Opportunities and Challenges of Promoting Agroforestry for Climate Change Mitigation: A Case-Study of the Mitigation of Climate Change in Agriculture (MICCA) Pilot Project in Tanzania

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Summary

Agriculture can help mitigate climate change through reducing emissions from the agricultural sector and pressure on surrounding forests by investing in agroforestry systems that enhance carbon sequestration and provide fuel wood, thus reducing the need to deforest. In Africa, the main driver of deforestation remains subsistence agriculture, which stresses the need to develop climate-smart agriculture at field level with adequate support from district and national level policies. Agroforestry has been identified as a climate change mitigation practice for its potential to sequester carbon. Moreover, it provides multiple co-benefits to farmers, thus supporting adaptation to climate change. Farmer group discussions in the Uluguru Mountains in Tanzania suggest that 77% of trees found in the area provide them multiple benefits, mainly the provision of fire wood (79%) followed by fruits/food (51%). They also highlighted local adoption challenges, mainly the land tenure system and the common practice of slash and burn agriculture, which both impede tree planting and the wider promotion of agroforestry. This paper shows the importance for addressing land tenure while promoting agroforestry and connecting small scale farming with district and national policies on land tenure, agriculture and environmental conservation to ensure that climate change mitigation in agriculture is to be successful in Africa.

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Introduction

Direct emissions from agriculture and agricultural-induced land use change is responsible for more than 30% of yearly greenhouse gases (GHG) emissions (IPCC 2007). Agriculture through agricultural expansion is the main driver of deforestation followed by infrastructure development and wood extraction (Geist and Lambin 2002, FAO FRA 2010). With population growth, arable land expansion will likely continue in many regions, including Sub-Saharan Africa (FAO 2011). However, agriculture also provides the potential to mitigate between 5.5-6 Gt of CO2eqv/yr (IPCC 2007) and about 70% of this potential is in developing countries. This implies that agriculture and developing countries have to be part of the solution for mitigating climate change and for reducing land use change causing deforestation, while facing the challenge of enhancing agricultural productivity to meet the needs of growing human populations.

In contrast to Latin America and Asia where export markets drive agricultural intensification, which is now a leading driver of deforestation in those regions, in Africa it has remained small scale subsistence agriculture and poorly or totally un-managed wood harvesting for fuel, charcoal production and timber (DeFries and al. 2010, Palm and al. 2005, Burgess and al. 2002, FAO FRA 2012). Subsistence agriculture, often characterized by unsustainable agriculture practices such as slash and burn or shifting cultivation, is practiced by millions of small scale farmers, and is associated with complex development issues such as human population growth, urban demand for charcoal and animal protein, poverty, and food and land tenure

insecurity (FAO 2008, DeFries and al. 2010). Thus addressing climate change in agriculture in Africa will require a bottom up approach in which district and national policies are aligned with local level needs and advocacy on how best to support small scale farmers to help mitigate climate change and reduce deforestation without limiting livelihood opportunities.

Supporting adoption of climate-smart agricultural practices seems a promising pathway. Climate smart agriculture is an agriculture that sustainably increases productivity, resilience (adaptation to climate change), and reduces/removes greenhouse gases (mitigation of climate change) while enhancing the achievement of national food security and development goals (FAO 2010). Farmers aim at increasing their farm productivity and resilience to improve or at least maintain their livelihoods. Hence climate-smart agricultural practices, if they are to be adopted and up-scaled by small scale farmers, have to provide multiple benefits going beyond carbon sequestration and reduction of GHG emissions. Agroforestry systems, which are traditional and modern land-use systems in which trees are integrated with crops and/or livestock, have a good potential to be climate and livelihood smart practices (Verchot et al. 2007, ICRAF 2009). Considering its wide applicability, agroforestry has a high potential to mitigate climate change through carbon sequestration in soil and biomass (IPCC 2000) Average carbon storage by agroforestry system is estimated at 21 and 50 Megagrams C/ha/year in sub-humid and humid regions respectively (Schroeder 1994). Agroforestry also strengthens farmers' adaptive capacity to counter climate change impacts by building more resilient agricultural systems and diversifying income sources. Also importantly to farmers, agroforestry contributes to food security by providing multiple products and benefits to farmers such as food, fodder and shade for livestock, timber and renewable wood energy. It also supports enhanced agricultural production by improving soil conservation, soil water holding capacity, soil organic matter, soil fertility, and other ecosystem services. A key issue is to understand why agroforestry is not widely adopted and address the constraints.

The Mitigation of Climate Change in Agriculture (MICCA) programme, launched by FAO in 2010, is working to make agriculture more climate-smart. One component of the program are two pilot projects in Kenya and Tanzania where climate-smart agricultural practices are integrated into farming systems demonstrating that smallholders can be part of the solution to mitigate climate change in agriculture. This case study based on the MICCA pilot project in Tanzania looks at agroforestry as an opportunity to promote climate smart agriculture and reduce deforestation considering its multiple benefits, and explores project-specific challenges and barriers to adoption, mainly the prevailing land tenure system and the practice of slash and burn.

Methods and Site

The pilot project in Tanzania, a partnership between FAO, CARE International and the World Agroforestry Centre (ICRAF), aims to contribute to decrease the net GHG balance of agricultural systems in the project area through conservation agriculture, agroforestry, soil and water conservation, and the introduction of energy efficient cooking stoves. The MICCA pilot project in Tanzania is active in 15 villages in the locations (wards) of Kolero, Kasanga and Bungu in the Uluguru Mountain in the Morogoro district.

Map 1: The villages in the project's area in the Uluguru Mountains, Tanzania

A rapid appraisal on agroforestry, slash and burn agriculture and energy was conducted by MICCA- CARE International and ICRAF-Tanzania in December 2011 (unpublished data). The agriculture-deforestation interface was explored considering its relevance for climate change mitigation in the project area.

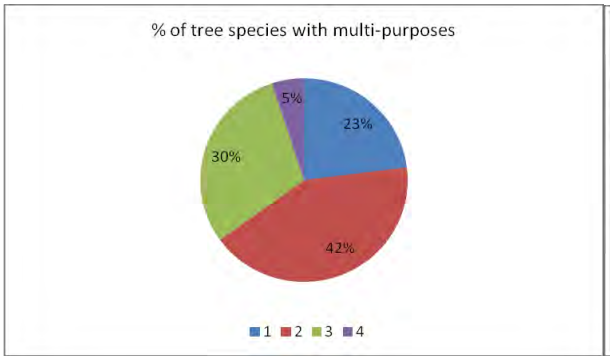
Seven focus group discussions (FGDs) were organized with a total of 63 farmers from the 14 villages located in the three sub-divisions (Table 1). Focus group discussion is a qualitative research method, in which a small group of participants discusses a specific topic under the guidance of a trained moderator.

Table 1: Number of participating villages and farmers by sub-division

Wards	Villages	FGD 1	FGD 2	FGD 3	Total
Kolero	5	6	6	8	20
Kasanga	5	8	11	-	19
Bungu	4	8	16	-	24

Results and Discussion

Trees provide natural, physical and financial assets. The FGDs were focused on the direct uses of trees and tree products as perceived by farmers; other ecosystem services provided or supported by trees were not discussed. Results from the FGDs showed that 43 tree species are important to farmers in the project area, and that 77% of these provided multiple benefits (Figure 1). The main uses mentioned were firewood (79%), fruits/food (51%), construction materials (30%) and timber (26%) (Figure 2). The results demonstrated the multifunctionality of trees in the project area and their contribution to farmers' livelihoods.



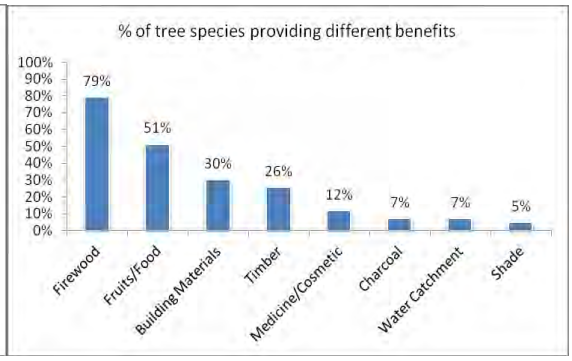


Figure 1(left): % of tree species with multi-purposes, and Figure 2 (right): % of tree species providing different benefits

It emerged from the FGDs that the main local drivers of forest degradation and deforestation in the project area were shifting cultivation through slash and burn practices, and the overexploitation of trees for timber, construction materials and firewood. Wood harvesting for brick making and removal of tree bark for storing crops were mentioned as reasons for forest degradation. Shifting cultivation and land clearing using slash and burn was perceived by farmers as being the main contributor to deforestation. It also impeded the subsequent regeneration of trees and the spread of wild fires. Slash and burn is the most common practice used in the project area for clearing and opening new lands for agriculture and for controlling weeds and pests posing a serious threat to forest edges, wood lands, and causing forest loss.

Challenges and barriers to agroforestry were discussed during the FGDs, and they could be grouped in three main categories (Table 2): land tenure system, land use and management, and capacity building and knowledge. Slash and burn is preferred by farmers as it is not time and labor consuming, and helps to control weed and pest. Thus, alternatives need to be provided to help address the issues of time availability, labor demand, and weed and pest management, in association with awareness on the impacts of slash and burn agriculture on climate change and environment conservation in general. There will be a trade-off between ease of agricultural production, and forest conservation and climate change mitigation.

Table 2: Challenges and barriers related to adoption of agroforestry in the project area

Challenges	Barriers to Agroforestry and tree planting
Land tenure system	- Small land plot size (mainly in upland villages) - Clan-owned land renting system - Absence of village land use plans
Land use and management	- Slash and burning practice which farmers mentioned is not time and labor consuming and allows to control weed and pest
Capacity and knowledge	- Lack of awareness by farmers of environmental benefits of trees and misconception about trees e.g. fear of tree shade negatively affecting crops, and fruit trees attracting monkeys - Lack of awareness of existing forest legislation - Lack of knowledge of tree seedling management, pest and disease control, and adequate seeds and germplasm supply

These results demonstrate that capacity development and awareness building is central to the expansion of agroforestry in the project area, and that the promotion of alternatives to slash and burn is a high priority. More importantly however, they highlighted the challenges related to improving the land tenure system in which a considerable proportion of farmers today rent clan-owned lands on a seasonal/annual basis. In most cases, land owners rented out the most unproductive land, and farmers believed that if the land owners noticed an improvement in production they would claim back the land. Moreover, changes in land use practices on rented lands were allowed only in regard to annual crops, not for perennial crops and long cycle crops such as cassava. Within such a land tenure system, planting trees raises several issues on tree and tree products ownership, land renting agreements and, more generally, on the social organization and power structures in the project area.

Conclusions and Recommendations

Agroforestry helps to sequester carbon and provides multiple benefits to the livelihood of farmers, and thus has a great potential to contribute to climate change mitigation; however at the local level, its implementation faces significant challenges. These include the prevailing land tenure systems, the common practice of slash and burn agriculture, as well as a lack of awareness and knowledge by farmers on alternative practices, which all together hinder tree planting and agroforestry. In this context, climate change mitigation will require field-based supportive policies and incentive mechanisms suitable for small scale farmers with the aim to promote agroforestry and the incorporation of trees in agricultural landscapes.

Based on the results obtained to date, the MICCA pilot project in collaboration with its partners will support the establishment and management of tree nurseries (individual, group and village levels), and provide trainings to raise awareness on the multi-functionalities and ecosystem services of agroforestry and the growing of trees on-farm. Moreover, the project and partners will support stakeholder consultations and contacts between local and district authorities, and clan land-owners and farmers to discuss solutions for farmers renting lands to engage in tree planting and agroforestry considering livelihood benefits while at the same time helping to mitigate climate change. Simultaneously, in collaboration with local and district authorities, incentive mechanisms and bye-laws will be identified and promoted for widespread adoption of agroforestry, as well as alternatives to slash and burn such as conservation agriculture. Changes also need to be introduced at district and national levels to promote policies supporting agroforestry and capacity building for climate-smart agriculture for smallholders and linking local deforestation dynamics with national initiative such as UN-REDD.

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