

Synthesis

This article can be found in:
Torquebiau E (ed.). 2024. *Agroforestry at work. Tropical Forest Issues 62.*
Tropenbos International, Ede, the Netherlands (pp. vii–xi).

Sorghum under *Faidherbia albida*, Senegal. Photo: E. Torquebiau

What makes agroforestry work?

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“As the world turns its attention towards nature-based solutions, agroforestry and community forestry, historically undervalued for their local impact, are seen as global assets. They are surely gaining momentum as scalable, bankable solutions — a pathway indeed to more sustainable solutions to environmental challenges, especially the climate and biodiversity crises.”

Why do many farmers still resist adopting and scaling agroforestry? Are the economic benefits not enough, or not perceived to be enough? Or are there other reasons? These are the questions that were asked when work began on *Tropical Forest Issues 62*.

The ecological benefits of agroforestry are well proved and documented, and there is no shortage of technical knowledge. However, while agroforestry is an age-old practice in many countries, its widespread adoption on both small and large farms, and its improvement where already practised, remain limited. The practice is often characterized as too small to benefit from economies of scale. But is that really the case?

This issue contextualizes agroforestry in four introductory articles in terms of economic viability and resilience [1.1], gender inclusiveness [1.2], interactions with climate change and biodiversity [1.3] and barriers to adoption [1.4].* We then present 22 case studies that show the clear and tangible benefits from the adoption of agroforestry.

Convincing cases

These 22 examples of agroforestry at work, from a range of developing countries, all show that agroforestry provides direct and indirect benefits to farming families and the wider economy. The well-documented case studies show that agroforestry “works” — it contributes to improved livelihoods (including direct cash income), subsistence activities, employment and other community benefits. In highlighting the reasons for its success in a range of contexts, we hope to demonstrate that agroforestry can spread, encouraging other farmers to develop and expand more diversified, productive and resilient farming systems. Depending on the local context and individual traditions and perceptions, different farmers will have a preference for different agroforestry practices. This shows the importance of developing locally owned agroforestry production systems in order to achieve the full range of benefits.

The articles in this issue describe a wide range of agroforestry practices from an array of environments and socioeconomic conditions. Nine come from Africa, eight from Latin America and five from Asia. They can be classified into four categories:

- crops under trees or intercropped with trees;
- annual crops under multispecies tree cover;
- perennial crops under multispecies tree layers; and
- agroforests.

Crops under trees or intercropped with trees

In perhaps the most common type of agroforestry around the world, crops are grown under trees or with scattered or planted trees in fields or around fields. These cases are typically characterized by a two-layer arrangement, with trees occupying an upper storey, more or less dense and sometimes diffuse, and crops cultivated in the understorey. In the simplest cases, there is only one tree species and one crop species at a time beneath the trees. In Honduras, the *Inga* tree agroforestry model shows good adaptation to climate change and has contributed to halting land degradation and supporting food security [2.3]. In Cameroon, *Faidherbia albida* agroforestry parklands provide significant direct

benefits to rural populations, such as firewood and fodder, and improve the productivity of associated crops [3.5]. In Burkina Faso, the development of hedged farmland (known as “bocage”) has led to well-functioning landscapes where runoff and erosion are reduced, water is stored and overgrazing is controlled, giving rise to improved yields and better livelihoods [3.3]. In Brazil, intercropping oil palm with native species of various life cycles (annual, perennial) and production objectives (wood, fruits, etc.) proved efficient in meeting the criteria of plant diversity, agroecological function and economic diversity [2.5]. In South Africa, intercropping groundnuts with eucalyptus trees contributed to increasing food security and improving community livelihoods [3.9].

Annual crops under multispecies tree cover

Many two-layer agroforestry arrangements have tree or crop layers composed of several species. In some cases, the associated crops are annual plants (e.g., maize, beans) or semi-perennial, non-woody plants (e.g., pineapple, aroids, spices). In Burkina Faso, agroforestry parkland has an upper layer of scattered trees from an array of different species providing multiple non-timber tree products [3.2]. In Bangladesh, pineapple, aroids and spice plants are grown under a range of trees that provide firewood or fruits [4.2]. In a similar situation in India, cardamom is cultivated under nitrogen-fixing alder trees [4.1]. The milpa agroecosystem of Mexico is comparable, with maize and other crops such as beans and pumpkins growing in the impressive biodiversity of native trees and fruit trees [2.2].

Perennial crops under multispecies tree layers

In this category, the lower layer consists of a perennial crop, typically coffee or cocoa. In the Democratic Republic of the Congo, efforts are underway to popularize the cultivation of cocoa and plantain bananas combined with trees from degraded forests and fallows [3.6]. In Brazil, cocoa is grown along with other commercial crops such as banana and açai palm under trees that provide shade as well as timber and non-timber products [2.6]. In Argentina, yerba mate, another perennial crop, is planted in araucaria timber tree plantations, where it finds a cool and humid environment [2.8]. In Bolivia, cocoa is planted with several companion crops (e.g., banana, coffee, ginger, avocado) in highly diverse ecosystems that favour the natural regeneration of trees [2.4]. With its very diverse trees, this last example actually looks like a case from the next category, with the tree component being a dense, mixed, multilayer, fully developed part of the plots.

*Please note: numbers in square brackets are cross-references to articles in this issue.

Agroforests

In this category, trees are found in dense, mixed, often multilayered arrangements, with crops or livestock occupying various niches that can change in time and space. The resulting agroforests are agroecosystems that frequently resemble natural forests. They certainly represent a promising approach now and for the years to come. In Mexico, ancestral native agroforests are extremely diversified, with several dozen tree species, and they harbour a notable shade-tolerant variety of pineapple [2.1]. In Lao People's Democratic Republic, ethnic minorities who have decided to stop practising shifting cultivation instead plant coffee in mixed seasonal tropical forests, maintaining a protective and diversified vegetation cover, which is particularly useful on hill slopes [4.4]. On the east coast of Madagascar, agroforests with clove trees and other export crops have become a major feature, also providing a wealth of subsistence commodities [3.8]. In Zanzibar's Spice Islands, in Tanzania, polyculture spice agroforests with clove trees, turmeric and black pepper — as well as resilient sources of food and firewood — allow families to eat a nutritious diet while generating income [3.7]. In Ghana, the application of agroecological principles has been found to boost the productivity of cocoa agroforests thanks to farming practices that favour crop diversity, crop rotations, biomass management and biological pest control [3.4]. In Indonesia, rubber agroforests are profitable business ventures with strong traditional importance in spiritual life, including respect for ancestors, and also function as social spaces for gatherings and collective fruit harvesting [4.5]. In Sri Lanka, forest gardens provide ecosystem services similar to those of nearby forests, such as watershed rehabilitation, and have been shown to improve livelihood security and contribute to poverty alleviation [4.3]. In Ethiopia, multispecies agroforestry homegardens around dwellings are a source of staple food to replace crops from remote fields during a time of conflict [3.1]. In Brazil, improved shade-tolerant pastures planted under native araucaria trees have proved to remain productive for most of the year and to support cattle-raising while protecting forest remnants [2.7].

Conditions for tangible benefits

All the 22 case studies presented here mention the positive effect of agroforestry on farmers' income; 15 report actual, quantified economic data. They represent factual, data-based cases of “agroforestry that works” and of money-making agroforestry initiatives. Direct financial benefits are often realized by those farmers who have market access, whether formal or informal. Indirect

benefits — such as improved subsistence, firewood and fodder security, increased savings and lower risks — are also among the tangible advantages that tree-based farming provides to farmers. Increased options for risk mitigation are also important. Greater stability of income from multiple products provides resilience against yield losses of any one product due to adverse weather or other unfavourable conditions. Diversity also contributes to more stable incomes, since loss of market value due to fluctuations in commodity prices can be compensated by better prices for other products.

However, these benefits should always be analyzed in the context of factors that may be hampering the uptake of agroforestry innovations, and thus from reaching its full potential in terms of productivity and adoption. Economic modelling based on actual field data [1.2] shows that there are four main categories of limiting factors: (1) lack of clear market opportunities for tree products other than the major crop; (2) perceived short-term costs at the time of converting to agroforestry; (3) additional perceived labour costs; and (4) lack of information on the positive environmental impacts of trees.

What then are the conditions that must be in place for these benefits to be realized? What steps have been taken by the farmers featured in this volume to demonstrate that agroforestry can indeed “work”? Based on recommendations formulated by the authors of the articles, some major trends emerge. They can be grouped in seven broad categories.

Improve social and human capital

The social and human capital necessary for the development of agroforestry are not always sufficient. Social relationships, as they exist through farmers' networks, often face constraints. More emphasis is required on innovative farmer agroforestry training, based on real-world agroforestry techniques; for example, to realize greater productivity. Criteria such as farmer happiness, well-being and the satisfaction of working on a pleasant farm in harmony with nature are seldom — if ever — taken into account, although they are mentioned by farmers as being important.

Pay attention to women

Failing to address women's needs and interests will limit the adoption of agroforestry. Women practitioners deserve more attention, as key stakeholders in monitoring and maintaining gender equality, as agents of change in the adoption of agroforestry, and because they often

play a significant role in agroforestry management. In spite of these contributions, gender disparities hinder women's adoption of agroforestry and their participation in decision-making processes, which calls for gender-disaggregated policies and practices [1.1].

Align priorities

The priorities of experts, NGOs and institutions and farmers do not always align in terms of farming choices; e.g., some may advocate agroecology while others will recommend increasing the use of agrochemicals. Achieving congruence is crucial for increasing acceptance by farmers because some existing agroforestry practices do not correspond to conventional farming patterns and because agroforestry innovations often require drastic changes in farming practices. Support from institutions or extension services sometimes focuses exclusively on just one commodity, or on yield objectives, when it would be more effective to focus on the entire system and the opportunity to diversify crops, or to make farmers aware of specific benefits such as improved agroecology, and the potential for risk reduction, climate resilience or biodiversity conservation. Agroforestry development requires an ongoing iterative and participatory process that involves a broad range of stakeholders, including smallholder farmers, government at all levels, NGOs and the private sector.

Provide technical assistance and capacity strengthening

There is a great need for technical assistance and capacity strengthening at all levels, from farmers to farmer organizations, municipalities and government officials. Many small-scale farmers have limited agroforestry knowledge and are not confident about embarking on a new practice. There is also a widespread lack of skilled and unskilled labour to assist farmers. Most extension services are still focused on monoculture, and agroforestry rarely gets much attention. On-farm learning to share agroforestry best practices (e.g., pruning of companion trees), as well as experience and knowledge, can be extremely useful. Model farms can be local hubs for training and for disseminating genetic material from nurseries of native trees and seeds. "Champion" farmers can play a key role in solidarity and knowledge sharing in their communities and provide a critical mass of innovators and a social licence for innovation. At the

village and landscape level, success is more likely if many people implement similar innovations.

Enable legal, institutional and policy frameworks

Policymakers must work to develop enabling legal, institutional and policy frameworks, including increased availability of public services, appropriate financing, access to credit and incentives, and insurance schemes specific to agroforestry. Legal steps may be necessary to modify laws or bylaws to make them more appropriate for agroforestry. Issues such as tenure regulations, timber-cutting permits and the right to use tree products must be enshrined in law and enforced by officials.

Expand economic research

Research institutions need to publish results that are based on multiyear and long-term data, and are convincing to non-specialists. Research must assess and address gaps, such as insufficient information about the use of multipurpose trees, the costs of establishing an agroforest, how to grow lesser-known crops in agroforestry associations, low-cost methods in terms of labour and inputs, disappearing Indigenous agroforestry knowledge, and agroforestry techniques that are well adapted to local agriculture. And high-yield agroforestry practices should not be neglected, as this is probably one of the best options to make sure that agroforestry farms benefit from economies of scale (i.e., by spreading costs over large areas). Research institutions must also acknowledge that complex systems such as multilayer agroforests require long-term financial resources and a multidisciplinary approach.

Develop value chains

Value chains for agroforestry products need to be developed in order to broaden income opportunities, and must take into account a variety of existing challenges: fluctuations in world prices, scattered and sometimes remote production, competition from other cash crops, the need to create access to new markets, transport costs and lack of transport. Institutional markets and niche markets for farm produce can provide important support for diversified agroforestry farms. Rewarding farmers for environmental services (e.g., carbon sequestration by trees), possibly linked with farm certification, can also contribute to strengthening farmers' economic resilience.

Conclusions

If the above conditions are met, as a function of local circumstances and taking the farmers' priorities as an entry point, of course, the co-benefits that agroforestry can bring — in terms of increased resilience to environmental and climate changes and to social and economic challenges — can be realized at a large scale and reach millions of farmers. Yet, for impact and adoption at scale to actually happen, a wide audience

needs to be mobilized, including policymakers and all stakeholders responsible for development/environment/food system programmes — as well as those advising them. Companies, governments and knowledge and financial institutions are encouraged to collaboratively strengthen the enabling environment to support the required changes. It is hoped that the testimonies presented here will help reach this audience and spread the message that yes, “agroforestry works!”

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