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Agroforestry – a viable option for sustainable cocoa production in Africa

Associations of cocoa trees with other trees—or so-called cocoa agroforestry systems—can contribute to the agroecological transition of this crop in Africa. Pure cocoa crop stands with little or no shade still prevail, but they are currently showing their limits. Technical solutions are thus urgently needed to consolidate the current cocoa-growing areas, reduce the pressure on forests and adapt to climate change. Farmers have been advised against agroforestry practices in recent years due to possible competition they could generate within cocoa farms, yet recent studies conducted in Cameroon have, conversely, shown that a balance can be struck between cocoa trees and fruit and forest trees chosen by farmers for their various uses, while maintaining a good cocoa yield in the long term. This balance, which farmers achieve through careful management of trees associated with cocoa trees, also enables the provision of ecological services such as carbon storage, biodiversity maintenance and cocoa pest control. **To achieve these trade-offs, cocoa agroforestry stands can be managed using a straightforward indicator, i.e. measurement of the relative basal**

area of cocoa trees calculated from the measurement of basal area of cocoa trees and that of associated trees. In Cameroon, this indicator is on average 40% in adult cocoa agroforestry farms producing 1 t/ha of marketable cocoa. Roughly the same value is noted in cocoa farms offering the best trade-off between cocoa yield, carbon storage and pest control. This easy-to-use indicator must be tailored to the cocoa growing area. It could also be adopted for sustainable cocoa production certification purposes, while the convergence between local know-how and scientific results could also facilitate joint drawing up of technical recommendations.

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▲ View of a typical cocoa agroforestry system in the central Cameroon (Obala).

Cocoa trees are dominated by an intermediate stratum consisting mainly of fruit trees, with the whole stand dominated by a canopy of tall forest trees.
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Hedgerows – functions in agroecosystems and contributions to carbon sequestration in France

IPCC stresses that the inclusion of trees in agricultural areas is an effective lever for climate change mitigation and boosting soil carbon stocks. Although hedgerows are widespread throughout the world, there is still little data on their contribution to carbon sequestration, particularly in temperate environments. Recent research in western France (Brittany, Pays de Loire)^(1,2) assessed soil carbon stocks in the vicinity of recent (20 year old) and older (40 to 120 year-old) hedgerows. **The findings revealed a significant effect of hedgerows on soil carbon stocks in adjacent plots (up to 3 m away). The annual increase in carbon stocks was estimated at between 9 and 13 % in the immediate vicinity of hedgerows, i.e. 2- to 3-fold higher than the 4% targeted annual increase in soil carbon stocks that could offset human-related CO₂ emissions⁽²⁾.** Otherwise, the impact of hedgerows on carbon storage on a landscape scale was found to be under the 4% objective—in a theoretical landscape consisting of 1 ha square plots, planting hedgerows all around the plots would only boost annual carbon storage by 1 to 1.5 %, which suggests that such planting should only be viewed as a complement to other practices.

Our research—focused on the environmental function of hedgerows—is now conducted to increasing extent in an interdisciplinary framework so as to dovetail farmers' management systems with long-term preservation of multiple targeted functions (ecological, agronomic), and with the design of sustainable hedgerow agroforestry systems⁽¹⁾. Yet hedgerows are still

solely viewed as environmental elements. Assessments of these environmental functions must now be linked to their agroecological production functions associated with crops and livestock in farming areas.

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▲ 15-year-old multistrata hedgerows in the Côtes d'Armor region (France), composed of chestnut, hazelnut, beech, oak and hornbeam trees.

These hedgerows are planted and managed by the Terres et Bocages farmers' association (<http://terresetbocages.org/>) in a bocage agroforestry approach, which is based on the integration of hedgerows in agricultural activities while fostering their multifunctionality. © V. Viaud



▲ A 20-year-old hedgerow in Finistère region (France), composed of oak, hornbeam, hazelnut, chestnut and elder trees. © V. Viaud