism. In the valley areas, there may be more limited opportunities for conserving biodiversity while promoting sustainable cacao production.

An eco-zoning approach may be useful to identify areas with more production than conservation potential, areas that have more potential for conservation than production, and areas where both goals can be harmonized, for example in the river margins. By intensively managing a small, optimal area of each cacao plot (0.5 - 0.7 ha), and leaving the rest under low input management favourable to biodiversity, farmers may be able to obtain higher productivity per unit of labour.

Cacao agroforests of less than one hectare in the hillsides and river margins already accomplish the goals of productivity as well as maintaining high biodiversity. The multifunctional nature of the diverse indigenous farms, through which farmers generate income from cacao, fruits, timber, crafts, ecotourism and preservation of biodiversity, offers the best opportunity to improve the livelihoods of the Talamanca indigenous people, while at the same time conserving the region's biodiversity. ■

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Reference

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