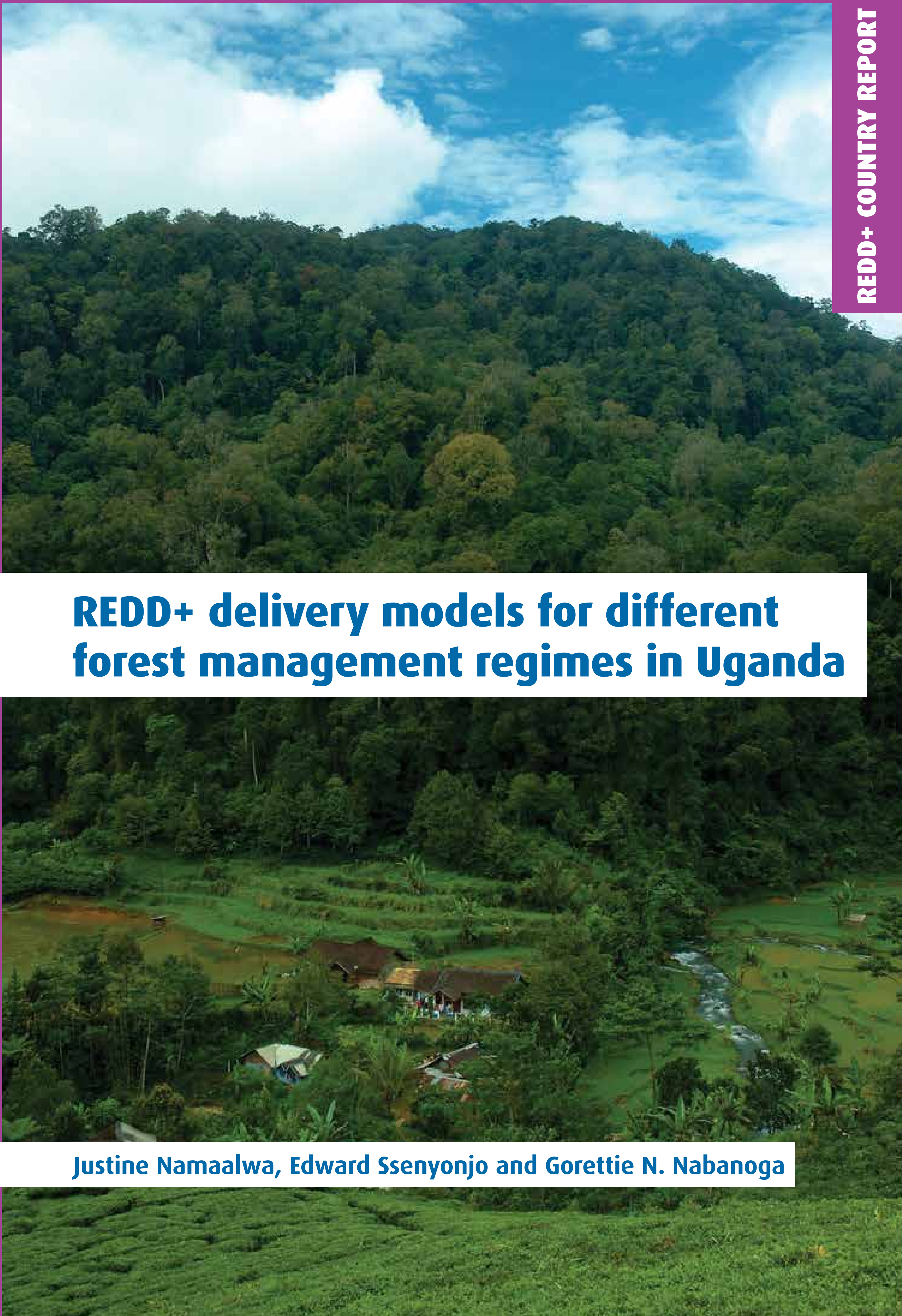
REDD+ COUNTRY REPORT



REDD+ delivery models for different forest management regimes in Uganda

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First published by the International Institute for Environment and Development (UK) in 2013

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Citation: Namaalwa, J., Ssenyonjo, E. and Nabanoga, G.N. 2013. REDD+ delivery models for different forest management regimes in Uganda. IIED, London.

This document has been produced with the financial assistance of the Norwegian Government through Norad, as part of a multi-country project coordinated by IIED in partnership with UMB on Poverty and Sustainable Development Impacts of REDD Architecture. The views expressed in this document are the sole responsibility of the authors and do not necessarily represent the views of the institutions involved in this project or of Norad.

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Poverty and sustainable development impacts of REDD architecture; options for equity growth and the environment

About this project...

Poverty and sustainable development impacts of REDD architecture is a multi-country project led by the International Institute for Environment and Development (IIED, UK) and the Norwegian University of Life Sciences (Aas, Norway). It started in July 2009 and will continue to December 2013. The project is funded by the Norwegian Agency for Development Cooperation (Norad) as part of the Norwegian Government's Climate and Forest Initiative. The partners in the project are Fundação Amazonas Sustentável (Brazil); Hamilton Resources and Consulting (Ghana); Netherlands Development Organisation (SNV) (Vietnam); Sokoine University of Agriculture, Faculty of Forestry and Nature Conservation (Tanzania); and Makerere University, Faculty of Forestry and Nature Conservation (Uganda).

The project aims to increase understanding of how different options for REDD design and policy at international, national and sub-national level will affect achievement of greenhouse gas (GHG) emission reduction and co-benefits of sustainable development and poverty reduction. As well as examining the internal distribution and allocation of REDD payments under different design option scenarios at both international and national level, the project will work with selected REDD pilot projects in each of the five countries to generate evidence and improve understanding on the poverty impacts of REDD pilot activities, the relative merits of different types of payment mechanisms and the transaction costs.

Acknowledgements

The authors would like to thank Norad for funding this project, IIED and UMB for coordinating the project activities, and all the collaborating country partners for sharing their experiences. Special appreciation goes to the communities and implementers of the PES experimental scheme in the Albertine Rift, the communities and implementers of the MERECEP project in Mount Elgon, the collaborative forest management communities and implementers in Mabira, to ECOTRUST and the communities of Ongo and to the private farmers in Gulu, especially Ocaka James. The authors are also very grateful to their research colleagues from Makerere University who greatly contributed to this work.

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The photos in this report were taken by Justine Namaalwa, Owen Sseremba, Kenneth Balikoowa or Allan Bomuhangi.

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Acronyms

CBO	Community-based organisation
CFM	Collaborative forest management
CFR	Central forest reserve
CRF	Community revolving fund (operated by CBOs)
CRM	Collaborative resource management
EAC	East African community
ECCF	Elgon Community Conservation Fund
ECOTRUST	Environmental Conservation Trust of Uganda
FACE	Forests Absorbing Carbon Emissions Foundation
FGD	Focus group discussion
Ha	Hectare
ICDP	Integrated conservation and development project
IUCN	International Union for Conservation of Nature
LFR	Local forest reserve
LVBC	Lake Victoria Basin Commission
M&E	Monitoring and evaluation
MENP	Mount Elgon National Park
MERECP	Mount Elgon Regional Ecosystem Conservation Programme
MOU	Memorandum of understanding
MoWE	Ministry of Water and Environment
MRV	Monitoring, reporting and verification
NFA	National Forestry Authority
NRM	Natural resource management
PMU	Programme management unit
REDD+	Reduction of emissions from deforestation and forest degradation
RUAs	Resource-use agreements
THF	Tropical high forest
UGX	Ugandan shilling
UNFCCC	United Nations Framework Convention on Climate Change
UWA	Uganda Wildlife Authority

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Introduction

1.1 Background

The REDD+ mechanism, which forms a key component of international climate negotiations, aims to provide developing countries with positive incentives for reducing forest-related greenhouse gas emissions. From an initial focus on reducing emissions from deforestation and forest degradation (REDD), the scope of the mechanism has broadened to include reducing emissions through the sustainable management of forests, conservation and the enhancement of forest carbon stocks (REDD+).

From the outset there have been efforts to build a firm foundation for the mechanism, given the challenges facing developing countries in terms of land tenure, lack of forest data and ensuring sufficient monitoring capacity. There have also been efforts to address concerns about potential adverse impacts of REDD+ interventions on the poor and marginalised, particularly indigenous communities.

At the UNFCCC Conference of the Parties in Cancun in 2010 (COP 16), there was multilateral agreement on taking a cautious approach to REDD+ to avoid potential problems. A decision[1] was adopted that actions related to REDD+ would be carried out in three phases, the first two constituting a readiness phase for preparation activities such as the development of national strategies or action plans, policies and measures, and capacity building; and implementation of national policies and measures and national strategies. These readiness activities would provide the foundation for the third phase of results-based actions that should be fully measured, reported and verified. COP 16 also adopted a decision on safeguards to address concerns about environmental and social impacts of REDD+.

Many developing countries with forest resources are currently engaged in readiness activities developing national REDD+ strategies to identify the most effective and most appropriate types of REDD+ intervention to reduce emissions, while delivering development co-benefits and meeting the Cancun safeguards.

1.2 REDD+ in Uganda

Uganda is in the early stages of developing a national REDD+ strategy with funding for readiness activities provided by the World Bank's Forest Carbon Partnership Facility. A REDD+ secretariat, headed by the REDD+ focal person, has recently been set up. The secretariat is expected to guide the government on carbon accounting rules relating to leakage and non-permanence. Priority actions for the secretariat include defining the institutional arrangements, developing a monitoring system and developing a system for benefit sharing. In developing the national REDD+ strategy for Uganda, it is important for the agencies involved to consider various approaches or models for delivering emission reductions, taking into account the extent to which they can not only avoid adverse impacts on the poor, but involve and benefit forest-dependent communities and small farmers in forest margin areas. This study aims to generate knowledge about the practical and economic viability of pro-poor models of REDD+ in Uganda to help fill this knowledge gap and inform the strategy process.

1. FCCC/CP2010/7/Add.1 paragraph 73

1.3 Aim of this report

This study forms part of the Norad-funded collaborative project Poverty and Sustainable Development Impacts of REDD Architecture, which seeks to generate knowledge on how REDD+ can be designed at the national and local levels to promote positive development co-benefits such as poverty reduction and the improvement of rural livelihoods.

This report examines the practical, institutional and economic viability of five different types of REDD+ models for delivering forest-related emission reductions that are in operation, are being piloted or are under consideration in four regions of Uganda. These five models target forest-dependent communities or small farmers and so have the potential to be pro-poor. The research aimed to examine whether such approaches can be cost effective in terms of cost per unit of emission reduction. The premise was that to have any chance of improving rural livelihoods, these REDD+ interventions would have to result in benefits for those participating at least equal to the opportunity cost of the changes in forest access/use required of them. The key issue was whether the opportunity costs together with the transaction and implementation costs would represent an economically viable delivery model for REDD+ emission reductions. A further aim was to examine the strengths and weaknesses of current institutional arrangements for forest management in these five models and to draw lessons for the national REDD+ architecture.

REDD+ delivery models and study sites

In selecting the REDD+ models (shown in Table 1) the aim was to achieve a spread across different regions in the country, different types of forest and land management regime and different types of approach for incentivising forest-related mitigation activities, involving small farmers, private forest owners and forest-dependent communities. This was not intended to be an exhaustive coverage of all possible types of potential REDD+ models. The aim was to ensure that some of the most important types were reviewed in different parts of the country.

Forest management regimes were an important starting point for selection of the models. The Forestry and Tree Planting Act 2003 classifies forests into central forest reserves (CFR), local forest reserves (LFR), community forests, private forests and forests forming part of a wildlife conservation area. Each of these forest regimes is legally assigned a management entity or responsible agency with stipulated roles and responsibilities. Further, each of these forest regimes has formal and informal or legal and illegal access/use practices, and thus are anticipated to have a unique management model that could be implemented to attain the desired objectives. Four forest management regimes were considered and, in addition, a customary land tenure regime in the northern region was also considered as set out in Table 1.

Each of these sites could be considered to have pro-poor potential in that they involve either individuals with small landholdings who are dependent mainly on farming for their livelihoods, or forest-dependent communities. For Mabira and Mount Elgon, the surrounding communities have been forest dependent for a long time. In the case of the community forestry model, the initiative aims to improve livelihoods for both landowners and the landless, as the latter would also benefit from the community resource. Further, the agroforestry model aims at securing the food needs as well as the tree-based needs of the poor communities who are reclaiming their livelihoods after 19 years of civil war.

Table 1. Selected REDD+ delivery models

Region	Site	Forest/land management regime	REDD+ model
Western region	Private forests in the Budongo–Bugoma corridor (part of the Albertine Rift)	Private forests	Payment for environmental services to individuals – for avoided deforestation and forest restoration
	Ongo Community Forest in the Budongo–Bugoma corridor (part of the Albertine Rift)	Community forests	Community forest management and payment for forest carbon-mitigation activities
Central region	Mabira Forest	Central forest reserve	Benefit sharing through community forest management agreements between communities and the National Forestry Authority
Eastern region	Mount Elgon	National park	Benefit sharing with local government Collaborative resource management (agreements between UWA and communities) ICDP – benefit-sharing and livelihood interventions through Mount Elgon Regional Ecosystem Conservation Programme (MERECP)
Northern region	Gulu District	Customary land	Promotion of agroforestry

The approach

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For each REDD+ model the research consisted of the following steps:

- Examination of the trends and drivers of deforestation and forest degradation in the surrounding area in order to establish the need for a REDD+ initiative and identify the type of interventions/mitigation activities most likely to be appropriate.
- Exploration of the opportunity costs of the REDD+ models through identification of the main types of cost and quantification where feasible within the scope of the study. Quantitative estimation is focused on agriculture, given its high importance to livelihoods. It is recognised, though, that forest resource uses are affected by REDD+ interventions, with some forest uses being restricted by a REDD+ intervention while others may be enhanced through tree planting and improved management associated with a REDD+ intervention. However, it was not within the scope of this study to make detailed quantified estimates of the opportunity costs associated with forest resource use.
- Review of the existing initiatives with a focus on their legal underpinnings and institutional arrangements, to draw conclusions on their practical and institutional viability as pro-poor REDD+ interventions and to draw lessons for REDD+ architecture at the sub-national and national levels.

Information was gathered through a combination of rapid appraisal methods such as focus group discussions (FGD) and key informant interviews, Landsat image analysis, ground observations and a document review.

3.1 Trends in deforestation and forest degradation

The main approach was the analysis of Landsat images complemented by some ground observations. For each site, Landsat images for three time periods were considered. The imagery analysis was done in two steps: (1) image segmentation and (2) image classification. This approach was preferred to avoid 'noise' in the results (the 'salt and pepper' effect) which usually occurs in pixel-based image classifications and is often odious to clean out. The Landsat image used had a resolution of 30 metres and was divided into regions of uniformity and each pixel was labelled as a distinct region. The similarity criteria were then computed for each spatially adjacent region, based on a statistical hypothesis test which checks the average among regions. The image was then divided into a set of sub images and after which a union operation was performed following an aggregation limit definition. The segmented image was classified using a regions classifier by applying the Isoseg algorithm onto the segmented image. After going through the automated steps of image processing, visual checking of the resulting images was done to identify those areas that were misclassified or that had mixed classes for purposes of planning the groundtruthing.

Where appropriate, groundtruthing was undertaken (a fieldwork activity aimed at collecting sample data in areas covered by an image, with the aim of checking the accuracy of the image interpretation done). For each of the time periods, the Landsat image was used to generate the land cover and then the biomass stocks. The changes over the time periods were then analysed for the vegetation types.

Forest walks were done in order to observe the current land-use activities and thus identify the causes of deforestation and forest degradation. This was useful in order to validate the information generated during the FGDs and further explain the trends observed in the Landsat images.

3.2 Estimation of opportunity costs

Opportunity costs have been defined as the forgone benefits that deforestation/forest degradation would have generated for livelihoods and the national economy. In the study sites, the alternative uses for the forest(s) included agricultural production, while forest resource uses would include the extraction of timber, poles for construction and firewood (commercial and subsistence). Other forest uses (permittable) include the extraction of non-timber forest products (NTFPs).

For agricultural production, the major crops grown by most of the households (for subsistence and commercial use) were identified. Other key considerations in the estimation of crop budgets included:

1. Land-use trajectories
    a. The land-use trajectory (for a period of 20 years) for a given piece of land (assumed to be a newly cleared forest site) often starts with high-return crops. Over a 4–6–year period, this changes to lower-value crops or a short fallow period i.e. the progression in different crops based on yields and value. However, it is important to note that some of the crops grown are perennial, and as such the land may be left under this crop for several years depending on the level of management activities undertaken to ensure continued productivity.

    b. Fallow periods/abandoning land: given the relatively high population pressure in most of the areas, almost all the available land is under cultivation throughout the seasons and therefore it is very unlikely that a piece of land will be abandoned. However, short fallow periods may be practiced for annual crops.

2. Yields
    a. Agricultural production databases from the district offices were considered, to compare with the average values generated from the individual farmers that were interviewed.
    b. Values were generated from the individual farmer interviews – consideration was made for the production activities (seasons 1 and 2) and hence yields for the investigation year were considered as the base values for future projections. However, it is noted that given the seasonal fluctuation, the chosen base year may have been a good/bad/average year but the investigations were limited to that year because farmers do not keep agricultural records.
    c. Yield trends: generally, with the exception of tobacco and sugarcanes, the farmers reported minimal use of fertilisers and/or pesticides. Hence, the farmers experienced substantial yield reductions over time while the few farmers who invested in improved planting materials and fertiliser were able to sustain their production levels to some extent. For this reason, it was assumed that the yield on annual crops would decline by 7–10 per cent per year.

3. Prices: farm-gate prices were considered where appropriate, since most produce is sold to middle men. In addition, farm produce that is consumed by the household other than being sold was valued using their market price.

4. Labour: both hired and family labour use was recorded. Family labour was valued at the average price per task as was reported by the individual farmers. It was, however, reported that several of the farmers engage hired labour during land clearing and harvesting of crops such as rice, tobacco, coffee and passion fruit.

5. **Other inputs and equipment:** for inputs such as seed and other planting materials, the quantities and prices were recorded. For the case of farm implements, the average number of each of the farm tools that each household would have was established and the initial cost was divided by their lifespan to obtain the annual value.

6. **Discount rate:** the estimation of opportunity costs is from the perspective of the farmer. Therefore, the discount rate (25 per cent) chosen to estimate the net present value of the stream of returns to agriculture over 20 years was based on the average lending rate of the banks in Uganda (2011/2012). Alternative discount rates of 10 per cent and 15 per cent were applied for sensitivity analyses and to also reflect possible lending rates for rural savings schemes. This is in line with the fact that farmers often have very short-term horizons and high discount rates.

The costs and benefits of agricultural production were generated through rapid appraisals to facilitate the estimation of opportunity costs of different land-use options. For each site, at least four land-use trajectories were derived and the average discounted net returns estimated over a period of 20 years.

3.3 Information sources and methods for data collection

3.3.1 Literature review

Available and relevant sources of secondary information were reviewed. Most of the information sourced related to land-use trajectories and trends in yields over time, while the sources of information included annual reports, project reports and district plans (agriculture and natural resources section).

3.3.2 Rapid appraisals

Field investigations using rapid appraisals were undertaken, which involved discussions with district technical staff in the production sector, appraisals of the agricultural and forest-related activities with the farmers in the selected communities and discussions with implementers of complementary programmes. During discussions with farmers, the approach relied on respondents' memories and their own reported values regarding quantities, costs and uses of various forest resources. Therefore, the interpretation of results must take into account potential biases, inaccuracies and imprecision which might cloud the truth. Typical sources of error in such an approach are the poor recall of facts, withholding information because the activity is probably illegal, and second-guessing the purpose of the survey (especially as some respondents perceived that some project benefits might accrue). For this reason, efforts were made to crosscheck data with other sources of information.

The district technical staff in the production departments for each district were consulted to obtain information on the major land-use activities in the area and major crop enterprises. Inquiries were also made on the average production records for the different crops as well as market outlets and price patterns. Some of the technical staff interacted with included district agricultural officers and agricultural extension officers. In addition, discussions were held with the district forest officers, staff of the National Forestry Authority (NFA) and Uganda Wildlife Authority (UWA) who oversee the management of the different forested lands. For the private forests, the forest owners were also engaged. The aim was to investigate the major causes of deforestation and forest degradation in the different sites as well as past and current management regimes.

Focus group discussions (FGD) were conducted with the communities involved in co-management arrangements with NFA (Mabira), UWA (Mount Elgon) and the community members of Ongo. The major aim was to investigate the competing land-use activities, as well as forest management activities. Given the variations within groups (in the different districts), there were differences in some responses regarding crop cycles (different cropping patterns) for a newly cleared area as well as the form of co-management activities. As a result, more than one crop cycle and benefit-sharing arrangement were reported in the respective sites.

Further, key informant discussions were held with the leaders of the co-management groups (CFM and CRM) in order to validate some of the group responses and minimise group bias. In situations where complementary programmes existed, discussions were held with some of the implementers to understand their contributions to the forest management programmes.

Following the FGD sessions, individual farmers were sampled based on their involvement in cultivating specific crops and were engaged to generate detailed information on the crop budget surveys. For each crop, six farmers (three male and three female) were interviewed from each community. These crop budget surveys were used to generate information for the input-output analysis for the individual crops.

Key findings: Mabira Forest (central region)

The target area in the central region was Mabira Forest, constituted of Mabira Central Forest Reserve (CFR) and the surrounding communities. Mabira has a continuous patch known as the Mabira CFR covering a total area of 30,038ha comprised of 63 compartments. There are also other CFRs technically regarded as part of Mabira including Namukupa (334ha), Namananga Namawanyi (457ha), Nandagi (442ha), Luban (472ha), Namavundu (683ha), Kalagala Falls (100ha) and Nile Bank (553.5ha). Mabira Forest spreads out in the districts of Mukono, Kayunga and Buikwe.

Mabira CFR is not a continuous forest cover but rather is characterised by a mosaic of human settlements (approximately 27 enclaves), which are completely enclosed or partly surrounded by the forest reserve (Figure 1). Some of the enclaves were earlier cleared for planting agricultural crops such as tea, rubber and coffee, while other areas were mainly cleared for settlements. These enclaves are known to have existed before its gazettement as a CFR and are therefore legally private land. In addition, Mabira is surrounded by sugar plantations belonging to the Mehta group of companies and several outgrowers (Figure 2).

Mabira Forest is the only region of medium altitude, moist and semi-deciduous forest in Uganda's protected areas systems and thus characterised by several socio-economic and ecological functions. It is categorised by the government of Uganda as a protected area of core conservation value and one of the critical biodiversity hotspots in the country. Further, it is one of the few major forests that form a ring of protection for Lake Victoria and is a large water catchment for Lake Kyoga and the River Nile through Musamya and the Sezibwa rivers. In addition, the forest is a source of livelihoods for over 200,000 forest-adjacent communities, providing NTFPs and employment to many community members in the form of eco-tourism activities or as researchers, forest officers and rangers. Many communities are also involved in collaborative forest management.

Despite its protected status, Mabira Forest is still under threat from a controversial proposal from the president of Uganda to allocate part of it (7100ha) to the Sugar Corporation of Uganda Limited (SCOUL), which is part-owned by the Ugandan state. This proposal was based on a SCOUL report that claimed that several parts of the forest were heavily degraded.

The communities around the forest are mainly farmers growing major traditional crops including coffee, bananas, maize, sweet potatoes and beans. In addition, sugarcanes are cultivated by several outgrowers for the Mehta Sugar Company.

The field investigations were undertaken in the CFM communities of Buikwe and Mukono districts. These areas were purposively selected to represent CFM arrangements.

4.1 Potential REDD+ model to deliver emission reductions

The potential REDD+ model under consideration draws from the benefit-sharing arrangements under CFM. According to section 33 of the National Forestry and Tree Planting Act 2003, all residents neighbouring the forest reserve have a de facto right to access dry wood for subsistence firewood. However, for those communities with members who have commercial interests in forest products, they are supposed to have an agreement with NFA under the CFM arrangement. Under CFM, communities are permitted and regulated to access the forest for specific products. The permitted activities may range from collection of wild foods for domestic use to commercial timber harvesting. However, these may vary from one CFM group to another. Under this arrangement, the community is expected to sign an agreement with NFA defining the forest utilisation, forest management activities as well as the roles and responsibilities of the different stakeholders, who each have varying roles and responsibilities (see below).

4.1.1 Roles and responsibilities of the community

The role of the community is to ensure that the areas under their jurisdiction are used sustainably. In each of the communities, there is a resource-use committee which enforces the agreements. Activities include:

- Recommending people who apply for licenses for commercial products;
- Carrying out joint patrols within their areas of jurisdiction:
  a. CFM management committee conducts daily patrols to curb illegal forest activities;
  b. CFM members conduct general patrols once a month to monitor the status of the area under their management;
- Planting trees in degraded parts of the forest reserve for poles and timber;
- Planting trees along the forest boundary;
- Planting trees on their private land to reduce pressure on the CFR; and
- Promoting alternative income-generating activities and activities that promote sustainable resource use.

In addition to the above roles and responsibilities, NFA contracts community members to undertake patrolling and monitoring activities, which is a source of income for these individuals.

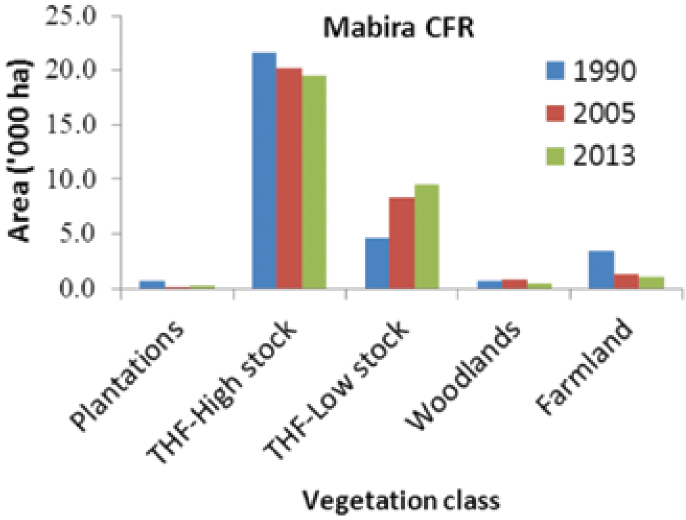
4.1.2 Roles and responsibilities of the National Forestry Authority

Under this arrangement, the National Forestry Authority (NFA) is expected to implement the provisions in the forest management plan and provide technical backup and supervision in the implementation of the CFM agreements. It is, however, important to note that all the existing agreements between NFA and the CBOs are regarded as trial agreements which have to be reviewed in due course. Thus, rolling out the CFM arrangements to cover all communities adjacent to the forest could be regarded as ‘illegal’ given that according to the law, it is only NFA that has rights over the commercial use of forest resources in CFRs. The law does not provide for commercial benefits to communities under CFM arrangements. This implies that NFA is basing benefit-sharing mechanisms with communities on humanitarian principles. Given the shortcoming in the prevailing law, NFA drafted an amendment in the existing law to provide guidance on benefit-sharing for specific resources.

4.2 Deforestation and forest degradation: trends and drivers

Analysis of the satellite images for Mabira CFR revealed that the land cover in the area had seven classes by 1990 according to the national biomass classification. These classes included: tropical high forest (THF) fully stocked, THF low stocked, plantations, bushlands, subsistence agriculture and wetlands. Amongst all the classes, THF fully stocked dominated across the three time periods (Figure 1). By 1990, most areas in the eastern region had been cleared for small-scale cultivation and some patches of plantations. However, by 2005, some parts of this region had regenerated into a low-stock tropical forest. In addition, some patches in the northern region had changed from THF low to THF high. By 2013, although there were no significant changes in the eastern region, more patches within the other parts of the forest had changed from THF high to THF low. Generally, there has been a significant reduction in small-scale cultivation within the forest over time.

Figure 1. Changes in land-cover classes (Mabira CFR)



With regards to biomass stock, the forest stocking changed from 218.2 to 224.2 tonnes/ha during the 1990–2005 time period, but later dropped to 207.8 tonnes/ha in 2013, which translates into approximately 381.2 tCO2e/ha.

The analysis of the Landsat images clearly indicates the existence of deforestation and forest degradation activities that ultimately lead to GHG emissions. Discussions during the FGDs revealed that several extractive activities are currently undertaken at commercial level that lead to deforestation and forest degradation. These include illegal timber harvesting, charcoal burning, extraction of poles and clearing land for cultivation. During the forest walks, some of these activities were evident (Figures 2–4)

Figure 2. Cultivation in Mabira CFR

Figure 3. Charcoal burning in Mabira CFR

Figure 4. Timber harvesting in Mabira CFR

Under NFA management there are several on-going activities such as concessional timber harvesting in Nagojje as well as enrichment planting in Cpt 175 with Mvule, Albizia, Maesopsis trees. However, due to the continuing controversial Mabira 'giveaway' saga, most concessional activities have been halted to avoid any suspicion that the forest has been given away to sugarcane investors. In addition, NFA is still facing financial constraints in facilitating forest management activities such as enrichment planting. The few funds available are being used to secure the forest estate, and about 80 per cent of NFA's activities/expenses are being used for law enforcement.

Besides NFA's forest utilisation and management activities, there are high levels of deforestation and degradation reported in Mabira. The major drivers of these activities include:

- Poverty among the communities neighbouring the forest reserve, mainly attributed to high unemployment levels and the tremendous decline in coffee production, which was for a long time the traditional cash crop in the region. As a result, communities have resorted to forest-related activities like charcoal burning.
- The increasing demand for forest products including timber from urban and peri-urban areas along the Lake Victoria shore.
- Increasing demand for land by the sugarcane outgrowers, as the Mehta Group is still facing challenges in expanding their plantation area.
- Institutional challenges/failures within the NFA, such as low levels of staffing and corruption among the law enforcers which has resulted in inadequate protection of the forest reserve.
- The bureaucratic process of acquiring forest-user licenses, which has frustrated many legitimate forest users and has made it difficult to get a forest-use license. In addition, the bidding procedures effectively exclude local people who traditionally use the forest reserve.

As a result of the above drivers, activities including charcoal burning (Figure 3), timber harvesting (using both handsaws and chainsaws in Ntunda and Nagojje), commercialised firewood harvesting and clearing of land for cultivation have been reported to be on the rise in Mabira. There were also high levels of herbal medicine harvesting, with people heavily debarking medicinal trees such as *Prunus africana* and *Alstonia bonnie*. The clearing of land for cultivation has been greatly aggravated by the unclear forest boundary, given that the boundary has not been maintained for the last 10 years, which makes evicting encroachers a big challenge. In areas of heavy encroachment, NFA has resorted to using a 'gentlemen's agreement' with local communities to stem the encroachment. Armed personnel (soldiers and the environmental police force) assist in arresting culprits engaged in illegal activities.

4.3 Estimation of opportunity costs

4.3.1 Main agricultural products and land-use trajectories

The discussions with the district production offices revealed the different crops grown by most of the households. Generally, coffee has been the traditional cash crop in Mukono District and grown by the majority of people, but recently crops that were formerly food crops are being grown as cash crops too.

- Cash crops: coffee, sugarcanes
- Cash and food crops: maize, bananas, beans, sweet potatoes, tomatoes, cabbages and passion fruit

Another cash crop in the area is *Catha edulis* which is cultivated by mainly the enclave communities although it is considered a controversial or illegal crop in the country. There are also estate crops (sugarcane and tea) that are grown by a few individuals, mostly Indian commercial growers, which cover a considerable area.

The land-use trajectory (for a period of 20 years) for a given piece of land (assumed to be a newly cleared forest site) is to start with high-return crops and over a 4–6-year period change to lower-value crops or a short fallow period. The progression of different crops is based on yields and value (Table 2). However, it is important to note that some of the crops grown in this area are perennial such as bananas, coffee and sugarcanes. Further, most of the crops are mixed with the exception of sugarcanes and *Catha edulis*. Given the relatively high population pressures in most of the areas, almost all the available land is under cultivation throughout the seasons and it is very unlikely that a piece of land would be abandoned. However, short fallow periods may be practised.

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Table 2. Major cash crops and their stage in the land-use trajectory

Crop cycles					
Option 1	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**
Maize and beans	Maize and beans	Bananas and coffee	Passion fruit	Sugarcane (start)	*Catha edulis* (start)
Sweet potatoes	Sweet potatoes	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis*
Maize and beans	Maize and beans	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis*
Sweet potatoes	Cassava	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis*
Bananas and beans	Maize and beans	Bananas and coffee	Maize and beans	Sugarcane	*Catha edulis*
Bananas	Sweet potatoes	Bananas and coffee	Sweet potatoes	Sugarcane (replant)	*Catha edulis*
Bananas	Fallow	Bananas and coffee	Maize and beans	Sugarcane	*Catha edulis*
Bananas	Maize and beans	Bananas and coffee	Fallow	Sugarcane	*Catha edulis*
Bananas	Sweet potatoes	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis*
Bananas	Maize and beans	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis* (replant)
Bananas	Cassava	Bananas and coffee (replant some)	Passion fruit	Sugarcane (replant)	*Catha edulis*
Fallow	Maize and beans	Bananas and coffee	Passion fruit	Sugarcane	*Catha edulis*

Most farmers reported a minimal use of fertilisers and/or pesticides, with the exception of those growing sugarcane and *Catha edulis*. Hence, farmers have experienced a substantial reduction in yields over time while the few farmers who invested in improved planting materials and fertilisers have been able to sustain their production levels to some extent.

4.3.2 Returns for crop production

A net present value was obtained at a discounted rate of 25 per cent for a period of 20 years. Crop cycle options 1–6 were considered for the discounting option given that different parts of the region have different priority crops. For the calculations, reductions in yields over time were duly considered with an assumption of a constant reduction factor of 10 per cent used to describe the relative annual declines in yield for every subsequent harvest in cases where fertilisers were not used. Cropping options 1 and 4 gave relatively low estimates, given the nature of the crops cultivated (mainly annuals) (Table 3).

Table 3. Discounted net returns for different agricultural options

Cropping cycle	**NPV (US$/ha)**		
	25%	**18%**	**12%**
Option 1	927	1088	1323
Option 2	738	891	1103
Option 3	2482	3112	3973
Option 4	1327	1631	2012
Option 5	1777	2621	3859
Option 6	2353	3867	5970
Average	**1601**	**1681**	**2103**

However, options 3 and 5 gave the highest discounted net returns given the value of the crops involved (coffee and *Catha edulis*).

4.3.3 Opportunity cost per unit of emission reduction

An attempt was made to estimate the opportunity cost per unit of emission reduction i.e. the minimum amount needed to compensate landowners for avoiding deforestation and forest degradation and undertaking forest restoration activities at different carbon rates. The potential carbon revenues were compared with the opportunity costs for the different agricultural options and it is evident that pro-poor REDD+ models can compete with agriculture only if carbon prices are above US$5/tonne (Table 4). Thus, this is the threshold carbon price at which carbon payments can provide an incentive to protect the existing forests. This does not take into account forest uses and other benefits from a potential REDD+ intervention.

However, it is important to note that the current estimates would vary highly, depending on the discount rate, yield reduction factor and inclusion of transaction costs.

Table 4. Potential carbon revenues versus opportunity costs for agriculture

Vegetation class	tCO2e/ha	Emissions due to conversion (tCO2e/ha)	Costs for emission reductions			
			US$3	US$5	US$8	
THF fully stocked	497.7	477.7	1433	2388	3822	
THF low stocked	231.4	211.4	634	1057	1691	
Woodlands	63.2	43.2	130	216	346	
Bushland/grassland	22.5	2.5	8	13	20	
Farmland (SS)	20.0					
NPV for agriculture (US$/ha at 25% dr)	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Option 5**	**Option 6**
	927	738	1327	2482	1777	2353

4.4 Major challenges and lessons for REDD+ architecture

The opportunity cost analysis reveals the high cost of protecting the forest in terms of the agricultural land uses forgone. The carbon analysis indicated that a REDD+ model that aimed to cover the full opportunity costs of small-scale and subsistence agriculture would have little chance of being financially viable, particularly for low-stocked forests, unless there is a step change in the payments made for emission reductions. The small decline in the area of subsistence farmland between 1990 and 2013 suggests that the enforcement action of the NFA and the benefit-sharing arrangements have been effective in addressing agricultural threats, although the problem has shifted to degradation. The analysis of deforestation and forest degradation trends shows that there has been a systematic increase in forest stock over time and a reduction in the area that can be considered degraded. The CFM arrangements show promise, therefore suggesting that REDD+ finance could go further if invested in supporting these existing arrangements than in trying to introduce different models such as PES.

However, there are several challenges cited in the implementation of the CFM arrangements, which should serve as learning points for REDD+ architecture. The biggest challenge is that the law does not provide for benefit-sharing mechanisms for the communities participating in CFM arrangements. That is, for the higher-ranked resources like poles and timber, without clear benefit guidelines, NFA cannot provide proportionate returns to the communities from the different concessions. Up until now, NFA has used a case-by-case unstructured method to provide returns to participating communities. As a result, some of the communities reported some levels of dissatisfaction with the way NFA has implemented the signed agreements. This may serve as a disincentive for the currently enrolled CBOs to meet their obligations, but also a disincentive for any new CBOs to engage in CFM arrangements. NFA, on the other hand, reported that CFM arrangements carry high transaction costs in relation to negotiating and enforcement.

Further, the CBOs reported that the groups have not been supported to start up other alternative livelihood activities and this makes them still dependent on forest resources. In addition, they reported that the CFM/NFA agreements have never been reviewed (since 2002) and yet some key elements were missed out in the first document. But also several socio-economic changes warrant revisions of some sections in the documents.

5

Key findings: Mount Elgon National Park

The target area in the Mount Elgon National Park is located in the eastern region of Uganda. This area was of interest given the unique trend of events that have taken place involving forest-habitat Benet communities, encroachment and gazettement by the government. The forest of Mount Elgon assumed a status of protected area as far back as 1929 and was gazetted as a forest reserve in 1938. After the gazettement, the Benet communities, who are part of the larger tribe called the Sabiny, were allowed to remain in the forest reserve without residence documentation on an understanding that this was their home. The Benet remained inside the park until 1983 when they were resettled in the lower belt of Mount Elgon together with some internally displaced people from the lowlands of Kapchorwa District (Himmelfarb 2006). In 1993, the government of Uganda decided to raise the forest's conservation status from a forest reserve managed by the forest departments to a national park, managed by the Uganda Wildlife Authority (UWA) (Kapchorwa District 2004).

The total area of Mount Elgon National Park is 118,385ha, spread across eight districts including Kapchorwa, Mbale, Manafwa, Sironko, Bududa, Bulambuli, Bukwo and Kween. The communities around the forest are mainly farmers growing major traditional crops including coffee, maize, bananas and beans. In addition, upland rice (Nelika variate) was introduced in the area in 2000 and several farmers are heavily engaged in its cultivation. In relation to forest access and use, Mount Elgon has historically been reported to contribute to people's incomes.

The field investigations were undertaken in the communities of Bushiuyo and Budwale in Mbale District and Ketagenge and Kwoti in Kapchorwa District. These areas were purposively selected as they represent collaborative resource management (CRM) arrangements as well as being beneficiaries of the Mount Elgon Regional Ecosystem Conservation Programme (MERECP).

5.1 Potential REDD+ model to deliver emission reductions

Subject to the Wildlife Act 2000, management of national parks in the country is the mandate of the Uganda Wildlife Authority (UWA) which is a government institution. However, in some areas like Mount Elgon, communities have been involved in the management of the park through a CRM arrangement. In addition, other complementary initiatives such as MERECP are also in place. The potential REDD+ model therefore to be considered is a combination of the CRM arrangements and the MERECP complementary component.

5.1.1 Benefit-sharing mechanism for UWA and the CRM arrangements

Section 69 (4) of the Wildlife Act Cap. 200 mandates UWA to pay 20 per cent of the park entry fees collected from a wildlife protected area to the local government of the surrounding area(s) for economic development. In relation to this, a number of projects have been supported in the different districts including classroom construction, community ecotourism projects, beekeeping and honey production, dairy farming projects and tree-growing projects. For the period 2002–2012 about 140 million Uganda shillings (approximately US$53,200) had been distributed, which has resulted in about 34 development projects (community conservation warden, pers.comm.).

In addition to this mandate, CRM arrangements are in place where UWA signs resource-use agreements (RUAs) with some neighbouring communities to participate in the management of the park. The agreements differ in scope, flexibility and in the roles and responsibilities of the agreeing parties. In this arrangement, the communities come into agreement with UWA to access selected resources in the park in an organised manner aimed at promoting sustainability. Such resources may include mushrooms, firewood, vegetables, stakes, bamboo (shoots and stems), wild honey, salt licks, herbal medicines, cultural site access and access routes.

There are also specific issue agreements e.g. beekeeping agreements and boundary management agreements. Under this arrangement, the participating communities sign an agreement with UWA and are allocated either a portion of the forest for beekeeping (Box 1) or a 10m-wide strip along the boundary to plant Eucalyptus trees (Figure 5).

Box 1. The formation and operationalisation of Kwoti Beekeeping Association

The motivation to start the group was to continue the tradition of beekeeping, which was dying out due to reduced access to the park. The local community had resorted to siting beehives in their gardens, which was risky to both animals and people.

For example in 2009, some members from Kwoti Community had formed an association and signed a memorandum of understanding with UWA, under which UWA allocated the group 16 hectares of forest land inside the park to site beehives. The group started off with seven beehives and now have approximately 200 local beehives. In addition, a CRM agreement was signed between the community and UWA (spearheaded by the association) which permits the collection of non-timber forest products such as deadwood for firewood and herbs, specifically on Wednesdays and Saturdays, as well as wild honey in March. The community are, however, restricted from accessing the 16 hectares that were allocated to the beekeeping association.

Figure 5. Beekeeping project in Kwoti and boundary strip plantations

Under the boundary tree-planting arrangement, the CBO is allocated a 10m-wide strip but varying in length for different communities along the forest to plant trees – most commonly Eucalyptus. Community members are allowed to practice the *taungya* system[2] by growing seasonal crops mixed with the trees. On maturity, these boundary trees are given to the communities for use as building poles or firewood etc. This activity therefore serves as a source of income from forest products as well as food/income from the crops. Further, they are expected to equitably share benefits from the harvests without discrimination against gender and social status. The boundary trees serve both as a permanent boundary feature but also as a source of products for the participating communities.

Each community has a boundary management committee which is in charge of permitting the use of the trees. For example, if one of the community members wants to harvest poles for subsistence use, s/he has to make a request to the management committee which then assesses the individual's needs. In consultation with UWA, the committee has the authority to grant permission.

2. The *taungya* system is a form of agroforestry. It consists of growing annual agricultural crops with the forestry species during the early years of establishment of a forestry plantation. Farmers are required to tend the forestry seedlings and, in return, retain a part or all of the agricultural produce, thus promoting afforestation. Source: www.worldagroforestry.org/units/Library/Books/Book%2032/an%20introduction%20to%20agroforestry/html/6_taungya.htm?n=29

5.1.2 Complementary support by MERECP

In 2006, the Mount Elgon Regional Ecosystem Conservation Programme (MERECP I), which is a trans-boundary (Uganda and Kenya) project, came into existence, with the main purpose of restoring the Mount Elgon ecosystem. This built on an earlier project, the Mount Elgon Conservation Development Project (MECDP). This was implemented by UWA and funded by IUCN, focusing largely on restoring the national park with livelihood interventions for the community. A review of MERECP I revealed that the benefits were not accruing to the local/target people, and as a result, the project was redesigned as MERECP II, which was piloted with a focus on benefit-sharing mechanisms. The project is being implemented in all of the neighbouring districts to Mount Elgon National Park (MENP).

The goal of MERECP II is to achieve the sustainable use of shared natural resources, benefiting livelihoods, and mitigating and adapting to anticipated climate change impacts in the Mount Elgon transboundary ecosystem. MERECP is involved in facilitating participatory benefit-sharing and co-management activities with some of the communities involved in the CRM arrangements. Some of these activities include:

i. The participatory benefit-sharing programme, which is a livelihoods improvement programme. It channels funds to community-based organisations (CBOs) located adjacent to MENP for the purposes of establishing income-generating activities. This is done by establishing community revolving funds (CRFs). The project facilitates the process with a seed fund, and the CBOs are charged with setting their own criteria for lending to the members as well as terms and conditions of repayment including interest rates. The CBOs are expected to use the funds for alternative income-generating activities. Some of the activities undertaken include beekeeping, raising tree seedlings and dairy farming (Figure 6).

ii. Livelihood plantations: these are often established in the sustainable utilisation zone (SUZ[3]), which is the area between the 1993 boundary formerly recognised by UWA and the 1983 boundary that is recognised by the local communities. Every participating household in the community is allowed to plant and tend up to 5 hectares of fast-growing species under the *taungya* system. That is, the communities are allowed to intercrop trees with annual crops such as beans and cowpeas for about six seasons. At the time of harvesting, the benefits from these plantations are to be shared in a rotation of 70:30 whereby the participating households receive 70 per cent of the proceeds and 30 per cent is contributed to the community revolving fund. Further, the agreement signed between UWA and the community makes provisions for revenue sharing when UWA engages in carbon trading.

iii. Enrichment planting/forest restoration: community members may be facilitated to undertake enrichment planting and rehabilitation of the degraded parts of Mount Elgon National Park. During enrichment planting, indigenous species are often used including *Cordia africana, Maesopsis eminii, Prunus africanum, Olea welwitschii, Antiaris toxicaria, Markhamia lutea, Khaya anthotheca, Milicia excelsa* and *Podocarpus spp*. To date, 114ha of the forest have been restored using indigenous tree species. The community is expected to provide contractual labour for forest restoration and enrichment planting activities. Hence, members of the CBO are offered employment opportunities in activities such as climber cutting and fire protection.

iv. Deforestation avoidance, where an intact patch of forest is identified and the CBO tasked to protect it against any illegal activities. In return, the community receives a payment, which they use for income-generating activities. This has been piloted with Kapchorwa District where the Kapchebut Elgon Farmer's Association and Tengwen Kwigate Beekeeping Association received US$7000 as an incentive for biodiversity conservation.

3. The sustainable utilisation zone refers to the area which is between the real boundary of the protected area and the boundary that was mistakenly put in place in 1993. The boundary had been contested by local people and their political leaders, who accused UWA of changing the boundaries in a bid to take the people's land. It has finally been agreed that these areas will be used by the local people to grow their own trees and plant crops in between the rows, but that no settlements are allowed there.

Figure 6. Dairy project beneficiary in Bushiuyo

5.1.3 Roles and responsibilities: the community, UWA and MERECP

Under CRM, the role of the community is to ensure that the areas under their jurisdiction are used sustainably. In each of the communities there is a resource-use committee, which enforces the agreements. Activities include:

- Community members near the park boundary are involved in boundary maintenance and fire control through the periodic clearing of fire lines.
- Community members are also involved in voluntary fire patrols in the forest (close to the community) by conducting daily fire patrols from January to March in groups of 6–10 individuals.
- Guarding against illegal activities like timber harvesting and poaching.
- Ensuring that only eligible members access the park for particular resources and that there is adherence to the quantities permitted in the agreement.
- Sanctioning those who go against the terms and conditions of the agreement and reporting illegal activities to UWA.
- Establishing income-generating activities (with additional support from MERECP) and ensuring their sustainability.

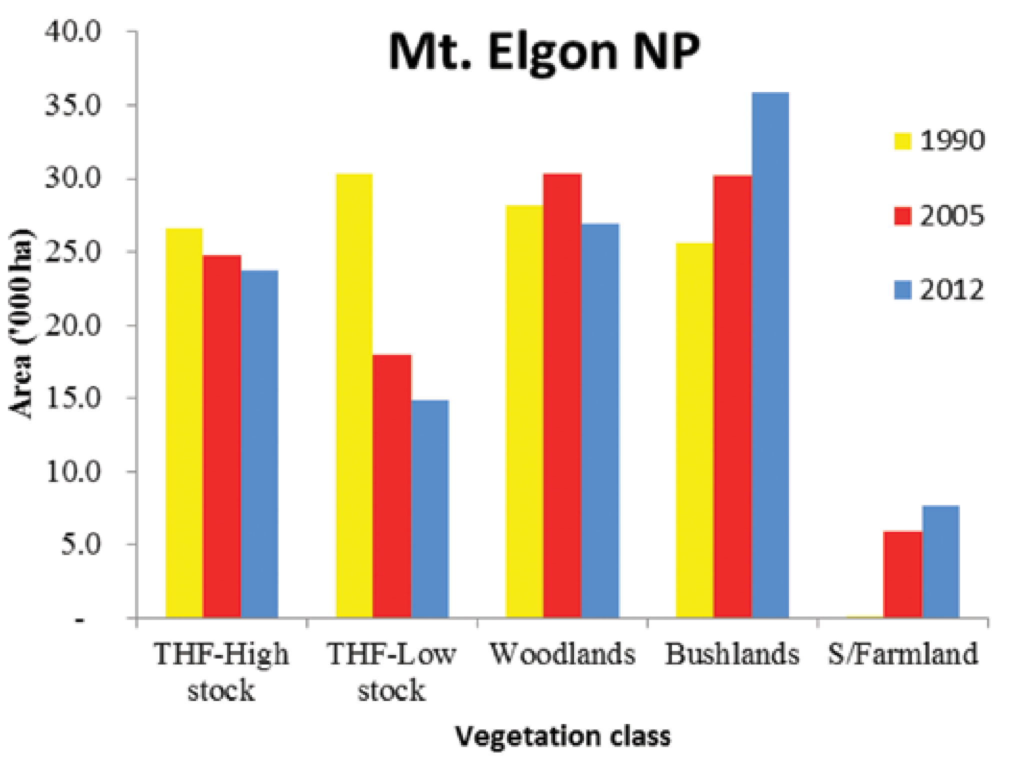
UWA is expected to provide the community with technical backup and supervise the implementation of the agreements. Further, UWA participates in the resolution of conflicts that may arise regarding the access of resources, by playing an arbitration role.

The MERECP project team is expected to give financial support to facilitate the different activities, as well as technical support in terms of skills in record keeping, entrepreneurship and group management.

5.2 Deforestation and forest degradation: trends and drivers

The area designated as the national park (112km^2) was assessed for land cover and mean biomass changes using Landsat images for the time periods 1990, 2005 and 2011. Generally, there were slight observable changes in the land cover for the time periods 2005 and 2011 given that 1990 was considered as the base period. There has, however, been an increase in the bushland areas and areas under subsistence farmland over time (Figure 7). Overall, the forest stocking decreased from 71.81 to 63.16 tonnes/ha during the 1990–2005 time period, and later dropped further to 61.3 tonnes/ha in 2011, which translates into approximately 112.4 tCO_2e/ha. The minimal changes in area and biomass stocks over time could be attributed to the management regime, where UWA has enforced the management restrictions.

Figure 7. Changes in land-cover classes in Mount Elgon National Park



The analysis of the Landsat images clearly indicates relatively low levels of deforestation and forest degradation activities and this was verified during the rapid appraisals and forest walks. Relatively low levels of illegal extraction of commercial firewood (Figure 8) and some incidences of agricultural encroachment were reported.

The primary proximate causes of deforestation included small- to medium-scale farming for commercial production and subsistence farming. These are as a result of the increasing demand for land given the increasing population pressure in some of the districts (such as Mbale, Manafwa and Kapchorwa) surrounding Mount Elgon. However, in the recent past, not much cultivation within the park/forest boundary was reported. On the other hand, degradation was more evident and mainly attributed to harvesting poles and timber[4] mainly in Kapchorwa and Bukwo districts, as well as the commercialisation of forest products especially firewood and both bamboo shoots and stems. Some people who have access to the park resources

4. The illegal activities of harvesting poles and timber were reportedly not undertaken by local people but by people outside of the communities.

through resource-use agreements (RUAs) sell the products that they are allowed to collect for subsistence use to communities further from the park, thereby increasing their overall demand and extraction levels for these products. It was also reported that given the historical changes in the forest boundary, some of the communities adjacent to the park have claimed the land at the forest frontier, while in some cases people think the forest has been reserved for them and that they should be allowed to access it at any time.

On the other hand, however, it was reported that the forest was slowly recovering from degradation which was very high in the early nineties. The improved sustainable use is as a result of implementing the resource-use agreements and the restoration of degraded areas under the Forests Absorbing Carbon Emissions Foundation (FACE) programme.

Figure 8. A commercial firewood collector carrying his load

5.3 Estimation of opportunity costs

Discussions with the district production offices revealed the different crops grown by most households. For areas close to the forest in Mbale District, the major crops include:

- cash crops: coffee and horticultural crops (cabbages, carrots, tomatoes, passion fruits, onions, sunflowers);
- cash and food crops: Irish potatoes, bananas, beans, maize, rice, soya beans and groundnuts; and
- food crops: cassava, sweet potatoes and millet.

While all the other crops have been traditionally grown in Mbale, interventions by the Vegetable Development Programme (VoDP), Japan International Cooperation Agency (JICA) and the National Agricultural Advisory Services (NAADS) Programme of Uganda have promoted crops such as sunflowers, groundnuts, rice and soya beans. Further, in 2009 a new variety of Irish potatoes (Kabale) was introduced, which is high yielding and with greater resistance to pests and diseases. In addition, it was reported that the farmers' involvement in cultivating maize has recently increased due to emerging markets for the produce in neighbouring countries, particularly Kenya and South Sudan. Also, although bananas were for a long time regarded as a food crop in the area, emerging markets due to increasing demand in the urban and peri-urban areas have led to a change in the status of this crop to a cash crop, so that the most widely grown food crops are now sweet potatoes and cassava.

In Kapchorwa District the major crops include:

- cash crops: coffee, wheat, cabbages, onions, Irish potatoes and barley;
- cash and food crops: bananas, beans, Irish potatoes; and
- food crops: beans and maize.

Tables 5 and 6 focus specifically on the major crops cultivated by the communities living adjacent to Mount Elgon, including the labour and fertiliser/pesticide requirements.

Table 5. Major crops grown in Wanale, Mbale

Crop	Purpose	Favourable season	Crop mixture/ monoculture	Labour requirements	Use fertilisers/ pesticides?
Carrots	Cash	I and II	Pure	High	Yes
Cabbages	Cash	All year round	Pure	Medium	Yes
Irish potatoes	Cash/food	I and II	Pure	High	Yes
Maize	Cash/food	I	Mixed crop with beans	Medium	Yes
Beans	Food	I and II	Mixed with maize	Low	No

Table 6. Major crops grown in Kapchorwa

Crops	Purpose	Favourable season	Form of cultivation	Labour requirements	Use fertilisers/ pesticides?
Maize	Cash/food	I	Mixed crop with beans	Low	Yes
Irish potatoes	Cash/food		Pure		Yes
Wheat	Cash		Pure	High	No
Barley	Cash		Pure	High	No
Beans	Cash/beans	I and II	Mixed crop with beans	Low	Yes
Cowpeas	Cash		Pure	Low	Yes
Onions	Cash		Pure	High	Yes
Cabbages	Cash		Pure	Medium	Yes
Carrots	Cash		Pure	High	Yes

It was clear from the FGDs that both men and women were engaged in the different crop enterprises as long as it was cultivated partially/completely for commercial purposes. Crops grown mainly for subsistence purposes (e.g. potatoes) were the domain of the women. Further, Irish potatoes were the preferred pioneer crop due to the fact that they are fast growing, high yielding and with a strong market both within and across borders (see Table 7).

Cropping options 1–3 gave relatively high estimates due to the reportedly high use of fertilisers for crops including maize. However, option 4 was calculated taking into consideration the minimal use of fertilisers, especially for maize (Table 8).

The potential carbon revenues for a range of carbon prices were compared with the opportunity costs for the different agricultural options. It is evident that with the exception of option 4 with minimal fertiliser use, pro-poor REDD+ models can compete with agriculture only if carbon prices are above US$5/tonne and only in fully stocked forests (Table 9). Thus, this is the threshold carbon price at which carbon payments can provide an incentive to protect the existing forests. However, it is important to note that the current estimates would vary highly, depending on the discount rate, yield reduction factor and the inclusion of transaction costs.

Table 7. Major cash crops and their stage in the land-use trajectory

Crop cycles			
Option 1	**Option 2**	**Option 3**	**Option 4**
Irish potatoes	Irish potatoes	Irish potatoes	Irish potatoes
Maize	Cabbages	Carrots	Cabbages
Wheat	Wheat	Maize/beans	Maize
Cabbages	Beans	Carrots	Beans/cowpeas
Maize	Maize	Beans	Cassava
Fallow	Cabbages	Maize/beans	Fallow
Irish potatoes	Fallow	Cassava	Irish potatoes
Maize	Irish potatoes	Fallow	Cabbages
Cabbages	Barley	Irish potatoes	Maize
Beans	Groundnuts	Carrots	Beans/cowpeas
Maize	Cabbages	Maize/beans	Cassava
Fallow	Maize/beans	Cassava	Fallow

Table 8. Discounted net returns for different agricultural options

Cropping cycle	NPV (US$/ha)		
	25%	18%	12%
Option 1	1204	1397	1642
Option 2	1594	1855	2179
Option 3	1427	1570	1744
Option 4	621	754	935
Average	**1212**	**1394**	**1625**

Table 9. Potential carbon revenues versus opportunity costs for agriculture

Vegetation class	tCO2e/ha	Emissions due to conversion (tCO2e/ha)	Revenue from emission reductions US$/ha		
			US$3 (tCO2)	US$5 (tCO2)	US$8 (tCO2e)
THF fully stocked	332.9	320.7	962	1604	2566
THF low stocked	112.4	100.2	301	501	802
Woodlands	73.9	61.7	185	309	494
Bushland/grassland	17.3	5.2	16	26	41
Farmland (SS)	12.1				
NPV for agriculture (US$/ha at 25% dr)	**Option 1**	**Option 2**	**Option 3**	**Option 4**	**Average**
	1204	1594	1427	621	1212

5.4 Major challenges and lessons for REDD+ architecture

The opportunity cost analysis indicates the high costs involved in restricting the expansion of agriculture in the park in terms of the agricultural returns forgone. The analysis of cost per unit of emission reduction indicates that a REDD+ model aiming to cover the full cost in terms of forgone returns to small-scale agriculture would have little chance of being viable at carbon prices currently prevailing in the voluntary carbon market. Carbon revenues would only be competitive with low-input agriculture but the fieldwork revealed that most of the farmers rely on external inputs.

The existing CRM arrangements appear to have been effective in slowing the expansion of agriculture within the national park. This is the perception of the key informants interviewed, and accords with the observed trends within the national park from the Landsat image analysis, although a more definitive indication would have been given by comparing deforestation rates with areas outside the park.

There are several challenges in the implementation of the CRM arrangements as well as the complementary MERECP support, and these should act as learning points for the REDD+ architecture.

5.4.1 Control of illegal activities

The CRM arrangements may have little effect on reducing illegal resource extraction both within the pilot communities and beyond. Resource-use agreements can be used as an entry point for illegal activities under the guise of permitted activities. For example, although the permitted activity is the collection of deadwood, there are instances of people cutting down trees for firewood and community members who engage in firewood collection for commercial purposes are often responsible for this, even though the agreement only permits subsistence use. This is because while the RUAs limit the access days and types of resources to be extracted from the park, they sometimes do not set limits on the quantities of the specific resources to be extracted. Within the community, these two categories of firewood collectors are recognisable in that those who often extract firewood for commercial purposes carry the loads on their back (given the size and weight), while those carrying firewood for subsistence use often carry it on their head. More attention in the agreements to setting limits on the quantities of resources extracted may help.

The other issue is the effect on illegal activities outside the pilot area. Given that complementary programmes start with pilot communities, some of the communities not involved in the pilot stage may consider the programme as selective, and hence continue with illegal activities. This indicates that the project should aim to increase the coverage to benefit more communities and to negate the accusation of partiality.

5.4.2 High transaction costs and implications for financial sustainability

The transaction costs are high both for the implementing organisation and the community organisations. CRM arrangements carry high transaction costs in relation to negotiating and enforcement of the agreements. The choice of income-generating activities may greatly affect the sustainability of some CBOs. Some activities are long term with high levels of risk, while some CBOs are likely to incur high transaction costs and use a bigger proportion of the funds in administrative costs. This would imply that the net gain to the community members will be minimal. In some cases, this has resulted in the collapse of the CBO.

The initial enrolment of members in CBOs under the CRM arrangements is often low, given that they do not expect any practical/realisable benefits in the near future. With complementary support programmes such as MERECP, once activities commence and members start to receive benefits, there is often a rush of other community members wishing to register in the group. This often comes at the expense of the limited resources/funds available. As refusing new entrants may not be accepted in the constitution, the net gain to the individual members will overtime decrease and this may demotivate some members.

Complementary programmes such as MERECP that are dependent on donor funds often face irregular flows of funds. This can be particularly problematic for some activities like tree planting, which need a regular and timely release of funds to support activities. This is often as a result of bureaucratic procedures, which could be lessened with proper monitoring to facilitate the timely realisation of the project objectives.

In order to improve the sustainability of community revolving funds (CRFs), the East African Community (EAC) is planning to enter into a memorandum of understanding with a microfinance institution (MFI). Under this plan, the Lake Victoria Basin Commission (LVBC) will deposit an equivalent of CRF money with the MFI under a MoU, where the MFI will manage the CRF kitty. The CBOs will be expected to enter into a MoU with the MFI, committing their members to contributing shares that will go into this kitty. Even after the project ends, CBO members will be able to borrow money from the MFI at an agreed interest rate which will have to be lower than the market interest rates

5.4.3 Monitoring, reporting and verification

There are challenges in the monitoring, reporting and verification of the CBO activities. This then poses a challenge in evaluating the impact of the project on the livelihoods of the people, as well as the forest resource. This calls for more capacity building and an emphasis on setting measurable indicators of progress.

Key findings: Albertine Rift private and communal forests (western region)

The target area in the western region was the Albertine Rift,[5] which is one of the most biodiverse regions of the African continent. Specifically, the focal area included the districts of Buliisa, Hoima, Kibaale and Masindi. This area is characterised by two large central forest reserves, Budongo and Bugoma, and several wildlife reserves. There are also small forest reserves in Hoima (4) and Kibaale (9) (NEMA 2010). The landscape is also characterised by several private and communal natural forests. Together with the small gazetted CFRs, these constitute the corridor forests which have very important conservation values – not based on their species content, but on the fact that they provide linkages between other larger forests (WWF 2006). Of specific interest is the fact that they serve as corridors for chimpanzees. The forests are also important water catchments to regulate the flow of water in streams and wetlands. The area is characterised by a high population density and people's livelihoods are heavily dependent on cultivation and forest activities.

6.1 Potential REDD+ model to deliver emission reductions

Two forest management/conservation initiatives are being piloted in the western region: the experimental PES scheme for private forest owners (PFOs) in selected sub-counties in Hoima and Kibaale districts; and a REDD+ pilot for two community forests (Ongo and Alimugonza) to be implemented by the Environmental Conservation Trust of Uganda (ECOTRUST). These two REDD+ models are similar in that they both aim to make payments in exchange for undertaking mitigation activities. However, they have two key differences. The PES scheme will pay individual forest-owner farmers while the ECOTRUST pilot is focused on making payments to the community surrounding the forest. Second, the PES scheme is paying primarily for avoided deforestation as well as some forest restoration – the ECOTRUST pilot is focusing more on forest restoration and tree planting. The subsequent sections give a detailed explanation of each of the models highlighting the proposed design, implementation and monitoring.

6.1.1 Experimental PES scheme

The experimental methodology (randomised evaluation approach) was developed to test the effectiveness of payments for ecosystem services (PES) to enhance the conservation of biodiversity in productive landscapes in Uganda (IPA 2012). The programme was targeted to constitute 70 treatment villages and a similar number as a control (through a public lottery). In the experimental sites, 413 PFOs had expressed an interest, of whom 337 have signed contracts and received an initial sign-up bonus of UGX10,000 (approximately US$4) per individual. Those who had not committed themselves cited reasons such as land conflicts (family and neighbours), low payment levels and scepticism about possible land grabbing. Some of them were unwilling to accept payments for conserving the forest as they it was something they had always done without any incentive before.

Socio-economic and ecological/biodiversity baseline surveys were undertaken (Akwetaireho *et al*. 2011; Plumptre *et al*. 2011) and each of the PFOs was assisted to develop an intervention plan based on a generic management plan (CSWCT 2011) indicating the objectives and land

5. The Albertine Rift is the western branch of the East African Rift, covering parts of Uganda, the Democratic Republic of the Congo (DRC), Rwanda, Burundi and Tanzania. It extends from the northern end of Lake Albert to the southern end of Lake Tanganyika.

management activity to be undertaken. The different land management practices include conservation of the existing forest area, assisted regeneration (such as climber cutting and gap filling) and reforestation of the degraded patches.

After consultation with the PFOs, the project beneficiaries expect to receive seedlings as well as approximately US$30/ha/year at the end of each implementation year for a period of two years. However, before any payments are made, an independent audit will be commissioned to make sample checks to verify the implementation progress.

6.1.2 REDD+ pilot for Ongo Community Forest

Ongo Community Forest has been earmarked as a pilot site for REDD+ to be implemented by ECOTRUST with financial support from MyClimate. ECOTRUST is a not-for-profit environmental conservation organisation established in 1999. It is committed to creating and maintaining effective mechanisms to support financing and programming in natural resources and biodiversity conservation. Throughout its initiatives, ECOTRUST supports the conservation of biological diversity and improved livelihoods by investing in people to care for the environment.

ECOTRUST sought to implement a pilot REDD+ with Ongo communities as part of the broader Trees for Global Benefits (TGB) programme, mainly aimed at achieving sustainable management of the Ongo Forest. The project seeks to reduce emissions from deforestation and improve forest management through the implementation of community-based forest management plans. The project expected to improve forest management by reducing the threats of fire and illegal activities, supporting forest rehabilitation through enrichment planting of heavily degraded areas and supporting alternative livelihood activities. These include the development of non-destructive forest-based enterprises and capacity building for ecotourism, apiary and crafts through the establishment of a micro loan system. Further, the project aims to support alternative sources of fuelwood to reduce pressure on the natural forests through the establishment of woodlots/agroforestry systems on private lands. The project is still at the start-up phase and some of the accomplished activities include biophysical and socio-economic baselines, community-level and technical consultative meetings, formal registration of the communal land association as a CBO, and third-party validation. Currently ECOTRUST is in the process of securing formal tenure rights for the community and to have the forest gazetted as a community forest.

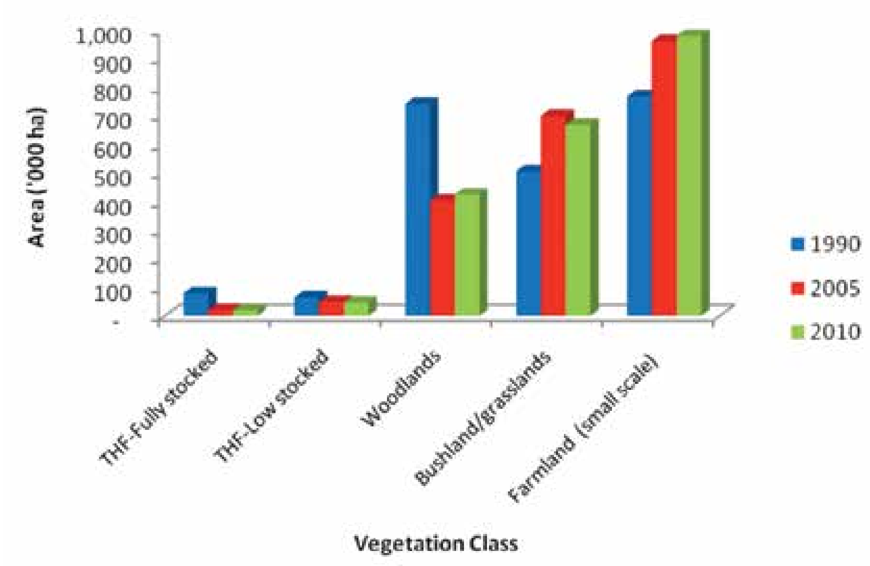
6.2 Deforestation and forest degradation: trends and drivers

Landscape level Landsat images for 1990, 2005 and 2010 were analysed and the corresponding land cover and mean biomass distributions estimated. Changes in land area and total biomass for the different land cover classes were investigated for two area categories:

- Areas within the protected areas (excluding Murchison Falls National Park), the three wildlife reserves and the CFRs of Budongo and Bugoma. The assumption was that these areas are well protected/managed against the key degradation/deforestation activities considered in this study.
- Areas outside the protected areas (forests on private and communal lands).

This report focuses on the latter category, which are referred to as corridor forests.
For areas outsides the protected areas, it was noted that the area under the different vegetation classes had changed over time with major transitions experienced in the fully stocked tropical high forest (THF fully stocked) where annual declines of 3914ha and 188ha were detected for the periods 1990–2005 and 2005–1020 respectively (Figure 9). The area under low-stocked THF changed by 1001ha/year[1] and 546ha/year[1] for the periods 1990–2005 and 2005–1020 respectively. On the other hand, the area under farmland had greatly increased, registering annual increases of 12,957ha and 3457ha for the periods 1990–2005 and 2005–1020 respectively.

Figure 9. Changes in area for the different vegetation classes (non-protected areas)



With regards to biomass stocks, the corridor forests have over time been generally low-stocked with mean estimates of 56.8 tonnes/ha in 1990. The stocks greatly reduced to 31.0 tonnes/ha and 26.8 tonnes/ha in 2005 and 2010 respectively. The observed trends could be associated with socio-economic factors in the different districts especially Kibaale, Hoima and Masindi over the analysis period. There were high influxes of immigrants especially in Kibaale District during the late 1990s which led to the clearing of several forested areas for both settlement and agricultural cultivation (e.g. Christensen and Jensen 2012; Espeland 2007).

The primary proximate causes of deforestation included small- to medium-scale farming for commercial production and subsistence farming, while degradation was mainly attributed to the harvesting of timber and poles. The high demand for timber, maize, rice and groundnuts across the region including Juba Town in Southern Sudan greatly aggravated the deforestation and forest degradation activities in the area. Further, high levels of national/regional and international demand for sugar and tobacco were reported to have escalated the forest-clearing activities. The high extraction levels for timber were reported to having led to forest degradation creating forest patches, which provided an opportunity for clearing the land for farming activities. This was reported during the key informant interviews and FGDs, and witnessed along the forest frontier as indicated in Figure 10.

Figure 10. Forest area cleared for cultivation, a tobacco nursery (within the forest boundary) and tobacco loading in Ongo

6.3 Estimate of opportunity costs

The reports from the districts and discussions with farmers revealed information about the most important cash and food crops and the relative impact on the forest (Hoima District 2011; Masindi District 2011). The crops are listed in order of importance according to the number of households cultivating the crop for Hoima and total acreage within the district of Masindi (Table 10). The socio-economic survey done by Akwetaireho *et al.* (2011) in the Budongo–Bugoma and Bugoma–Kagombe corridors documented similar crops.

Table 10. The most important cash crops and their stage in the land-use trajectory

Crops in Hoima	Stage in land-use trajectory after forest clearance
Upland rice	Initial: years 1–2
Tobacco	Initial: years 1–2
Maize	Initial: years 1–2
Sugarcane	Initial: years 1–6
Cassava	Rotational (year 3 onwards)
Sweet potatoes	Rotational
Groundnuts	Rotational
Bananas	Rotational
Beans	Rotational
Sugarcane	Rotational

Source: Hoima District (2010) and Masindi District (2010)

It was clear from the FGDs that crops like tobacco and sugarcane were mainly cultivated by the men while other crop enterprises were engaged with by both men and women as long as it was cultivated partially for commercial purposes. Crops mainly for subsistence purposes (e.g. potatoes) were grown mainly by the women.

Further, the socio-economic survey and biophysical assessment reports for the community forests revealed that much of Ongo was cleared for tobacco and rice growing while Alimugonza had been heavily cleared for growing maize (Nabanoga *et al.* 2012; Namaalwa and Ssenyonjo 2012).

The possibility of and timeframe for letting a piece of land that has been under continuous cultivation (6–8 years) lie fallow depends on the availability of alternative land for cultivation. Individuals with relatively large areas of land or a number of land parcels can afford to allow land to lie fallow (Table 11). After the fallow period, the crop cycle may resume.

Table 11. Typical land-use trajectories

Option 1	Option 2	Option 3	Option 4
Tobacco	Rice	Tobacco	Maize
Beans	Rice	Beans	Beans
Tobacco	Rice	Tobacco	Maize
Beans	Maize	Maize	Beans
Maize	Beans	Groundnuts	Maize
Groundnuts	Groundnuts	Maize	Beans
Maize	Maize	Beans	Potatoes
Groundnuts	Cassava	Sugarcane	Beans
Cassava	Cassava	Sugarcane	Cassava
Cassava	Cassava	Sugarcane	Cassava
Cassava	Cassava	Sugarcane	Cassava
Fallow	Fallow	Fallow	Fallow

The crop cycles were investigated for newly cleared forest land and the options reported by the farmers are shown in Table 11. It is important to note that farmers often prefer to cultivate tobacco, rice and maize in newly cleared areas with high fertility. The farmers who grow tobacco are expected to have a crop rotation with a cereal or leguminous crop before the next tobacco season. Further, for the sugarcane growers, the crop can be coppiced for up to three growth cycles (6–7 years) before the area is re-cultivated with a completely new crop. Alternatively, a new crop is cultivated when the yields drop to less than 65 tonnes/ha.

The average yields for the different crops were derived from the values generated during the rapid appraisals with the sampled farmers. They were compared with the reported values in the district reports (Table 12).

Cropping options 1–3 gave relatively high estimates due to the nature of the crops considered, which are high-value crops such as tobacco, rice and sugarcane (Table 13).

Table 12. Average crop yields

Crop	Activity period (months)	Average values for present production (kg/ha) (2010)		Field observations	
		Masindi*	Hoima**	Harvest	Yields (kg/ha)
Tobacco	9		2457	First harvest	1966
Tobacco	9			Subsequent	1843
Rice	8	3071	4044	First harvest	3931
Maize	5	1500	1673	First harvest	2948
Maize	5			Subsequent	2654
Beans	4	1100	860	First harvest	1179
Groundnuts	6	950	1106	First harvest	983
Cassava	12	6000	4914	First harvest	4900
Cassava	12			Subsequent	2948
Sugarcane	18–24			First harvest	95,000
Sugarcane	18–24			Subsequent	80,000

*Masindi District Report (2010)
**Hoima District Report (2010)

Table 13. Discounted net returns for different agricultural options

Cropping cycle	NPV (US$/ha)		
	25%	12%	18%
Option 1	1307	1583	1440
Option 2	1121	1355	1255
Option 3	1255	1648	1457
Option 4	803	1034	913
Average	**1122**	**1405**	**1266**

6.3.1 Opportunity cost of reduced access to forest resources

Figure 11. A newly constructed tobacco barn

One specific land use linked to commercial purposes is the extraction of poles for the construction of tobacco barns. It was reported that a new tobacco barn is constructed every 2–3 years by a continuous/shifting tobacco grower. Poles of different sizes are extracted for making the posts and roof (Figure 11).

The socio-economic survey revealed that about 46 per cent (n=69) of the surveyed households had engaged in tobacco growing for the year 2011, of which only 23 per cent (n=16) had cultivated an area of 0.5–1ha (Nabanoga *et al*. 2012). The amount of poles extracted for subsistence use ranged between eight to 200 with a mean of 60.71±46.22. An average-size tobacco barn (to dry tobacco from >= 0.5ha) was reported to require an average of 58 stand poles, 80 roofing poles and 120 stakes. If we assume that each of the households constructs a new tobacco barn every three years, the discounted cost[6] over a period of 15 years at varying discount rates are as presented in Table 14.

This implies that if the extraction of poles is halted in this forest, the community members may fail to participate in tobacco growing due to a lack of materials to construct the barns, or because their net income will be reduced by the approximate cost for obtaining the poles from an alternative source. Other lost opportunities would include the loss of land for the nursery beds as well as the areas for cultivating the tobacco.

Table 14. Costs for poles required for construction of a tobacco barn

Description	Quantity	Estimated unit cost (UGX)	Estimated total cost (UGX)
Stand poles	58	1500	87,000
Roofing poles	80	800	64,000
Tobacco stakes	120	200	24,000
Total for each barn			**175,000**
Discounted costs			
r =10%			662,637
r =5%			837,104
r =15%			460,271

6.3.2 Opportunity costs compared with potential carbon revenues

Estimates were made of the current carbon stocks and potential emissions from converting forests and woodland to farmland. The carbon stock estimates are fairly low but are in line with those of Leal *et al*. (2011) who noted that the forests of the Murchison–Semliki landscape are relatively low in carbon density when compared with the mean values for different forest types in tropical Africa (Proforest 2009).

6. Taking into account the varying distances from the forest.

Table 15 shows the potential carbon revenues at different carbon prices for emission reductions from avoiding deforestation. Comparison with the returns to agriculture shows that the carbon price would need to be at least US$5/tCO2e for REDD+ finance to be able to compete.

Table 15. Potential carbon revenues versus opportunity costs for agriculture – Albertine Rift

Vegetation class	Carbon stock tCO2e/ha	Emissions due to conversion tCO2e/ha	Potential carbon revenues at different carbon prices US$/ha		
			US$3/tCO2e	US$5/tCO2e	US$8/tCO2e
THF fully stocked	347.1	326.8	980	1634	2614
THF low stocked	149.9	129.5	389	648	1036
Woodlands	60.8	40.5	122	203	324
Farmland	20.3				
NPV for agriculture (US$/ha at 25% discounted rate)	Option 1	Option 2	Option 3	Option 4	Average
	1307	1121	1255	803	1122

6.4 Major challenges and lessons for REDD+ architecture

The high rates of deforestation in this region and in the study sites mean that a REDD+ intervention is timely and has the potential to make a significant difference. Agriculture is a primary driver of deforestation so both the models reviewed need to be able to provide a package of benefits comparable to the returns from agriculture. This will be particularly challenging give the high returns from agriculture estimated in the study.

6.4.1 The PES model

The PES scheme has a number of features which suggests that it has pro-poor potential:

- it engages with farmers of small landholdings, thus involving communities;
- there is voluntary participation, suggesting that landowners will only participate if they perceive a net benefit – and will only continue to participate if the benefits work out in practice;
- there are efforts to consult with landowners so that they can make informed decisions; and
- the project is working with landowners who do not have a formal land title and uses local recognition of landownership (e.g. by the LC chairman) for moving forward.

However, it is also important to highlight some drawbacks of this model. It only benefits those individuals who own land, and has the potential to reduce forest access for people in the community who do not have land or who do not have forests on their land. Further, the predominant land tenure system in the region is customary and forests on customary land are usually perceived as common property resources. Entitlement to resources under customary tenure is legally not vested in an individual (Land Act 1998). Nonetheless, even where there is local recognition that forests are on privately owned land, there are still expectations that access by other community members to the forest for subsistence use of forest resources is acceptable. Therefore, paying individuals other than the community who feel they have vested interests in these forests may create animosity and anxiety among the community members. It may also lead to the displacement of forest-product harvesting, for example timber and pole extraction and fuelwood production to the CFRs, LFRs and other privately owned non-project forests.

It could be possible for the implementing organisation to address this by promoting tree planting at the community level or with households who do not have forest land. This would add to the costs of implementation but could pay off by reducing conflict and contributing to greater security of permanent emission reductions.

Given the customary land tenure system, people have not acquired land documentation to ascertain private ownership. The approach adopted for the PES scheme of using a verifying authority (i.e. the LC chairperson) is not legally recognised under the current multi-party dispensation. Therefore, this verification could not be used in the event of any legal claims by other members of the community. It is too soon to assess whether this will be a major problem in practice.

A major threat to the long-term viability of the scheme is the high level of opportunity costs. These are far higher than the amount being offered to PFOs in the PES scheme. While there have been complaints about the low level of the payment in the PES scheme, it has attracted 342 participants – about 50 per cent of the PFOs targeted. However, at this early stage in the scheme it is not clear whether the decision to participate is the result of a cost-benefit calculation on the part of the PFOs or whether it is leading to changes in forest land use. The project team has also highlighted challenges (CSWCT pers. comm. 2012) of managing people's expectations and high administrative costs.

Regarding the potential sustainability of the PES project, given that participation is voluntary, the knowledge and skills attained during the process are expected to enhance the continued implementation of land-management practices stated in the intervention plans developed during the project period. The expectation is that there will be a change in the mindset of the people about the importance and value of sustainable management of forested landscapes. Hence, while land-management practices continue to be implemented, some benefits may continue to accrue to the beneficiaries and the wider community with or without payments.

6.4.2 Ongo Community Forest

The pro-poor potential of this model could be attributed to the fact that it involves communities who have in the past expressed a desire to communally own and manage their forest in a sustainable manner. The community members have been consulted regarding their voluntary participation in a REDD+ pilot project and the potential implementing organisation is taking the lead in processing the land ownership document on behalf of the community. Further, all the community members in the four villages surrounding the forest are expected to benefit from the scheme.

However, there are potential setbacks for this model that may affect its sustainability:

- There are several potential leakage elements including agricultural activities and timber and pole extraction shifting to Budongo CFRs and hence the net emission reductions may be greatly affected. In relation to sustainability of the intervention, the management structures developed and their level of functioning will have a great influence on the sustainability of the programme. The current experience is that a management committee for the community forest which is not fully empowered (legally or technically) and with no logistical support may not support the sustainability of the REDD+ intervention.
- Under the law, an identifiable group is required to register a community forest, thus creating a cluster of members and non-members. However, the law is not clear on the kinds of benefits that non-members of the identifiable group responsible for a community forest can derive.
- In practice, they allow non-members to derive some benefits.
- Ownership of land: when a community forest is registered, a certificate of registration rather than a land title (which gives full ownership of land) is granted. The land where the forest is located remains the property of the district land board and the community is granted some of leasehold, which has provisions for incidents of the lessee. This may make the community suspicious given that their expectations might be of having full ownership and management powers over the resource. Further, in cases where proof of ownership is tagged to a legally recognised land ownership document before a REDD+ intervention, this may become contentious.

Key findings: customary and private lands in Acholi, northern region

The northern region is semi-arid area. The Acholi sub-region (also known as Acholi-land) is an inexact term that refers to the region traditionally inhabited by the Acholi people. It is composed of the present-day Ugandan districts of Gulu, Kitgum, Pader, Amuru, Nwoya, Lamwo and Agago. It encompasses approximately 11,000 square miles near the Uganda–Sudan border. Its current population is estimated at 600,000 individuals or 4 per cent of the total national population. The area was of interest given the opportunity to observe the trend in forest cover and land use before the war (1986), during the war (1986–2005/6) and after the war (since 2005/6) when many people returned to the area.

The field investigations were undertaken in the communities of Gulu and Kitgum. These districts were purposively selected to capture information on (a) the major causes of the observed changes in forest cover; (b) the existence of interventions to promote forest management and tree planting in agroforestry systems; and (c) availability of opportunities to enhance agroforestry for REDD+ mitigation/as a REDD+ intervention.

Almost all the land is under customary tenure with the exception of the municipality and there are very few leaseholds. However, the customary land is mainly used privately by individual members of the clan. The land holdings at household level range from 1–3ha (for districts like Gulu and Lira) and 2–8ha (for districts like Kitgum, Amuru and Pader) while land-scarce districts like Lira registered average holdings. Men are primarily the owners of land acquired mainly through inheritance and usually bequeath the land to their sons. Women only have access to land as children, allocated to them by their father. During marriage, women then access land through their spouses by their default marital status. In the event that a girl child does not get married or loses her marital status, her father may reallocate her subsistence land at her natal home. According to the customs of the area, different household members exercise different rights over the land holdings. Women do not own land and therefore can never sell, bequeath or rent out land. They can, however, improve and use the land in consultation with the owner of the land (any male relative). Access and use rights are exercised by all members of the family/household (men and women) for subsistence use and to a limited extent for commercial use once land is allocated to them.

The main commercial land uses are crop cultivation and limited animal husbandry. The main crops cultivated for both cash and food include maize, sorghum, millet, groundnuts, beans, cassava, simsim, rice, cowpeas and pigeon peas. Sweet potatoes and vegetables are often grown for subsistence use, while cotton and tobacco are grown by some few individuals as cash crops. A few individuals own animals including goats, pigs and cattle. The forested lands are often used for harvesting timber, poles and fuelwood and for charcoal burning in some areas.

7.1 Potential REDD+ model to deliver emission reductions

Agroforestry interventions can contribute to REDD+ by providing alternative sources of forest products such as timber, poles and fuelwood thus reducing the impact on naturally forested landscapes. This is achievable in cases where agroforestry systems involve tree-planting activities.

Further, other agroforestry systems such trees conserved in situ (i.e. scattered trees on farms) and alleys of natural vegetation can save natural vegetation which contributes to carbon storage.

The field investigations revealed the different agroforestry systems that have been practised by different farmers or are desired by others. The main practices include growing scattered trees (especially shea trees), woodlots, tree belts (alleys) and fruit orchards. Other agroforestry practices identified include planting woodlots of pine, eucalyptus and teak, which are commonly adopted by schools, although a few individuals were reported/observed to also be engaged (Figure 12). In addition, indigenous fruit-tree orchards were also evident to some extent.

The field visits included tree belts/alleys that are cropped for teak, citrus and *Calliandra*. The crops mainly intercropped included cotton, millet, sunflower and pineapples (Figure 13). However, the farmers mentioned that several crops could be intercropped in the alleys especially during the first years of cropping, especially legumes.

Figure 12. Woodlots for teak, pine and eucalyptus

Figure 13. Tree belts (alleys) with crops

The institutions engaged in promoting agroforestry practices included mainly NGOs such as World Vision, Lutheran World Foundation (LWF), Mercy Corps and Tree Talk and a government programme known as the Farm Income Enhancement and Forest Conservation Project (FIEFOC) for the Ministry of Water and Environment. These institutions focus on capacity building and raising awareness about tree planting and environmental management, woodlot establishment in institutions such as schools, restoration of former internally displaced persons (IDP) camp areas and tree planting/management on individual farms. The farmers often receive seedlings and technical knowledge/training. It was noted that all the institutions engaged in promoting agroforestry aimed to boost household incomes by generating income from the trees as well as the crops. In addition, Gulu Agricultural Development Company (GADC) has established a tree nursery and distributed thousands of seedlings to farmers in order to reverse deforestation caused by felling trees to produce charcoal.

Other previously practiced agroforestry systems (in situ conservation and tree belts) could continue to be promoted in the area to reduce emissions from deforestation and forest degradation. Woodlots could also increase production of on-farm timber and fuelwood. But there is an urgent need to address the massive land clearing by large-scale farmers to reduce the emissions from deforestation. One of the models under practice by one private landowner (under customary law) is clearing land while leaving natural vegetation belts. The cleared land is approximately 40m wide and 500m long, while the natural vegetation belts are about 5–6m wide. The belts are established along the land contours to control erosion and as a result, the cleared land and vegetation patches are meandering (Figure 14). The arrangement of this system is similar to the alleys/tree belts established as indicated in Figure 13, although in this case the natural vegetation with indigenous tree species remains. The 40m-wide cleared strip is sufficient to allow for mechanisation such as ploughing. This practice could be preferred to that which other large-scale famers have adopted in the area, where all the natural vegetation is cleared to facilitate mechanisation (see Figure 16).

Figure 14. Land for commercial agriculture with natural vegetation belts

7.2 Deforestation and forest degradation: trends and drivers

To determine the land-use and land-cover dynamics of the area, three distinct time periods were considered: 1986 (just before the war), 2006 (just after the war) and 2013 (currently). The image analysis revealed that forest cover in the region had increased due to the long fallow period inevitably caused by the civil war (1987–2005/6) when people were confined to camps and their homesteads and farmlands slowly changed into forest or thick savannah (Figure 15). However, since the end of the war, people have returned and are now aggressively turning their forests and colonised lands into farmlands again. Further, changes in livelihood activities mean that charcoal burning – which is a recent undertaking (especially by the youth) – is now one of the major drivers of degradation of existing forest lands. Therefore, there is a continuous decline in natural forest cover in the area.

Figure 15. Trees that have regenerated in the abandoned homesteads and farmlands

Discussions during the rapid appraisal revealed that the continuous decline in natural forest cover is mainly driven by an insatiable demand for forest products like charcoal and timber, by mainly urban dwellers. Decline is also exacerbated by high poverty levels in the north as people continue to struggle to acquire the basic necessities of life. Harvesting timber, building poles and wood for charcoal production has greatly contributed to the degradation of forested areas, while clearing forested land for cultivation is the major cause of deforestation (Figure 16). The latter is often undertaken after harvesting the existing trees for timber, poles and/or fuelwood (especially charcoal) (Figure 17).

Figure 16. Former forested landscapes cleared for cultivation in the northern region

The charcoal trade, referred to as 'black gold' by Kampala traders, has over time become more profitable than the forests where trees are being indiscriminately cut down for charcoal burning. For the rural population, the charcoal trade is an opportunity to earn an income as they provide labour while the businessmen are often the urban dwellers. Previously, Kampala charcoal traders relied on charcoal from Nakasongola, Hoima, Masindi and Luwero areas (Namaalwa *et al.* 2009; Kalumiana and Kisakye 2001; MWLE 2002) which have since been depleted. Recent trends indicate an increasing flow of charcoal from the northern region. 'I have been in this trade for three years; we get our supply from northern Uganda because the charcoal produced there is of a good quality and on high demand,' a Kampala charcoal dealer reported. For instance,

Figure 17. Charcoal produced from the areas cleared for cultivation

Langele village, adjacent to the Murchison Falls National Park in Nwoya in northern Uganda, formerly known for its beautiful scenery and thick forests, is no more. Locals refer to Langele as a charcoal factory.

Due to the low numbers of livestock in the area, the formerly communal grazing areas have ceased to serve this purpose and are either cleared (partially or wholly) or are yet to be cleared for cultivation. It is, however, important to note that most of the farmers expressed an interest in having relatively clear fields (with very few scattered trees) mentioning that most of the crops cultivated demand good light to grow and the shading from the trees would greatly affect the expected yields. As a result, very few large important tree species are left in the cultivated fields.

Several of the small-scale farmers use the traditional hoe and as a result, only small pieces of land are cleared at a time. Quite often the trees are harvested and sold for charcoal burning, while is some cases bush burning is adopted to clear the land. Some trees, especially the shea tree and sometimes *Combretum* are conserved in situ. In the case of commercial farmers, vast lands have been cleared of trees in preparation for planting or have already been planted with different crops such as sunflowers (Figure 16).

7.3 Emission reductions and opportunity costs

In order to estimate the likely emission reductions, three types of agroforestry system were compared with the situation where all the tree cover is cleared in preparation for farming activities (Figure 16). The agroforestry systems examined were the creation of natural vegetation alleys or belts in the process of clearing land for cultivation and having scattered indigenous trees in cultivated fields. The tree cover in the remaining vegetation patches was sampled and various parameters estimated as indicated in Table 16. About eight indigenous species were identified in the vegetation patches including *Vitellaria paradoxa, Combretum, Grewia, Acacia, Arizonia* and *Piliostigma* while in the cultivated fields *Vitellaria paradoxa* was the dominant species. Earlier studies (e.g. Byakagaba *et al.* 2012) also indicate that areas under fallow for long periods had a vegetation structure showing an inverse 'J' shape, implying many individual trees in the smallest diameter classes, with the number gradually declining in the middle and larger diameter classes. Currently, cultivated fields have trees mainly in the large diameter classes. It was reported that farmers retain large trees on cultivated land because they are more productive in terms of fruit yields, but also because the shea tree is non-competitive and thus prefers sites where there is less competition from other tree species.

Table 16. Tree cover in vegetation belts and farmlands with scattered indigenous trees

Parameter	**Estimate**		
Arrangement	**Natural vegetation belts**	**Scattered indigenous trees**	**Scattered trees in cultivated fields**
Species composition	**Mixed species**	**Mixed species**	**Shea nut**
Tree count	400 trees/ha	32 trees/ha	29 trees/ha
DBH range	6.7–31cm	17.5–48cm	3–64cm
Mean DBH	15cm	27.3cm	40
Height range	3–12m	5–18m	2–17.6cm
Mean height	8.6m	12m	10.1m
Mean crown width	3.5m	9.64m	9m
Range for crown width	2–6m	5–16.6m	2–14.3m
Biomass stock	31.7 tonnes/ha	19.65 tonnes/ha	20.78 tonnes/ha
Carbon stocks	58.2 tCO2e/ha	36.06 tCO2e/ha	38.09 tCO2e/ha

These estimates need to be compared with the carbon stocks on converted farmland. Ground measurements were not taken in this region but figures estimated in other regions (20.3 tCO_2e/ha in the western region – see Table 15) or in other studies give a basis for comparison. A range of 5–30 tCO_2e/ha was earlier estimated for converted farmlands reported for the Albertine Rift in the western region (Leal *et al.* 2011).

Therefore, if the system of vegetation alleys is promoted as an alternative to complete land clearing, substantial amounts of carbon will be sequestered or avoided to be emitted, taking into account the large areas over which farmlands are being re-established. However, this system is only applicable for individuals with relatively large pieces of land and who are planning to undertake large-scale farming. For the small-scale farmers, adopting the system of in situ conservation of indigenous species would lead to lower but still substantial amounts of avoided emissions.

7.3.1 Opportunity costs

Opportunity cost estimates were not made in this case because of the greater complexity of the comparison. It is not just a case of estimating returns to crops on cleared forest land and comparing this with no crop production but of estimating how different types of agroforestry systems affect the return to crop and livestock production because of the effects of shade. As mentioned earlier, this is a key concern for the farmers in the region. The literature on the costs and benefits of agroforestry suggests that viability is heavily dependent on location and species, and the timeframe for analysis, discount rate and the range of benefits included. However, a common conclusion of the studies that are in favour of the profitability of agroforestry is that it requires a considerably higher investment in the early years, thus constituting a major obstacle to its adoption (UNEP 2011). This seems likely to be the case in the northern region also but also points to the possible advantages of integrating with REDD+ finance.

7.4 Challenges and lessons for REDD+ architecture

There are several challenges cited in the implementation of agroforestry interventions, and these should act as learning points for developing a REDD+ architecture in semi-arid areas similar to study area.

- Since resettlement, customary norms are fading and people are starting to prefer private/individualistic ownership of land so that they are able to exercise all property rights. On the one hand, this individualistic land ownership limits access to a few people and hence reduces the availability of land to other community members who could be engaged in agroforestry practices. However, on the other hand, for those who own land, the private ownership model would provide security of tenure and hence promote the adoption of agroforestry practices.
- Conflicts pertaining to land ownership and boundaries between and within clans and institutions are still prevalent. Due to long fallow periods, the grass bands which commonly served as the physical boundary markers have disappeared. In other locations, the regeneration of the forests over the landscape has made the clear identification of boundaries difficult. As a result, most trees have been cleared to re-establish boundaries.
- The district technical personnel reported that the concept of carbon markets is still new and there is a need for sensitisation to enable the people to understand the value added in managing forested landscapes if they are linked to such markets. Further, the operationalisation of such markets needs to be clearly explained to the local communities, to avoid speculation of land grabbing by urban elites.
- The mindset of the local communities towards agroforestry is to have woodlots of mainly exotic species such as pine and eucalyptus. The main argument was that these species provide multiple products such as fencing posts, construction materials and telephone poles, whose markets are readily available. Therefore, the promotion of other agroforestry systems which involve indigenous tree species may require a lot of sensitisation with proof of the comparative advantage over the exotic species.

8

Discussion

A review of these five REDD+ models reveals some key similarities in relation to deforestation and degradation trends and opportunity costs.

8.1 Deforestation and degradation: trends and drivers

The analysis shows the impact of population pressure and a buoyant urban market for charcoal and commodity crops. Deforestation is proceeding very fast in both the western and northern regions. In the other two cases, regulations restricting deforestation through the creation of a protected/conservation area are having some effect but there are still latent pressures. Irrespective of the forest management regime, there are significant drivers of deforestation and forest degradation in the four regions examined. However, the pressures are higher in the private and community forests than in the forests managed by UWA and the NFA.

8.2 Opportunity costs

The opportunity costs of avoiding deforestation are very high in the three regions where this has been examined. The tables below compare the net present value (NPV) of returns to land across three of the regions. Returns to land are above US$1000 per ha, except for crop-cycle options that involve annual food crops and/or minimal fertiliser use.

Table 17. Discounted net benefits for different land-use trajectories

Site	Major crops	NPV (US$/ha) at 25%dr					
		Option 1	Option 2	Option 3	Option 4	Option 5	Average
Mabira	Coffee, sugarcanes, maize, bananas, *catha edulis*	927	738	2482	1327	1777	1628
Elgon	Coffee, wheat, Irish potatoes, horticultural crops, maize, rice	1204	1594	1427	621		1212
Private and communal forests	Upland rice, tobacco, maize, sugarcane	1307	1121	1255	803		1122

The average values obtained are relatively high compared to the mean value of US$942ha^{-1} reported for Tanzania (Fisher *et al.* 2011). However, it is important to note that while the Tanzania study considered only maize, several high-value crops including tobacco, sugarcane and rice were considered in some of the options. The values are also in line with estimates from earlier studies (e.g. Namaalwa *et al.* 2001) which indicated discounted values of US$1562, US$913 and US$660 for slowly decreasing, quickly decreasing and rapidly decreasing yields for average-value cropping options such as maize, beans, potatoes and some sugarcanes.

Carbon density in Ugandan forests is relatively low, particularly in low-stocked forests, and this coupled with the high returns for crops results in rather high costs per unit of carbon emission reduction. Table 18 compares the average return to agriculture across the main land-use trajectories with the potential carbon revenues per hectare at different carbon prices for emission reductions from avoiding conversion of tropical high forest to farmland, averaged across fully stocked and low-stocked forest.

Table 18. Estimated costs for carbon emission reductions (converting THF to agricultural land)

Management regime	*Discounted net returns for agriculture (US$/ha @ 25% dr)	Emissions due to conversion (tCO_2e/ha)	Potential carbon revenue at different carbon prices (US$/ha)		
			US$3	US$5	US$8
Private and communal forests	1122	208.1	624.3	1040.5	1664.8
Mabira CFR	1450	248.9	746.7	1244.5	1991.3
Mount Elgon NP	1212	210.5	631.5	1052.4	1683.9

*The discounted values are averages of 4 land-use trajectories (5 for Mabira).

The results indicate that pro-poor REDD+ models in these three sites can compete with agriculture only if carbon prices are above US$5/$tCO_2e$.

In order to examine the financial viability of a pro-poor REDD+ model, it is important to factor in transaction costs. It was not possible in this study to make precise estimates of transaction costs for each model but from the interviews with the implementing organisations it emerged that the existing benefit-sharing arrangements and payment systems are perceived to have high transaction costs. It was also possible to make rough estimates of certain categories of cost as a percentage of the total costs for four of the models, based on a project period of four years. In all four cases, the costs of activities such as planning, monitoring, reporting, verification and administration together exceeded 30 per cent of total costs and was somewhat higher in the case of the PES scheme, given that there are numerous participants with small amounts of forest. This would imply that carbon prices would need to be over US$7 per tonne of CO_2e, to cover both opportunity costs and transaction costs.

Taking into account a leakage and non-permanence buffer of 20 per cent of the emission reductions, and the need to provide an amount on top of opportunity costs as an incentive, the carbon price required to break even would be in the region of US$10 per tonne of CO_2e. This is considerably higher than current carbon prices in the compliance market but not so out-of-line with prices in the forest sector part of the voluntary carbon market, although somewhat higher. In 2012, the average price/tCO_2e in the voluntary carbon market was US$7.7 (FTEM 2013).

8.3 Key messages for the national REDD+ architecture

The positive and negative lessons from the different benefit-sharing forest management schemes should serve as learning points for developing the REDD+ architecture at national and sub-national levels.

- The existing community-based organisations could form the basis of the REDD+ architecture. Financial and technical support could be given to address institutional challenges (existing between NFA/UWA and the CBOs and within the CBOs).
- Financial and technical support could be given to the CBOs in order to address the institutional challenges relating to financial management and ensuring the sustainability of the alternative livelihood options.
- In the existence of other complementary programmes which aim to improve people's livelihoods and increase communities' access to forest resources through collaborative mechanisms, REDD+ interventions should avoid the duplication of efforts and build on or complement existing interventions.

- Given the minimal use of fertilisers by farmers, efforts can be made to facilitate improved agricultural activities through the provision of improved planting materials and fertilisers to boost production on currently cleared parcels on private land. Interventions enhancing productivity could be more targeted and focus on all aspects of agricultural production:
  - production: encourage/facilitate the use of improved planting materials/high-yielding varieties, fertilisers and integrated pest management;
  - post-harvest management to increase the value of crops such as coffee; and
  - marketing e.g. identifying and linking farmers to markets and lobbying for fair prices (through market associations).
- Given that complementary programmes start with pilot communities, some of the communities not considered in the pilot stage may consider the programme as selective, and hence continue with some illegal activities. This calls for the project to aim at increasing the coverage to benefit more communities and to negate the accusation of partiality.
- The choice of income-generating activities may greatly affect the sustainability of some CBOs. Some activities are long term and with high risk levels, while some CBOs are likely to incur high transaction costs and use a bigger proportion of the funds in administrative costs. This would imply that the net gain to the community members will be minimal.
- The current forest management initiatives involving communities register high transaction costs with regards to negotiating, implementing and monitoring resource-use agreements. REDD+ interventions could deliver in a cost-effective manner, provided that transaction costs are reduced by learning from the experiences of current benefit-sharing mechanisms.
- The biggest challenge is that the forest law does not provide for benefit-sharing mechanisms for the communities participating in CFM arrangements. This to some extent serves as a disincentive for participating or potential CBOS.

Conclusions

This report aimed to examine the practical, institutional and economic viability of pro-poor approaches to REDD+ mitigation. The research investigated the appropriateness of REDD+ interventions (by identifying the levels of deforestation and forest degradation) and possible REDD+ models given the existing forest and land-use management practices.

Based on the analysis of the trends of deforestation and forest degradation, it was evident that irrespective of the forest management regime, there are high rates of loss of forest area and quality. However, the extent is higher in private/community forests as compared to the areas managed by UWA. Therefore REDD+ interventions are timely. However, one of the key questions is whether the possible REDD+ options would be pro-poor and cost effective.

Potential REDD+ delivery models investigated built on existing forest management arrangements and land-use practices, which have formally/informally operated in the different sites. The arrangements make provisions for access to different forest resources (for both subsistence and commercial purposes), and boost agricultural production under the *taungya* system for boundary plantations. These are likely to have positive implications for the livelihoods of the participating communities. However, there are several challenges observed in the current implementation of the different initiatives, which should serve as learning points for developing the REDD+ architecture. REDD+ finance can serve as a premium to improve productivity and efficiency of forest use. However, REDD+ interventions should be aligned with complementary programmes to improve forest management and the productivity of agriculture on existing cleared land.

In conclusion, the general expectation is that the current resource management arrangements will foster a change in the mindset of the people about the importance and value of sustainable management of forested landscapes, thus providing a foundation for REDD+ interventions. However, the lessons learnt from the experience with these arrangements should be a reference point for developing the REDD+ architecture.

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