
Mariam Mubiru, Uganda. Photo: Linda Andersson.

Agroforestry Network

FOUNDED BY VI-SKOGEN

AGROFORESTRY FOR ADAPTATION AND MITIGATION TO CLIMATE CHANGE

Agroforestry is increasingly recognized as a land management system that can serve as a response option for both climate change adaptation and mitigation, while addressing many of the challenges that smallholder farmers are facing. Agroforestry can generate multiple livelihood and environmental benefits, as it can help to mitigate climate change and help farmers to adapt to extreme and variable weather (IPCC, 2019). Agroforestry supports tree-related ecosystem services, such as regulation of water and sediment flows, carbon and nutrient cycling in soils and it provides habitat for biodiversity. This leads to increased soil fertility, reduced soil erosion and flood and pest control. Benefits of agroforestry to smallholder farmers include increased farm productivity and reduction of external inputs such as conventional fertilizers and chemicals for pest management, leading to increased income.

Climate change is happening now (Ripple et al. 2019) and urgent action is required to limit the temperature increase to 1.5 degrees (IPCC, 2019). Climate change risks (e.g. severe droughts, flooding, diseases) can have extensive impacts on agricultural systems, triggering soil erosion, crop failure, loss of biodiversity, reduced soil moisture, pest damages and economic losses. More extreme events and greater occurrence of drier and wetter conditions are already making it difficult for farmers to plan planting and harvesting (SIWI, 2018), threatening current production systems and food security as a result. Trees, forests and agriculture are key to reducing carbon emissions and achieving the Paris Agreement targets. Replanting the right tree species in the right place can help farmers adapt to climatic impacts.

Agriculture, forestry and other land uses stand for 23% of the world's total emissions

LAND DEGRADATION – A DRIVER OF CLIMATE CHANGE

About 25% of the Earth's ice-free land area is subject to human-induced degradation and many countries expected to be severely affected by climate change are located in the tropics, with large parts of their populations dependent on agriculture (IPCC, 2019). Organic matter in soils contain approximately three times more carbon than the atmosphere (Jobbágy and Jackson, 2000), and it is easily removed by land degradation. Over time, soil can thus serve as a carbon sink or source depending on soil properties, local climate and land use (IPCC, 2019).

About 23% of the world's total emission of greenhouse gases (GHGs, e.g. CO_2, N_2O and CH_4) come from agriculture, forestry and other land uses, for example from deforestation, livestock production and soil and biodiversity degradation (IPCC, 2019). Farming activities may generate significant amounts of GHGs, for instance from inorganic fertilizers, pesticides, fossil fuels, manure and crop residues, as well as increased numbers of livestock. At the same time, impacts of climate change make farming more difficult and unpredictable for smallholder farmers, while the demand for food increases as populations grow. Degraded landscapes mean lost opportunities and negative impacts for people, society, economies, and for ecosystem services and environmental flows. Also, allowing degradation to continue increases the difficulty and cost of land restoration (Molin et al., 2018).

AGROFORESTRY – EFFECTIVE LAND-BASED ADAPTATION AND MITIGATION OF CLIMATE CHANGE

Sustainable Development Goals (SDGs)

Agroforestry contributes to many of the SDGs (Agroforestry Network, 2018). In this policy brief we focus on the following SDG targets:

SDG 2.4

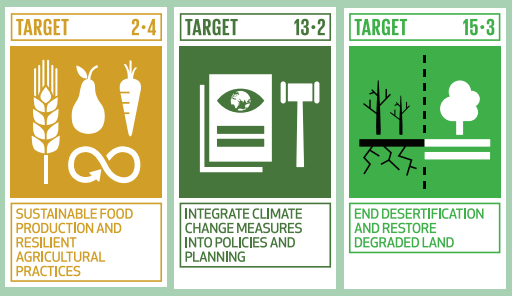
By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality

SDG 13.2

Integrate climate change measures into national policies, strategies and planning

SDG 15.3

By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world



AGROFORESTRY FOR ADAPTATION AND ECOSYSTEM RESILIENCE

Climate change can increase risk for agriculture such as droughts, flooding and pests. The ability of farmers to continue living on their land depends on how well they adapt to climate change risks. Agroforestry for climate adaptation at the farm level and enhanced resilience at the landscape level can take many forms. For instance, agroforestry can reduce air pollution and enhance both warming and cooling of the atmosphere, creating a resilient microclimate for crops and livestock (Ellison et al., 2017). It also enhances water security through improved

infiltration to soils and groundwater (Bargues Tobella et al., 2014), protecting water catchments and watersheds. The potential to improve soil properties and water availability to plants also make agroforestry practices suitable for landscape restoration. Moreover, trees provide a number of ecosystem services, such as water regulation, climate buffering, soil fertility, erosion and flood control, as well as food, fodder, medicine and wood – all important for resilience to climate change and reduced vulnerability of local people (Verchot et al., 2007; Mbow et al., 2014).

Equally important, agroforestry can improve livelihoods in smallholder farming systems through diversified income and cash crop systems (e.g. cocoa, coffee, nuts), increased food security and improved access to nutritious food. Trees on farms can also help the farmers reduce the economic recovery time after natural disasters (Simelton et al., 2015). Climate adaptation is particularly important for female farmers as they often have less access to resources compared to their male counterparts (Kiptot et al., 2014). Female farmers produce a major part of the food in many developing regions, but generally do not have the same opportunities to improve their livelihoods (Agroforestry Network, 2018). It is also common that women are left in charge of the smallholder farm when their spouse is migrating for work, and therefore need more capacity to handle the increased workload (Leder et al., 2016). Agroforestry can be a suitable land management system to reduce gender inequalities related to natural resource access, while contributing to increased control of their benefits.

AGROFORESTRY AS A POTENTIAL MITIGATION STRATEGY

Agroforestry practices can reduce or remove significant amounts of GHGs through increased carbon storage in biomass above-ground and below-ground and in soil organic carbon (IPCC, 2019). Integrating agroforestry into cropping and livestock keeping systems can enhance carbon sequestration by significant amounts. Home gardening, boundary planting, fruit orchards, riverine, hedgerows, woodlots and firewood lots are major agroforestry practices that sequester CO_2. Agroforestry stores more carbon than pastures and fields with annual crops, but less than forested areas (see Figure 1).

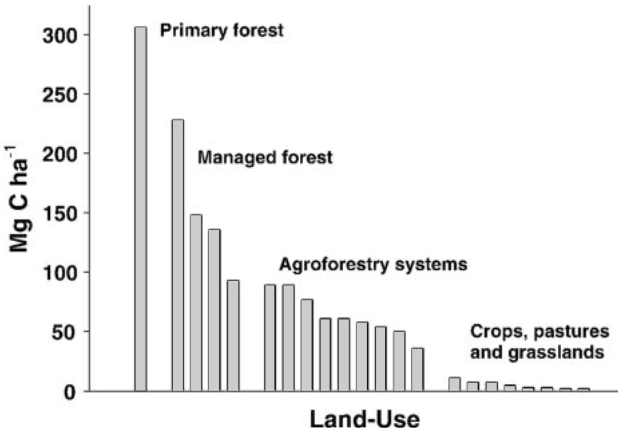


Figure 1. An illustration of different land use management systems and their potential to store carbon in the tropics (Verchot et al., 2007)


Photo: Riccardo Gangale.

Photo: Linda Andersson.

CASE STUDY – KENYA AGRICULTURAL CARBON PROJECT

The Kenya Agricultural Carbon Project promotes agroforestry and has helped almost 30,000 farmers in western Kenya to grow over 3 million indigenous agroforestry trees, alongside learning other sustainable land management practices; such as composting, mulching, and application of livestock manure. The project is a partnership backed by the World Bank, where Vi Agroforestry trains the farmers involved in practices to increase the content organic matter in the soil. Increased organic content in soil improves yields, provides resilience to droughts and heavy rains, limits erosion, and stores carbon, for which the farmers receive payment. The project sequestered about 345,000 tons CO_2 between 2010 and 2016, while improving agrobiodiversity, food security and adaptation to climate change as co-benefits.

The project was a game changer, where farmers who had experienced a decline in crop and livestock yields over time and severe environmental degradation, achieved over 150% increase in yields over a period of eight years. Increasing yields was the main economic incentive for the farmers to engage in the project, and since the start of the project savings among farmer families have increased – along with a greater resilience to a wide range of shocks, including climate change impacts. Other results include increased knowledge about climate change and increased access to firewood, fruits and fodder from trees. When the project ends in 2030, the expected sequestrated amount of carbon will be about 2 million tons (Agroforestry Network, 2018).

150%
increase in yields in eight years

ENABLING FACTORS AND BARRIERS TO THE IMPLEMENTATION AND SCALING-UP OF AGROFORESTRY

Agroforestry is a widespread practice in both developing and developed countries, and its visibility is increasing at national level and in international institutions. However, there are a number of barriers working at different scales that are preventing a broad-scale implementation of agroforestry practices, such as inefficient markets, unclear land-rights, limited access to knowledge and finance and lack of intersectoral collaboration (Agroforestry Network, 2018). The Agroforestry Network proposes key enabling actions to scaling-up agroforestry (2018), which include:

- *Improving access* to credit and monetary resources, e.g. by supporting scalable financial models addressing long-term returns on investment in agroforestry practices.
- *Improving farmers' access* to markets and creating value chains for agroforestry products.
- *Improving farmers' access* to high-quality planting material and extension services.
- *Improving demand driven*, participatory and inclusive agroforestry-related research.

Despite intentions to expand agroforestry practices, significant gaps exist between countries' ambitions and their capabilities to measure, report and verify agroforestry actions (Rosenstock et al., 2018). There is a need to develop strategies, frameworks and indicators at all levels to measure agroforestry diversified systems and climate benefits.

POLICY BENEFITS OF CLIMATE CHANGE ACTIONS THROUGH AGROFORESTRY

The United Nations Framework Convention on Climate Change (UNFCCC) and other international organisations and scientific panels are emphasizing the importance of using sustainable land management systems, such as agroforestry, to generate multiple environmental and socio-economic benefits (e.g. FAO, 2019; IPBES, 2019; IPCC, 2019). The implementation of agroforestry can help countries reach their goals related to climate change adaptation and mitigation, reforestation as well as SDG-targets related to food and water security. An analysis by CGIAR showed that, as of June 2018 over a third (59 of 147) of developing countries had proposed agroforestry as a climate change mitigation activity for achieving their Nationally Determined Contributions (NDC) under the UNFCCC (Rosenstock et al., 2018). Agroforestry can thus be a resilient land management solution with cross-cutting benefits for both adaptation and mitigation to climate change.

Moderata Josephia, Tanzania. Photo: Linda Andersson.

RECOMMENDATIONS TO POLICY- AND DECISION MAKERS

1. Support local communities in implementing agroforestry practices to tackle climate change with e.g. financial, capacity and legal support, to create multiple socio-environmental benefits, such as improved farm productivity and biodiversity, increased food and water security and soil health, as well as improved gender equality.
2. Secure land tenure rights and create incentives to encourage farmers to invest time and money in land use practices with a longer return on investment, such as agroforestry.
3. Make agroforestry visible, by exploring policy changes to include agroforestry, for instance in development cooperation strategies, technical assistance and budgets. A starting point is to make it easier to identify if development cooperation includes support to agroforestry.
4. Develop strategies, frameworks and indicators at all levels to continuously measure progress in agroforestry systems and their climate benefits.
5. Create effective, cost-efficient and equitable policies by using agroforestry to combine climate change adaptation and mitigation, as well as their cross-cutting synergies, with economic development.
6. Connect agroforestry to the climate agenda and report progress. As countries are committed to fulfilling their National Determined Contributions (NDC) under the United Nations Framework Convention on Climate Change (UNFCCC), supporting agroforestry makes sense from both an adaptation and mitigation standpoint.

Benta Muga, Kenya. Photo: Amunga Eschuchi.

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