Food and Agriculture Organization of the United Nations

International Commission on Poplars and Other Fast-Growing Trees Sustaining People and the Environment

Brief

# HOW CAN FAST-GROWING TREES OPTIMIZE AGROFORESTRY BENEFITS?

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## The role of the International Commission on Poplars and Other Fast-Growing Trees Sustaining People and the Environment

### 1. WHAT ARE AGROFORESTRY SYSTEMS?

Agroforestry systems (AFS) are land management systems that encompass the **deliberate integration of trees with crops or livestock, or both within a single management unit**. When properly designed and actively managed, AFS are **sustainable, productive and resilient systems** that provide economic, social and environmental benefits to farmers, communities and society. These benefits accrue because well-adapted AFS utilize tree and crop species with **complementary growth traits, chosen for their mutually beneficial interactions,** which optimize the **use of available natural resources, such as light, water and nutrients**.

Trees in AFS can be of various types and provide diverse goods and services, including food, fuel, fodder, products for sale, and ecosystem services. Ideally, the tree species selected in AFS provide multiple benefits to farmers. Fruit trees are commonly integrated into AFS, for example avocado (*Persea americana*), papaya (*Carica papaya*), mango trees (*Mangifera indica*) or citrus trees (*Citrus* spp.). Another main category are timber trees, which can include paulownia (*Paulownia* spp.), teak (*Tectona grandis*), eucalyptus (*Eucalyptus* spp.) and black locust (*Robinia pseudoacacia*). Some trees provide important ecological services, such as nitrogen fixation (e.g. acacia (*Acacia* spp.), calliandra (*Calliandra* spp.) or sesbania (*Sesbania* spp.) trees), soil stabilization (e.g. casuarina (*Casuarina* spp.)) or shade. The specific combinations of trees, crops and livestock vary depending on local conditions and objectives.

When AFS are **optimized for biophysical interactions** among species and with their environment, there is generally reduced reliance on external inputs, such as fertilizers, pesticides or irrigation, and a reduction in associated costs. These synergies can also increase the productivity of the whole production system and provide a variety of ecosystem services. These positive outcomes enhance the resilience of communities to shocks and stresses, including those caused by climate and market changes, and they can improve livelihoods.

## 2. THE BENEFITS OF FAST-GROWING TREES IN AGROFORESTRY SYSTEMS

### Traits and uses of fast-growing trees

Fast-growing trees (FGTs) are multipurpose and versatile trees that exhibit many useful traits. They establish rapidly, often propagate easily from cuttings, and demonstrate an ability to coppice. Some FGT species readily hybridize with each other, leading to high levels of genetic diversity, a feature that has been further enhanced by tree breeding and improvement programmes. Some have extensive rooting and elevated water use in comparison to other tree species.

As their name implies, FGTs have rapid growth and are typically grown in short rotations, meaning that they can be coppiced or harvested earlier than slower growing trees. Globally, there are hundreds of FGT species from several genera, the most common of which are poplar (*Populus* L.), willow (*Salix* L.), eucalyptus (*Eucalytus* L'Hér) and acacia (*Acacia* Mill.).

All these functional traits are reflected in the numerous uses of FGTs. The rapid growth of FGTs and their ability to coppice make them ideal for intensive cultivation for production of biomass for timber, fibre, bioenergy, biofuels and other bioproducts. Fast-growing trees are also particularly suited to environmental remediation and land restoration applications, including as windbreaks to minimize soil erosion. Some species with extensive rooting can rapidly stabilize eroding or otherwise degrading soils. Other FGT species exhibit elevated water use, making them ideal candidates for remediating soils degraded with contaminated groundwater or agricultural pollution from fertilizers, along riparian zones. Due to their rapid growth, elevated woody biomass production and extensive rooting systems, FGTs have great potential for carbon sequestration and therefore contribute to climate change mitigation. By providing habitat for other species, FGTs can contribute to improving biodiversity. They are also species suited for urban afforestation.

## Boosting the social, economic and environmental benefits of agroforestry systems with fast-growing trees

Integrating FGTs in agroforestry is an important strategy to maximize the potential of AFS. Because of their fast-growing nature, FGTs can provide benefits in a much shorter time and can diversify income. For example, FGTs can provide harvestable biomass for biofuels and bioproducts in 3 to 15 years, depending on the genera.

Fast-growing trees provide ecosystem services that not only benefit the land management unit where they are grown but also the surrounding environment, through improved soil and water quality, and substantial carbon sequestration. Depending on the species and management, including density, environmental benefits from FGTs integrated into AFS include:

- the development of favourable microclimates, including lower temperatures, wind speeds and higher humidity;
- higher biodiversity compared to fields or pastures without trees;
- lower soil erosion, higher soil organic matter and reduced soil temperatures;
- reduced water runoff during storm events; and
- improved groundwater recharge.

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## Maximizing benefits and mitigating risks when integrating FGTs in AFS

The rich genetic diversity among FGT species and varieties means that trees can be selected to boost the efficiency of AFS according to the desired objectives. This diversity is reflected on several key traits, such as biomass production and carbon sequestration rates, canopy structure, water use and rooting depth. **Proper variety selection is therefore key to maximizing the potential gains from incorporating FGTs in AFS**.

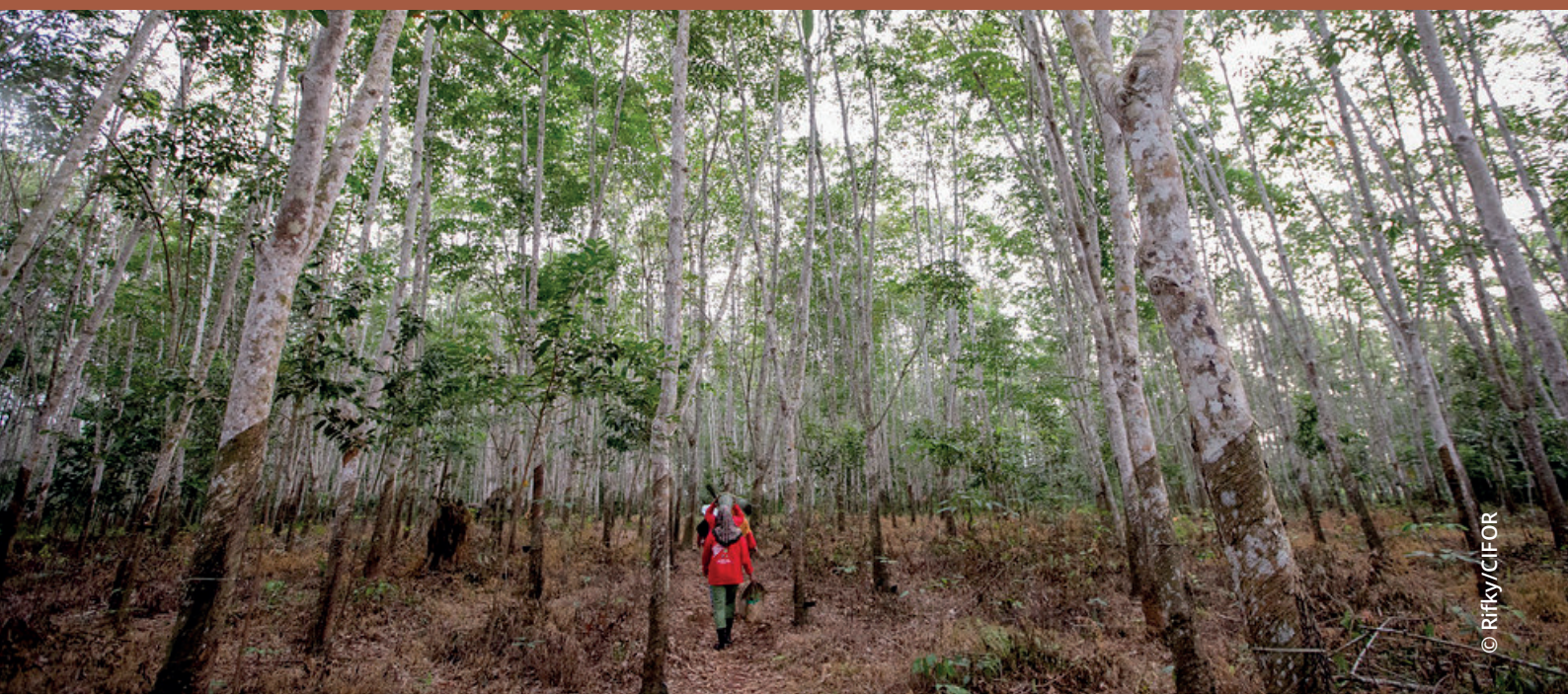
Selecting the right varieties is also key to minimizing the negative impacts of some FGTs, most notably **invasiveness and elevated water use**. When selecting FGTs for use in AFS, farmers should consider a number of factors to prevent potential negative effects and maximize the benefits of integrating FGTs in AFS. This can be done by:

- selecting species or varieties native to the region;
- selecting genotypes with lower risk of invasiveness;
- implementing shorter rotations to limit flowering and seed production;
- thinning, pruning or coppicing;
- maintaining effective distances between FGTs and valuable natural habitats; and
- considering the growth and water use of different varieties in drought-prone or nutrient-poor areas.

## 3. CHALLENGES FACING THE WIDESPREAD ADOPTION OF AGROFORESTRY SYSTEMS INVOLVING FAST-GROWING TREES

The integration of FGTs in agroforestry is considered **a sustainable solution for addressing pressing agricultural, social, economic and environmental challenges**. It is also important to acknowledge that there can be barriers to adopting agroforestry, some of which are specific to the inclusion of FGTs. Main challenges include:

- uncertainty about land and tree tenure, and constraining rules governing the use of agricultural lands;
- lack of extension services and practical information on integrating FGTs in agroforestry;
- the time, knowledge and resources needed to successfully establish these integrated systems, and the need to mitigate the risks involved for farmers;
- lack of access to markets and credits;
- lack of rural infrastructure;
- research gaps on agroforestry species combinations in different ecological contexts, the economics of integrating FGTs in agroforestry, and the trade-offs of integrating trees with crops or animals, or both.




## 4. THE ROLE OF THE IPC IN FOSTERING THE SUSTAINABLE MANAGEMENT OF FAST-GROWING TREES

The International Commission on Poplars and Other Fast-Growing Trees Sustaining People and the Environment (IPC) is a treaty-based statutory body within the framework of the Food and Agriculture Organization of the United Nations (FAO). Its mission is to reduce poverty and improve ecosystem services worldwide by fostering the sustainable management of FGTs to improve livelihoods and ecosystem goods and services. Through the implementation of its 2022–2032 strategy, the IPC aims to contribute to the United Nations (UN) Sustainable Development Goals, the UN Global Forest Goals, the UN Decade on Family Farming and the UN Decade on Ecosystem Restoration.

The IPC achieves its objectives by facilitating technical knowledge exchange on the sustainable management of FGTs through the activities of five working parties, which focus on genetic resources; production systems for the bioeconomy; environmental and ecosystem services; policy and livelihoods; and communication and outreach. These working parties aim to accelerate research, management, education and outreach on the environmental, economic and social aspects of FGTs and their contributions to sustaining people and the environment across the world.

The IPC is a knowledge- and capacity-development network and a platform at the interface of science, policy and practice. It is uniquely placed to address the most important barrier to the widespread adoption of AFS integrating FGTs: the lack of available, accessible and actionable information. To meet this challenge, the IPC commits to:

- continue to provide space for practitioners, researchers and extension specialists to interact, share experiences, challenges and best practices;
- build on its collaborations with agroforestry institutions and engage with new partners to support the adoption of FGTs in agroforestry around the world;
- encourage research on barriers to the scaling-up and scaling-out of AFS using FGTs;
- expand its knowledge-sharing and outreach capacities to reach the broadest possible audience;
- improve support for FGT management in agroforestry at all scales, as well as from peers, governmental institutions and society; and
- strengthen the contributions of AFS to food security, sustainable livelihoods and land use in rural and urban communities.

# How can fast-growing trees optimize agroforestry benefits?

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For more information, please consult:
https://www.fao.org/ipc/en/

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