Many farmers are encroaching on classified forests. Moreover, climate change will further reduce areas suitable for cocoa production in West Africa. In response to the threat of seeing their last forests disappear, Côte d’Ivoire and Ghana, along with major companies in the cocoa industry, therefore pledged at the Bonn Climate Conference in 2017 (COP23) to protect these forests and promote agroforestry.

Sound technical solutions are now urgently needed to enable this region to address two major challenges—stabilize existing cocoa-growing areas while reducing the growing pressure on residual forests and, secondly, adapt to climate change.

Moreover, alternatives to cocoa monocultures should be considered in countries that still have abundant forests, especially in Central Africa. These countries could legitimately diversify their economy by developing cocoa farming, thereby reducing the strain on West Africa where the peak production capacity could soon be reached.

Agroforestry – a viable option for enhancing cocoa cropping in Africa

Cocoa farmers have been advised against adopting agroforestry—i.e. combining fruit and forest trees with cocoa trees—since the 1960s. This traditional practice is still being denounced today for delivering lower yields than...
cocoa monocropping, despite the fact that it is implemented in many cocoa-producing countries elsewhere. According to its detractors, associated trees of varying numbers compete for light, water and minerals to the detriment of cocoa trees.

These arguments may be partly relevant, yet recent research in Cameroon illustrates that the presence of service trees in cocoa stands does not preclude decent crop yields. Actually, cocoa agroforestry systems predominate in this country. The average cocoa yield, estimated on the basis of pod counts, is 740 kg/ha of commercial cocoa in plots with an average of 1,500 cocoa trees—similar to densities in monocropped cocoa plantations—and 190 fruit and forest trees. Yields as high as 1 t may be obtained, even without chemical fertiliser applications. Moreover, depending on the complexity of these cocoa stands (number and types of associated trees), their average carbon sequestration capacity can reach 75 t/ha or even more, which often represents 50% of that of secondary forests in the areas where they have been planted. Otherwise the carbon sequestration capacity of monocropped cocoa plantations is around 10 t/ha.

In some plots, this trade-off between cocoa production and carbon sequestration coincides with another crucial ecological service for farmers, i.e. controlling two major pests: black pod rot caused by a fungus, and mirids, i.e. biting and sucking insects whose repeated damage gradually leads to cocoa tree death. Farmers modulate the shade provided by associated trees to curtail fungal dissemination [favoured by dense shade] and infestation by mirids [which swarm when there is little or no shade]. This enables them to reduce pesticide treatments and therefore save up to 70% of the crop protection budget in intensively managed plots.

**Basal area – an operational indicator for cocoa agroforestry system management**

Studies on cocoa agroforestry stands in Cameroon have shown that the basal area per cocoa tree, which reflects the extent of competition between cocoa trees and associated trees, is a good indicator to help farmers decide on trade-offs between cocoa production and ecological services. The basal area is determined by measuring the trunk circumference at a given height and then calculating the cross-sectional area, or so-called ‘basal area’. This measure—which is conventionally used by foresters—can be readily applied by technicians and even farmers.

The target indicator here is the relative basal area of cocoa trees (see box p. 3), i.e. the ratio between the sum of the basal area of all cocoa trees in the stand and that of all trees in the stand [cocoa trees + associated trees]. In Cameroon, the mean value of this indicator is 40% in adult cocoa agroforestry stands that produce 1 t/ha of commercial cocoa, whereas it is 36% in cocoa farms with the best trade-offs between cocoa production and other uses and services according to their production strategy and economic capacity. The cocoa yield variability noted in Cameroon suggests that many farmers would need to better select and manage their associated species mixtures, yet their empirical knowledge seems to be in line with the scientific knowledge overall. This convergence between local know-how and scientific results could serve as a legitimate basis for dialogue between farmers and researchers so as to be able to co-construct technical advice tailored to farmers’ needs.

In conclusion, the relative basal area of cocoa trees appears to be a key indicator for managing cocoa agroforestry stands, their agronomic performance, longevity and trade-offs between cocoa production and various ecological services. This type of analysis—which may be achieved via a straightforward measurement on cocoa trees and associated trees—could readily be carried out in other cocoa growing areas or environmental situations. Local values of this basal area indicator and the associated tree densities should be specified. This would enhance estimation of existing trade-offs and help identify optimal levels that could be achieved locally (cocoa yield, carbon storage, etc.). Such calibration would provide a basis for discussions with farmers on technical levers that could help them achieve their sought-after balances.

**Potential update of certification criteria**

Since the late 1990s, voluntary sustainability and fair trade standards relating to the cocoa sector [Rainforest Alliance, UTZ, Fairtrade, etc.] have aimed at boosting the productivity and sustainability of cocoa stands. It is assumed that these standards—which benefit from certification systems—will ensure compliance with a set of sustainability criteria via different procedures, such as the development and revision of specifications, as well as compliance criteria, audit procedures, and training and accreditation of certification bodies. The specifications of these standards include a set of agricultural, social and environmental management criteria. However, criteria for agroforestry practices differ from one standard to another—they may include the number of mature trees present in the cocoa stand [e.g. 12 trees/ha], above-ground cover of shade trees [e.g. 30%] combined with a number of associated tree species [e.g. five species], or indigenous vegetation cover [e.g. 15%].
These standards have been widely adopted over the last decade and have led to the implementation of a virtuous chain of agroforestry practices in cocoa production systems. There are, however, serious shortcomings in their criteria with regard to ecological service provision and cocoa stand longevity—the expected benefits seem quite marginal in terms of carbon storage, biodiversity, pest control and soil fertility maintenance, etc.

Firstly, the research carried out in Cameroon shows that the expected benefit of associated trees—i.e. interesting trade-offs between cocoa production, several ecological services and cocoa tree longevity—presupposes conservation of about 100 trees/ha, which is much more than set out in the recommendations of current certification programmes.

Secondly, the above-ground shade tree cover criterion is very hard to quantify, which makes it interpretable and reduces its reliability. Shading is indeed a highly variable parameter and the various techniques geared towards estimating it have many drawbacks. This is also the case for indigenous vegetation cover, whose definition could also be questioned.

Finally, the criteria adopted—tree density, number of species, shade, vegetation cover, indigenous or not—do not enable a genuine assessment of the trade-offs between cocoa production and ecological services. This is why the relative basal area of cocoa trees may serve as a compliance criterion that could be mainstreamed with these standards to generate a new cocoa stand management tool—a precise, easily measurable indicator that can be tailored to local conditions.

Yet to achieve the targets set by the European countries that signed the Amsterdam Declaration [2015], which...
perspective n° 54 is the result of research and consultancy initiatives conducted firstly on cocoa agroforestry systems by CIRAD and the Agricultural Research Institute for Development (IRAD) in Cameroon, and secondly on cocoa certification by CIRAD for the French Development Agency (AFD, https://www.afd.fr/en/).

In Cameroon, research was carried out over the 2009–2017 period as part of the Platform in partnership for research and training (dP) Agroforestry systems in Central Africa – Agroforesterie Cameroun (https://www.cirad.fr/en/our-research/platforms-in-partnership-for-research-and-training/list-of-platforms/agroforesterie-cameroun) via the following projects:


A few words about...

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A few links

Amsterdam Declaration Towards Eliminating Deforestation from Agricultural Commodity Chains with European Countries: PDF document posted online on 18–01-2017 in the web archive: https://euandgyc.archieweb.eu/#

Fairtrade. https://www.fairtrade.net


Rainforest Alliance. https://www.rainforest-alliance.org

UTZ, Part of the Rainforest Alliance. https://utz.org

World Cocoa Foundation [WCF]. https://www.worldcocoafoundation.org


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