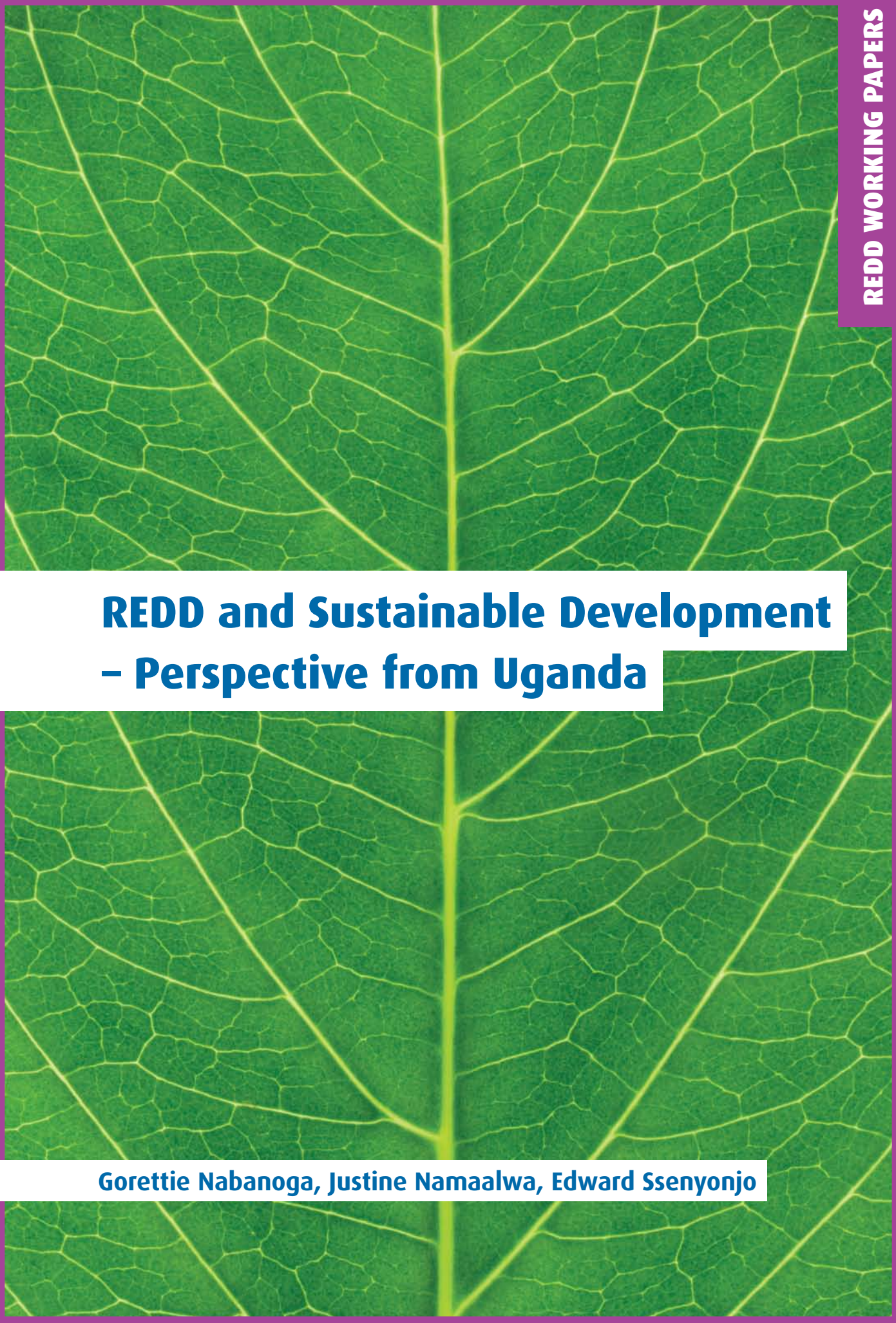

REDD WORKING PAPERS

REDD and Sustainable Development – Perspective from Uganda

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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 University of Life Sciences (Aas, Norway). It started in July 2009 and will continue to May 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 first phase of the project (July 2009 to May 2010) has been in partnership with Fundação Amazonas Sustentável (Brazil); Civic Response (Ghana); SNV (Viet Nam); 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 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.

In the first phase of the project, exploratory studies of different aspects of the design of REDD mechanisms were conducted to lay the foundation for the work in Phase 2. These Working Papers are designed to share the preliminary findings of research undertaken during the first phase of this project. They have not been subject to a full peer review process and are being made available online to stimulate discussion and feedback.

...in Uganda

This report considers the viability of REDD options in the Ugandan context. A broad analysis at national level is made of the drivers of deforestation and forest degradation and historical trends in forest cover, land use change and biomass density.

This is followed by examination of the Mabira Central Forest Reserve (CFR) which has previously been highlighted as a potential pilot site for REDD in Uganda. This report considers biological composition, legal status, and historical uses and management of the Mabira CFR, with a view to establishing the opportunity costs of REDD, the opportunities for sustainable forest management and the estimated avoided emissions from maintaining the forest rather than converting it to alternative activities.

Acknowledgements

The research leading to this report was supported by undertaken in collaboration with International Institute for Environment and Development (IIED) and with the support from the Norwegian Agency for Development Cooperation (NORAD). We express gratitude to all the Local Council Leaders, communities and Forest Managers of Mabira forest Reserve who participated in the research; and the graduate students who participated in the field activities.

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Acronyms

CFM	Collaborative Forest Management
CFR	Central Forest Reserve
Cpt.	Compartment
CRM	Community Resources Management
EIA	Environmental Impact Assessment
GHGs	Greenhouse Gases
KESI	Katoomba Ecosystem Services Incubator
MWLE	Ministry of Water Land and Environment
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NFTP	National Forestry and Tree Planting
NP	National Park
PEAP	Poverty Eradication Action Plan
SCOUL	Sugar Corporation of Uganda Limited
SFM	Sustainable Forest Management
THF	Tropical High Forest
WR	Wildlife Reserve

The country's forest estate

The government of Uganda recognises that forests are central to the three pillars of sustainable development; that is, the economy, society and the environment. The country has thus set the vision for Uganda's forests as "*A sufficiently forested, ecologically stable and economically prosperous Uganda*" (MWLE, 2001). A summary of the forest state and its contribution to the wider economy is presented in Box 1.

Box 1. Forestry in the wider economy

Contribution to GDP by 1991	6%
Annual turnover of business by 2001	Ugx. 356 billion
Estimated annual value attributed to environmental services 2001	Ugx. 112 billion
Estimated annual contribution to the tourism industry	Ugx. 2.7 billion
Increase in number of tourists 1999-2002	34%
Increase in foreign exchange earnings from the tourism industry 1999-2001	81%
Employment in formal and informal sector	>1 million jobs
Forest Values	
Wood Forest Products: Timber, poles, firewood, charcoal	
Non-wood Forest Products: Wild foods, wild game, medicinal plants, craft raw materials, water and fibre	
Biodiversity: Diversity of plant species, mammals, birds, butterflies	
Services: Rainfall formation, carbon sequestration, soil and water conservation, nutrient recycling, cultural and spiritual values	
Forests Goods (estimates)	
National energy demand met from wood fuels	90%
Annual firewood consumption	18 million tons
Annual charcoal consumption	500,000 tons
Annual pole consumption	875,000 poles
Annual timber consumption for construction, furniture-making and other manufacture	800,000 m^3
Level of resource-dependence in rural communities	90%

Source: NEMA (2005); World Bank (2002)

Forests in Uganda cover approximately 24 per cent of the total land area, of which 19 per cent are tropical forests, 81 per cent woodlands and bushlands and 1 per cent plantations. The forests are owned and managed differently as presented in Table 1.

Table 1. Approximate areas* (ha) of forestland under different categories of ownership and management

	Forest Reserves (NFA)	National Parks & Game Reserves (UWA)	Private	Total
Tropical high forest	306,000	267,000	351,000	924,000
Woodlands	411,000	462,000	3,102,000	3,975,000
Plantations	20,000	20,00	11,000	33,000
Total forest	**737,000**	**731,000**	**3,464,000**	**4,932,000**
Other cover types	414,000	1,167,000	13,901,000	15,482,000
Total land	**1,151,000**	**1,898,000**	**17,365,000**	**20,414,000**

Source: MWLE (2001)

* The value reported in this table for each forest category is as per the inventory in 1990

Deforestation and degradation in Uganda

The confusion that reigns between the two notions of deforestation and forest degradation has all too often been kept alive, or unconsciously made. In order to avoid any ambiguity, we might like to recall a number of elements that should be kept in mind:

- **Deforestation:** This involves a decrease in the area covered by forest. However, it cannot be so defined without adding a reference to its use or allocation. In point of fact, there exist certain forms of forest utilisation – and priority objectives of forest management – that clear temporarily the forest cover whilst guaranteeing its maintenance. This is the case of clear cutting of areas where forest will regenerate itself or be regenerated, or of the final cut in an even-aged forest sylvicultural treatment once natural regeneration has been assured. In other words, there is no deforestation if there is a guarantee of continuity in maintaining the forest cover.

- **Degradation:** This does not involve a reduction of the forest area but rather a quality decrease in its condition, this being related to one or a number of different forest ecosystem components (vegetation layer, fauna, soil), to the interactions between these components, and more generally to its functioning. The ambiguities of the term degradation and the difficulties of estimating it, are additional reasons for clearly differentiating between deforestation and degradation.

2.1 The drivers of deforestation and degradation in Uganda

The causes and drivers of deforestation and degradation include:

i. **Population pressure and rural poverty:** Uganda ranks fourth among the countries with the highest population growth rate in the world with a rate of 3.6 following Maldives (5.57, UAE 3.83 and Liberia 3.66). In addition, the GDP based on the purchasing power parity (PPP) of the country is one of the lowest in the world at 1,300USD (CIA, 2008). This implies that human survival is entirely dependent on direct consumption of environmental amenities, in particular forest products like food and shelter, and hence accelerates deforestation.

ii. **Agricultural expansion:** The expansion of agricultural production to feed the growing population is a major driver of deforestation and degradation. This condition is worsened by poor agricultural practices that provide low production per acreage of forest cleared. Virgin forest land is usually very fertile but loses its fertility in a few years, prompting further clearing of more forest. In aggregate, there is total loss of land and environment value over a short period of time.

iii. **Accelerated biomass energy demands:** Non bio forms of energy have been developed to only a limited degree, with very low exploitation of the Hydro Electric Power (HEP) energy potential of the country. This leaves biomass as the main source of energy for the nation accounting for about 93 per cent of total energy consumption in the country (Mukiibi and Nabuduwa, 2009). Consequently, the demand for fuel wood and charcoal as sources of home energy has caused enormous deforestation.

iv. **Timber exploitation:** The construction industry in Uganda has grown rapidly since 1986. Among the raw material used, timber had the highest demand and topped the Construction Sector Indices (CSI) of construction materials, far above cement, PVCs and paints (UBOS, 2009). Odokonyero (2005) noted that the annual demand for commercial timber is about 240,000m^3, which is twice the annual allowable cut and hence is unsustainable. This implies that the demand for timber is one of the major drivers of deforestation in the country.

v. **Property rights and tenure of land and natural resources:** The majority of wood and bush lands suffer from being open access property. Uganda is considered to be a country with a hybrid regime of democracy, with a history of conflicts over politics, land and other natural resources, forestry included. In the struggle for a developed democracy, several conflicts have occurred over the ownership of forestry resources. Several boundary disputes around forest reserves have been encountered with unlimited ambiguities and conspiracies from political organs of the state. In particular, the country is struggling to develop a land use policy that could likely help in the control of land disputes and improve land tenure. The hazy and undefined land tenure system reduces proper jurisdiction over the forest estates and hence accelerated degradation of the forest estate.

2.2 Deforestation and/or degradation rates and trends

FAO has been producing a global forest resources assessment since the late 1940s. Between 1990 and 2005, Uganda lost about 26 per cent of its remaining forest cover (about 1.3 million hectares per year), and deforestation continues today at a rate of 2.2 per cent per year (an average of about 86,400 hectares of forest), mostly due to subsistence farming, cutting for fuel wood, and colonisation by the burgeoning population. The forest estate in Uganda has been degraded so much that today very little of Uganda's forest cover is considered primary forest by the U.N. In spite of this, more than 25 per cent of the country is under some form of protection (FAO, 2006).

The land use/cover change assessment presented in the R-pin for Uganda (GOU, 2008) indicated deforestation rates ranging between 0.3-3.6 dependent on the forest type under consideration (Table 2).

Table 2. National level land use/cover changes 1993 to 2006

	Forest area (ha)			
Forest type	**1990**	**2005**	**Change in area**	**Annual % change**
Plantations				
Broadleaved	18,682	9,915	- 8,767	- 2.9%
Needle leaved	16,384	15,535	- 849	- 0.3%
THF-High stocked	651,110	580,010	- 71,100	- 0.7%
THF-Low Stocked	273,061	187,147	- 85,914	- 2.0%
Woodlands	3,974,508	1679558	- 2,294,950	- 3.6%

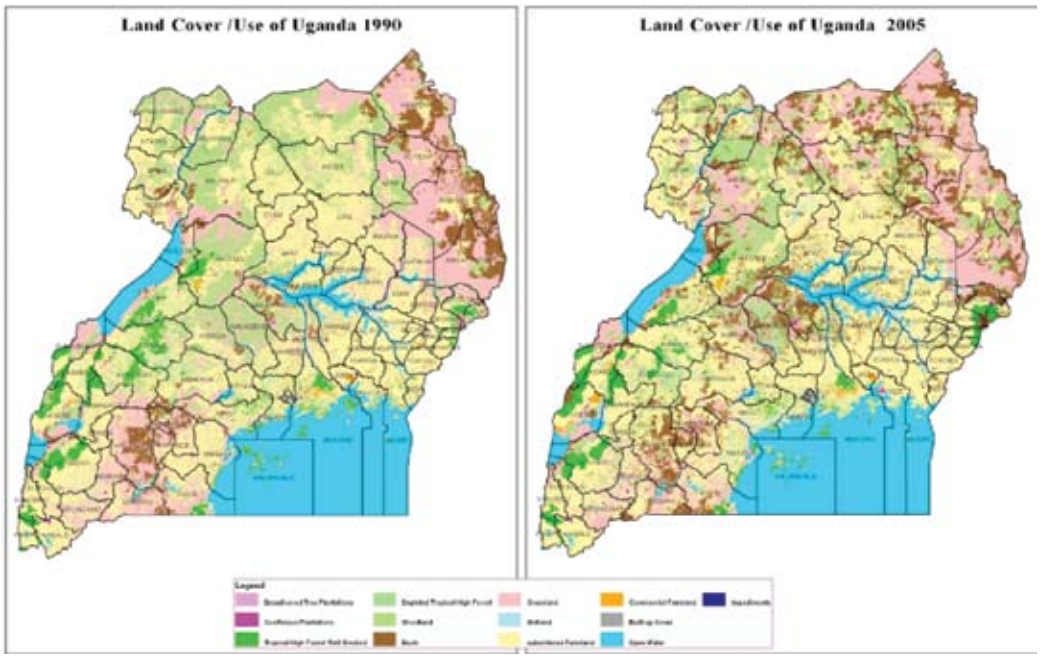
Source: (GOU, 2008)

THF High stocked = >150 tons per ha; THF low stocked = 50 -150 tons per ha; Woodlands = 40-80 tons per ha

Considering THF-high stocked, an average annual change of 548 ha implies a biomass density loss of approximately 82,191 tonnes, given the average stocking.

Further, the assessment of the landsat images indicated tremendous changes in the land cover and hence biomass density between 1990 and 2005 (Figs 1 & 2).

Figure 1. Land Cover/Use Change for Uganda (1990-2005)

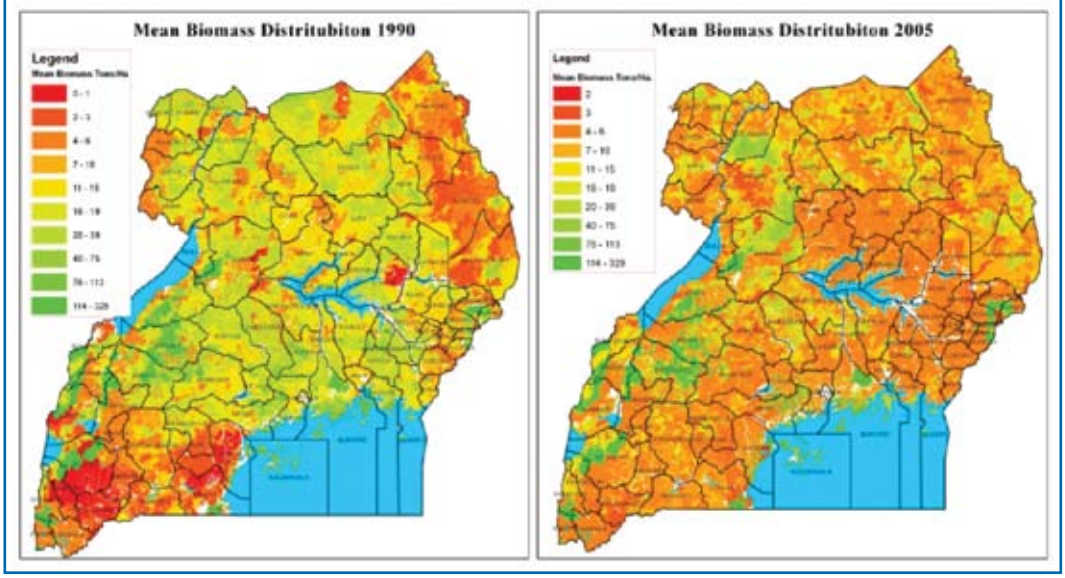


Source: NFA (2010)

Based on this assessment it is evident that several of the areas are degraded. This can be further disaggregated as indicated in the report by MWLE (2003). It was reported that unlike forest degradation, deforestation was more in Local Forest Reserves (LFR) than in Central Forest Reserves (CFR). The results revealed that in relative terms, 9 per cent and 43 per cent of the total CFRs and LFRs respectively had been deforested. However, it is also important to note that the degradation problem may probably be more widespread than the deforestation problem because the latter starts as degradation as the forest is selectively harvested by the communities around. If this goes on unabated, a point is reached whereby forest recovery is slower than degradation. Further harvesting leads to land cover change and we get deforestation, with most of the trees gone. Note the temporal aspects of these phenomena: they both take time to manifest. However, there have been localised cases where the process is accelerated, that is, deforestation quickly following degradation, for example in Kibaale district, around camps for internally displaced persons, and the eastern block of Mabira CFR prior to evictions.

Given the reported degradation and deforestation drivers, it is anticipated that the historical rates will continue or even get worse overtime. This is particularly in relation to the population growth and the subsequent increased pressure on forest resources.

Figure 2. Mean Biomass Stock by District (1990-2005)



Source: NFA (2010)

REDD

Reducing Emissions from Deforestation and forest Degradation (REDD) is based on a core idea: reward individuals, communities, projects and countries that reduce greenhouse gas (GHG) emissions from forests (Angelsen, 2009). REDD is an objective rather than a clearly delimited set of actions or activities and it has the potential to deliver large cuts in emissions at a low cost within a short timeframe. At the same time, it could contribute to reducing poverty and sustainable development.

In discussions, however, REDD primarily refers to: (i) developing mechanisms to make payments to developing countries for reducing emissions from deforestation and forest degradation (compared with a reference level); and (ii) readiness activities which prepare countries to participate in the REDD mechanism. A core issue in REDD, therefore, is to create a multi-level – international and national – 'payments for environmental services' (PES) scheme.

3.1 The costs and benefits of REDD

As countries embark on the different REDD programmes or options, there is a great need for information on the associated costs and benefits, which will greatly influence and determine the viability of the different programmes. Pagiola and Bosquet (2009) clearly indicated that there is no single numerical answer to the question of what the cost of REDD is for a country. Given that agro-ecological, economic, and social conditions can differ substantially from place to place within a country, the costs of REDD can likewise differ substantially from place to place. Likewise, the cost and effectiveness of measures to reduce deforestation will vary. The results of the analysis of the costs of REDD will thus consist of a range of costs applicable to different situations or areas. The costs of REDD are mainly categorised into three: opportunity costs; transaction costs; and implementation costs. Although they may be distinct, there is however an overlap between them. The subsequent sections will focus on opportunity costs.

3.1.1 Defining opportunity costs

The opportunity cost of pursuing a certain action can be defined as the benefits that are lost because an alternative action must be forgone. Using the forestry perspective, despite the fact that deforestation (and/or degradation) has several negative impacts such as biodiversity loss, it can also bring benefits, for example harvested timber can be used for construction, and cleared land can be used for crops or as pasture. Reducing deforestation and/or degradation by preserving forests means foregoing the benefits that would have been generated by the alternative land uses that would have replaced the forests. If forests are cleared for agriculture, for example, then preserving forests means foregoing the benefits of crop production. The difference between the benefits provided by the forest and those that would have been provided by the alternative use is the opportunity cost of avoiding deforestation.

3.1.2 Importance and approaches for estimating opportunity costs[1]

Pagiola and Bosquet (2009) reported that "opportunity cost" is usually the single most important category of costs a country would incur if it reduced its rate of forest loss to secure

1. The review in this section is mainly from Pagiola, S. and Bosquet, B., 2009. Estimating the Costs of REDD at the Country Level. Forest Carbon Partnership Facility, Version 2.2. World Bank.

REDD payments. Estimating these opportunity costs is thus the central problem in estimating the costs of REDD. Estimating opportunity costs is also critical to understanding the causes of deforestation. Estimates of the opportunity costs thus provide inputs not only into the costs the country would bear from REDD but also into the causes and distributional implications of deforestation and, hence, the types of interventions needed to actually reduce deforestation and the potential need for mechanisms to avoid adverse social consequences.

The basic building blocks of the cost analysis are estimates of returns to forest and to alternative land uses, and of their respective carbon stocks. The difference between the returns to forest and those to the land use that would replace it indicates the opportunity cost of maintaining forests, while the differences in carbon stocks indicates the avoided emissions from doing so. In general, the forests of interest to a REDD programme have on-site benefits that are lower than the potential benefits of alternative land uses, that is, with a high risk of deforestation and/or degradation. This implies that almost always, the opportunity costs of REDD programmes for such sites will be positive.

In computing opportunity costs, there are two possible considerations: the actual and the potential opportunity costs. In terms of analytical procedures, there are two alternative approaches: the simple method for which the benefits generated by forests in an area are estimated and compared to the benefits generated by non-forest lands; and the more sophisticated approach which involves developing models of returns to different activities, based on parameters such as yields, input use, and prices. Other critical considerations in the estimation of opportunity costs would include spatial variation, time perspective and multiplier effect.

3.2 The status of REDD in Uganda

Uganda has been an innovator and early mover in forest carbon markets, with several pioneering and internationally recognised projects (ECOTRUST, FACE and World Bank supported afforestation and municipal waste management). The institutional framework to facilitate and coordinate REDD implementation in the country is yet to be established. NFA is currently coordinating the initial REDD activities such as developing the World Bank Forest Carbon Partnership Facility Readiness Project Information Note (R-Pin). Structures at the ministry and national level are yet to be worked out for administering REDD in forests outside NFA reserves.

The Katoomba Ecosystem Services Incubator (KESI) undertook a REDD Opportunities Scoping Exercise (ROSE) with the following aims: (a) identify a portfolio of promising REDD projects that can assist communities to access PES markets or funds; (b) provide input into government REDD "readiness" and priority-setting processes; and (c) generate recommendations in terms of the legal, policy and institutional actions or reforms necessary to stimulate forest carbon finance in Uganda (KESI, 2009). Following this exercise, six ecosystems were scored against various criteria (Table 2). It is important to note that although Tropical High Forests well stocked (under NFA, UWA and private ownership) scored highly, they were not included among the higher potential project types because of their low additionality potential. These forests are often highly protected with no co-management arrangements. However, KESI (2009) mentioned that while overall deforestation rates in this forest type at the national level are relatively low as compared to other biomes, deforestation threats and dynamics will clearly vary from site to site. Hence, given the high carbon stocks, individual sites may be important candidates for REDD project development.

It was further highlighted that successful implementation of REDD requires clear identification and nurturing of viable projects, as well as appropriate policy, legal and institutional frameworks. Implementation of REDD could be undermined by the lack of a favourable policy

and legal regime, one that provides clarity over forest tenure and carbon rights, the absence of a conducive institutional set-up for decision-making and information flows, the want of clear and transparent benefit-sharing mechanisms, including a financial management system that allows funds to flow to the beneficiaries. Consequently, the identification of such gaps is essential for developing a conducive environment for successful implementation of REDD projects.

It is further important to note that REDD, if well implemented, may provide economic incentives for forest conservation and good forest management and therefore has the potential to support and deepen participatory forest management approaches that have been adopted by the country in recent years.

Table 3. Summary of priority project types for REDD/PES in Uganda

Forest/ project type	Institution/ tenure	Management framework	Main DDs	Opportunity costs	Threat level/ additionality	Possible REDD sites/region
1. THF-low stocked	UWA	CRM/CWAs	Unregulated pit-sawing, livestock grazing	Low	Moderate	CRM sites around NPs of Mt Elgon, Semliki & Queen Elizabeth; Kitengule & Nyakalongo local communities around Murchison Falls NP
2. THF-low stocked	NFA	CFM and licensing	Agriculture, legal & unregulated harvesting	Low	High	L. Shore region: South Busoga, Sango Bay & Mabira CFRs; Albertine Rift: Budongo & Kasyoha-Kitomi CFRs
3. THF-low stocked	Private	Private	Agriculture, firewood and poles	Moderate	High	Northern, Central & Western regions
4. Woodland	NFA	CFM and licensing	Charcoal, Agriculture & Plantation forests establishment	Moderate	High	The CFM process has been initiated, but not implemented yet in Wooded Savannah Forest
5. Woodland	Private	Private	Charcoal, overgrazing, agriculture			Mostly in northern & eastern Uganda. Also western regions of Kibale, Hoima, Kyenjojo districts
6. Woodland	UWA	CRM/CWAs	Charcoal, overgrazing, agriculture			CRM around L. Mburo NP; CRM & CWA around Karuma WR; Toro-Semiliki WR & Kabwoya WR

Mabira as a potential pilot site for REDD

The Katoomba ecosystem services incubator has proposed a pilot study in Albertine Rift, focusing on the private forests (category 3 in Table 3). For comparison and supplementary purposes at the National level, Mabira CFR has been selected as the focus for this pilot study. The site is classified as THF-low stocked managed by NFA (Table 3). Table 4 presents the scoring of this ecosystem (THF-low stocked) managed by NFA against selected criteria.

Table 4. Scoring of THF – Low Stocked against selected criteria for ranking viable REDD project sites in Uganda

Criteria	Scoring
Clarity of land tenure	Clear
Contribution to Uganda's carbon emissions reduction profile	High
Likely level of government interest	High
Potential for bundling or combining carbon with other ecosystem services	High
Probable leakage risk for deforestation actors and drivers	High
Replicability (i.e. potential for scaling up to other similar areas)	High
Size of forest blocks and/or aggregation potential	Large
Biomass or carbon levels of the ecosystem	Medium
Level of community benefits (as a proxy for poverty reduction)	Medium
Opportunity cost associated with alternative (to REDD) land use	Medium
Poverty status in area where forest is located	Medium
The deforestation threat level (often associated with population density)	Medium
Likely local institutional or governance capacity	Medium clarity

Source: (UNEP/GRID-Arendal, 2008)[2]

4.1 Physical description of Mabira CFR

Mabira CFR is located on the Kampala-Jinja highway at about 54km from Kampala and 26km from Jinja, 20km north of the Lake Victoria shoreline and immediately to the east of the Victoria Nile (Howard, 1991). Mabira CFR spreads into parts of Nakifuma, Buikwe, and Mukono Counties in Mukono District, and Ntenjeru County in Kayunga District in Central Uganda (MWLE, 2002).

The reserve covers a total area of 306km^2, demarcated with numbered concrete posts at the corners, as well as directional trenches and cairns. It occupies gently undulating terrain with numerous flat-topped hills and wide shallow valleys. The topography is such that the land drains to the north, even though the reserve's southern boundary lies only 13km from the lake shore. The forest lies at an altitudinal range of 1070-1340m above sea level, with approximately 3.5km^2 comprising isolated hills lying above 1,250m and 303km^2 occupying land at altitudes of 1,000-1,250m (Howard, 1991).

2. UNEP/GRID-Arendal, 'Forest vs. Agriculture – the case of the Mabira forest reserve, Uganda', *UNEP/GRID-Arendal Maps and Graphics Library*, 2008, < http://maps.grida.no/go/graphic/forest-vs-agriculture-the-case-of-the-mabira-forest-reserve-uganda > [Accessed 17 March 2010]

Mabira is not a continuous forest cover but rather characterised by a mosaic of human settlements (approximately 27 enclaves), which are completely enclosed or partly surrounded by the Forest Reserve. Some of the enclaves were earlier cleared for plantation agricultural crops such as tea, rubber and coffee, while other areas were mainly for settlement. These enclaves are known to have existed before its gazettement as a CFR and are therefore legally private land. Those who are not familiar with the nature of the Forest Reserve can easily misinterpret the enclaves as encroachments. In addition Mabira is surrounded by sugar plantations belonging to Mehta group of companies and several out-growers.

4.2 The legal status

According to Howard (1991), Mabira forest reserve was established in 1900 under the Buganda Agreement. It was then first gazetted as a CFR with an area of 29,592 ha under the Legal Notice No. 87 of 1932. The reserve was finally gazetted with the present area of 29,964 hectares contained in Statutory Instrument 1998 No. 63 under Legal Notice No. 78 of 1962. Closely associated with Mabira in one forest management plan are three other CFRs, namely Nandagi, Namananga and Namawanyi. The last two are commonly referred to as Island forests, first gazetted under statutory instrument No. 176 of 1968, while Nandagi was gazetted under Legal Notice No. 41 of 1948.

4.3 Flora and fauna

Mabira is considered to be a secondary forest, in which the distinctive vegetation types represent sub-climax communities, heavily influenced by man over prolonged periods of time (Sangster, 1950). About 95 per cent of the forest area is occupied by *Celtis-Chrysophyllum* medium altitude deciduous forest and five per cent by *Piptadeniastrum-Albizia-Celtis* medium altitude moist evergreen forest. About 212 tree species have been recorded so far including one (*Diphasia angolensis*) not known from elsewhere in Uganda. Five tree species from this reserve are listed as endangered (FAO, 1986): *Milicia excelsa, Cordia millenii, Irvingia gabonensis, Entandrophragma angolense* and *Lovoa swynnertonii*. Wild coffee (*Coffea canephora*), grows in this forest as well.

The fauna for this reserve is reasonably known and includes 151 species of forest bird (46 per cent of the country's total), 2 species of diurnal forest primates (17 per cent of the country's total), and 39 species of forest swallowtail and *Charaxes* butterfly (57 per cent of the country's total). The Tit Hylia is known only from Mabira in the East African part of its range. The present status of the larger mammals is not known but buffalo (*Syncerus caffer*) were reported along the Musamya River in 1983; leopard (*Panthera pardus*) are regularly seen; but elephants (*Loxodonta africana*) were last recorded in the mid 1950s. In addition to the above threatened or near threatened species are the blue swallow (*Hirundo atrocaerulea*) and Nahans francolin, which has been highlighted in the IUCN Red list category (IUCN, 2007).

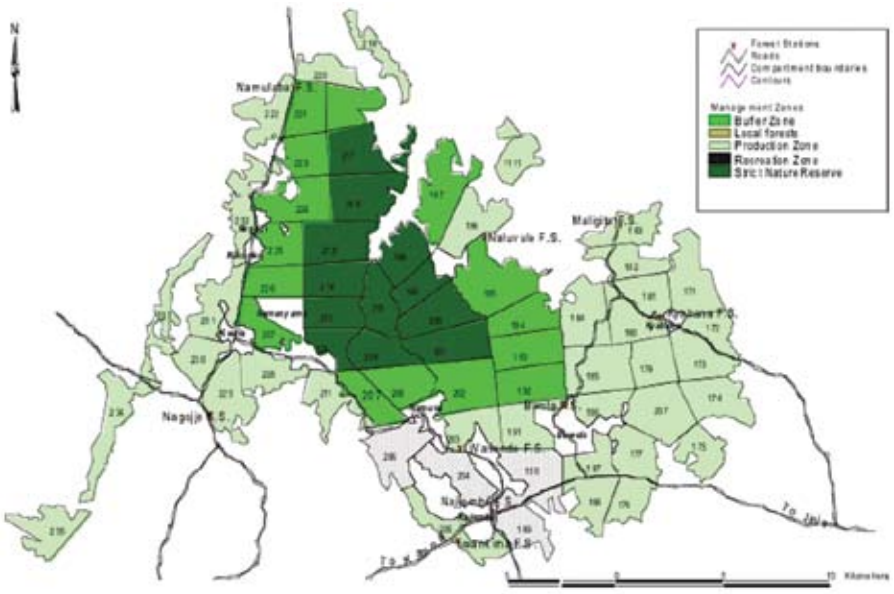
Given the diversity of fauna and flora, Mabira has been categorised as a protected area of core conservation value and one of the critical biodiversity forests in Uganda (IMTC, 2006; MWLE, 2005).

4.4 Past utilisation and current management patterns

Mabira has been mechanically harvested since 1906 but the management has often been poor. The forest was one of the main sources of charcoal to the nearby towns of Jinja and Kampala and produced an estimated 1,500 tons (60,000 bags) per year in the 1960s (Earl, 1971). In the 1980s, the forest was heavily encroached by settlers and subsistence farmers, encouraged by politicians.

According to the management plan of 1994/95, the forest is subdivided into 65 compartments numbered from 171 to 235, and four management zones: buffer zone; recreation zone; production zone; and strict nature reserve (Fig 3). For a better description of the forest attributes, the forest will be categorised into the eastern and western blocks.

Figure 3. The Management zones for Mabira CFR[3]



4.4.1 The Eastern block

During the 1970s, the Idi Amin government declared a double crop production campaign in which people cut down prime natural forest for cultivation of food crops. By the mid 1980s, this part of the forest was heavily encroached by local people who were coming from various areas to clear land for agriculture and settlement, hence leading to severe degradation. In 1988, the Forest Department enumerated a total of 3,506 families who lived or cultivated in the reserve. As a result, over 25 per cent of the reserve was heavily degraded or cleared. However, the government seriously addressed the encroachment problem and the encroachers were evicted in 1988-89.

The diagnostic sampling by NFA revealed that this block was characterised by an invasive colonising species known as paper mulberry (*Broussonetia papyrifera*). The mulberry provided a conducive microclimate that facilitated re-colonisation of the natural species. Today the indigenous forest species were reported to rapidly replace the mulberry trees evidenced by the reducing number of juvenile mulberry trees. "This has demonstrated the amazing ability of natural forest ecosystems in Uganda to recover even after heavy degradation. Within 16 years,

3. UNEP/GRID-Arendal, 'Forest vs. Agriculture – the case of the Mabira forest reserve, Uganda', *UNEP/GRID-Arendal Maps and Graphics Library*, 2008, < http://maps.grida.no/go/graphic/forest-vs-agriculture-the-case-of-the-mabira-forest-reserve-uganda > [Accessed 17 March 2010]

46 tropical moist forest species had come back to this formerly encroached area" (Uganda, 2006 pg.3). An inventory conducted in 2003 revealed an existence of about 38 indigenous species with average basal area of 18.7m^2 per ha. A recent inventory (2003) of the formerly encroached areas in the Compartment (Cpt) 185 (694 ha) revealed the existence of about 47 indigenous species with a total volume of about 124.6 m^3 per ha distributed across various diameter classes. This is evidenced in the landsat images which indicate a change from low stocked to high stocked tropical forest (Figures 4 and 5).

Restoration activities in the Eastern block

This has been an effect of both natural regeneration and restoration activities such as enrichment planting. In addition to the efforts by NFA, several national and international initiatives have targeted this block, such as a restoration programme by the FOREAIM project funded by EU, and vegetation monitoring by the SUNREM project. Both projects are implemented by the Faculty of Forestry and Nature Conservation, Makerere University.

4.4.2 The Western block

The western block is generally characterised by a well stocked forest cover (figures 4 and 5). However, some Cpts (for example, 234-235) in which the vegetation cover was not satisfactory, private tree farmers were licensed, and NFA carried out enrichment planting. In other Cpts (such as 229) CFM has been piloted. A forest inventory conducted in 2003 revealed that Mabira has an annual exploitable timber yield of 30,305m^3 based on trees of diameter 50cm and above and a 60 year felling cycle (Table 5). Given this stocking level, Nile Ply Ltd acquired a harvesting concession (in Cpt. 222) licensed under SFM (License No. 106) for the period 25th July 2006 – 24th July 2007. In addition, NFA licensed the Alarm Group together with the Mauroo chain to establish a 5-star eco-lodge. This is an important facility for the eco-tourism activities in this area and an income generating source for NFA.

Table 5. Mabira Forest exploitable timber yield trees above 50Cm Dbh

Utilisation Class	m^3/ha	m^3/yr	m^3/ha/yr
Class 1	12.5	6,312	0.208
Class 2	28.7	14,495	0.479
Class 3	18.8	9,794	0.313
Total	**60**	**30,601**	

4.4.3 Collaborative forest management initiatives

The main goal for this initiative is to collaboratively manage the compartments in a sustainable manner to stop illegal activity, improve on the livelihoods of the surrounding communities and earn revenue for the government. The agreements are made in pursuant to section 15 of the NFTP Act, 2003. Under this initiative, Compartments 176 and 229 have been demarcated for Collaborative Forest Management (CFM) with Buvunya-Koko and Nagojje communities. The agreements were signed on 20th April 2006 with the communities for Sustainable Forest Management (SFM) using the 4Rs principle (Rules/Regulations, Responsibilities, Rights, Returns). This was considering the following products: firewood, timber, charcoal, handcraft materials, minerals (stones and sand), poles, herbs, tree seeds and honey. In Cpt. 171, CFM has been piloted with Nakalanga community.

The CFM plan is a fulfillment of a number of policy and legal requirements: The National Forestry policy commits government to promote innovative approaches to community participation in Forest Management (FM). The NFTP Act provides the legal framework for the forest policy on CFM. The Act defines CFM as a mutually beneficial arrangement in which a local community or user group and the responsible body share roles, responsibilities and benefits in a Forest Reserve (FR) or part of it. The Poverty Eradication Action Plan (PEAP) and the Plan for the Modernisation of Agriculture (PMA) also identify forestry as a one of the main sectors that will improve the livelihoods of the poor. The vision in 20 years time for the CFM initiatives is: a forest back to its original status and collaboratively managed by the local community in a sustainable manner to improve on their livelihood, earn revenue for the government and enhance its environmental benefits for the people of Uganda and international communities.

Further, Four ways Universal Group, specialising in cultivating spices (such as cardamom) for the international market, acquired a permit 1986 for a period of 40 years to operate in Cpt. 175.

4.5 Deforestation and degradation threats

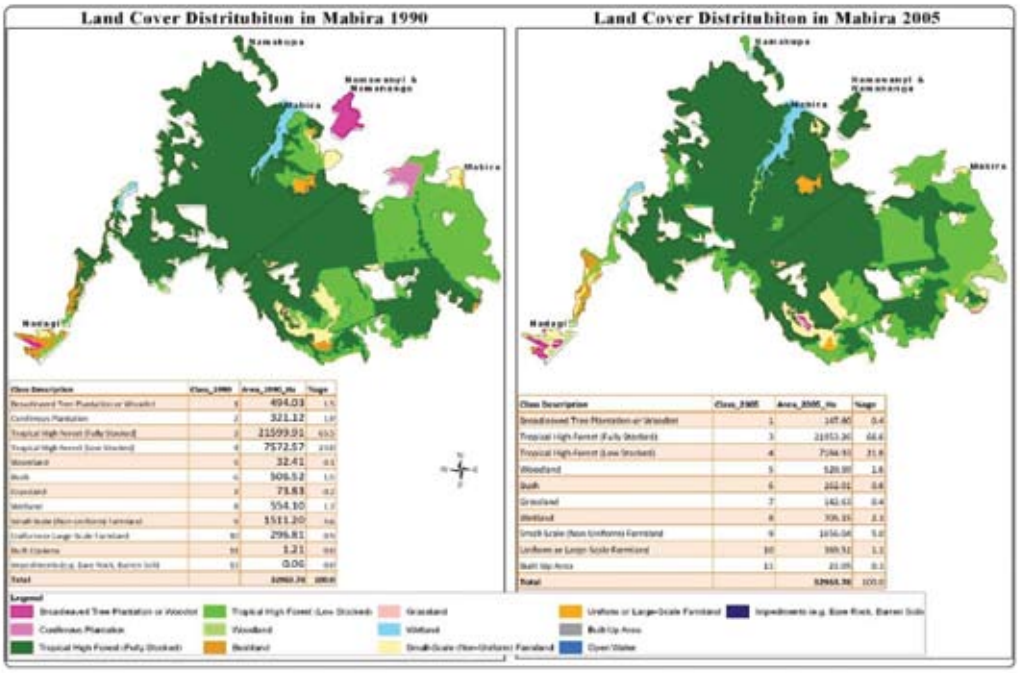
In the desire to expand the sugar production by this company, the Sugar Corporation of Uganda Limited (SCOUL) had earlier requested for 7,100 ha of Mabira CFR, which is about a quarter of the total area. The company had expressed interest in the Eastern block (Cpts. 172, 173, 174, 175, 180, 184, 185, 192, 202, 203, 236, 237) covering a total area of 4552 ha or the western block (Cpts. 228, 229, 230, 235, 222, 234) covering a total area of 2850 ha.

Further, given the location of Mabira (about 54km from the capital city Kampala and 26km from Jinja, a major city as well), the forest is highly vulnerable to potential effects of urbanisation such as increased extraction of forest products such as timber, charcoal and building poles as well as clearing for agricultural production. In addition, the reserve has 27 official village enclaves and is surrounded by sugar plantations, tea estates and public lands making it more susceptible to degradation.

The changes in land cover distribution and the subsequent changes in biomass were assessed for the periods 1990 and 2005. Figure 4 compares the land cover in Mabira CFR for the years 1990 and 2005, while Figure 5 presents the average biomass distribution of Mabira for the same period. Significant changes can be seen mainly in the Eastern block and the "arm" in the far east. The two pairs also bring out the direct linkage between land cover types and biomass distribution, which further highlights the importance of land cover mapping in the attempt to measure biomass from which the amount of carbon is derived.

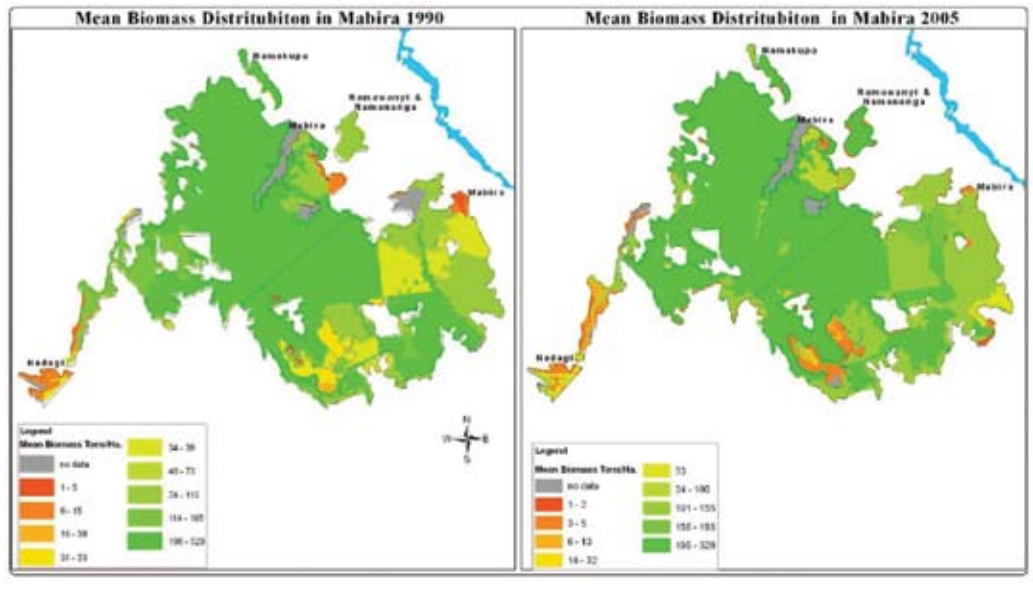
We further observe a positive change mainly in the eastern block as a result of evictions and increased protection of the reserve from illegal harvesting. It is important to note however that this positive trend may only be temporary since the government continues to solicit for the conversion of about a quarter of the total area into sugarcane plantation. One of the major concerns by politicians has been the economic justification for the existence of Mabira CFR in respect of the anticipated returns to the economy from SCOUL. Therefore, the implementation of REDD initiatives in Mabira will further enhance its economic importance.

Figure 4. Land Cover Distribution in Mabira 1990 – 2005



Source: NFA (2010)

Figure 5. Mean Biomass Distribution in Mabira 1990 – 2005



Source: NFA (2010)

4.6 The opportunity costs of REDD in Mabira CFR

In computing the opportunity costs for Mabira CFR, both the actual and potential alternative land uses should ideally have been considered, given the current land conversions for agricultural production and the threat of conversion to sugarcane growing by SCOUL. However, the opportunity costs were estimated based primarily on the current land uses, due to data limitations on the potential land uses. Information on the costs and benefits of alternative land use activities was obtained through field visits. Discussions were held with individuals involved in agricultural activities in two villages (enclaves) in Mabira CFR.

4.6.1 Sustainable forest management

Sustainable Forest Management (SFM) refers to forest utilisation by both present and future generations. Mabira is designated as a CFR and subdivided into four zones: a strict nature reserve, buffer zone, recreation zone and production zone. The recreation zone is mainly for the eco-tourism purposes while the production zone is for harvesting of wood and non-wood forest products.

Despite the zoning, the reality is that the government is unable to enforce the zoning system and the current local forest managers and community institutions (CFM groups, Communal Land Associations, and so on) still lack capacity in natural resource management, monitoring and evaluation, governance and accountability aspects. Their ability to manage the forests for REDD projects and channel benefits to their members in a transparent and equitable manner is still limited. Also, the current CFM agreements do not include provisions for REDD. This highlights the need for capacity building for local institutions if REDD+ is to be successful.

With REDD payments, CFM 'ring-fences' around forest reserves would also reduce unregulated activities in the more restricted zones of the forest and improve livelihoods of forest-adjacent communities.

From the production zone, a couple of products are obtained. Harvesting of timber is through concessions with an annual allowable harvest of about 2,000m^3 (UGx. 90,000 per m^3). The main concessionaire in the past has been Nile ply. Other income sources include the NFA ecotourism centre and License fees from Mabira Eco-Lodge. The total annual revenue generated amounted to US$160,000. (Pers. Comm. 2009[4]). The major operational costs include forest protection, restoration of degraded areas, partnership arrangements, stock monitoring, biodiversity zoning/maintenance, transport/fuels, and salaries and allowances yielding a total annual budget of US$85,000. It is important to note that surrounding communities have use rights for non-timber forest products including fuelwood, wild foods, fodder, poles and wild medicine. Vedeld *et al.*, (2004) estimated a mean forest environmental income of US$219 per household per year from medium forest types in East Africa, and this figure has been adopted in these estimations. Considering the 27 enclaves, the total mean forest environmental income is estimated at US$473,000.

Previous reports[5] estimated benefits from timber and other ecosystem services of 1.1 million USD per year from maintaining and managing Mabira as a forest reserve. This equates to US$72 – US$205 per ha, per year depending on whether the calculation refers to the whole forest area in the reserve or just the part earlier proposed for conversion to sugarcane growing.

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4. This information was obtained from the Mabira Sector Manager who is also a member of the project team
5. UNEP/GRID-Arendal, 'Forest vs. Agriculture – the case of the Mabira forest reserve, Uganda', *UNEP/GRID-Arendal Maps and Graphics Library*, 2008, <http://maps.grida.no/go/graphic/forest-vs-agriculture-the-case-of-the-mabira-forest-reserve-uganda> [Accessed 17 March 2010]

4.6.2 Agricultural production

Agricultural production in a formerly forested area includes initial land clearing and utilisation of the wood. The costs and benefits associated with establishment of new cropland have been adopted from an earlier study by Namaalwa (2000) and adjusted for inflation. The basic assumptions included:

1. A normally stocked forest has a mean of 174 tonnes per ha (205m^3/ha) and a depleted forest has a mean of 152 tonnes per ha (179 m^3/ha). This assumes 22 tonnes per ha (26m^3) represent the commercial timber harvested.
2. All the trees with non commercial timber value are converted into fuelwood and sold in the nearby urban market.

The net return is Ugx. 936,500 per ha which indicates a vibrant one-time payment from land clearing.

Uganda is characterised by two rainy seasons; the short rains (October to November), and the long rains (March-May). Quite often the farmers grow intercrops in the long rains such as potatoes and beans, and maize and beans. They then grow monocrops such as beans or potatoes in the short rains, provided that the crop was not cultivated in the previous season. Other major crops grown in the area included *Catha edulis*, sugarcane and coffee (as major cash crops) with an average maturity period of three to four years. The major costs considered include fixed production costs incurred on agricultural equipment used per ha, such as hoes, axes, pangas; agricultural inputs, such as seedlings, fertilizers, herbicides and pesticides; and labour – family and/or hired. The prices were mainly farm gate prices, with the exception of maize. The input-output analysis for the major crops indicated net annual returns per hectare of US$154 for the annual crops, US$191 for sugarcane outgrowers after every two years, and US$ 361 for catha[6] after the maturity period of three years. These estimates were based on average annual yields for the annual crops and after every two years for sugarcane. In the case of coffee and catha the average maturity period is three years and there is continuous harvesting after maturity, which can continue for the next six to fifteen years depending on the management practices.

Important to note, however, is that the above yield values are obtainable from a newly cleared forest land with high productivity levels. Under normal circumstances, the average yields reduce over time, unless strict soil and water conservation measures are supplemented with fertilizer use. Given that tropical soils are known to be fragile, weakly buffered and have low exchange capacity, they cannot sustain high crop yields under intensive cropping. Therefore, in order to forecast continuous crop production, a reduction model adopted by Namaalwa *et al.*, (2001) was applied on the annuals. Further, returns from conversion of part of Mabira to sugarcane growing by SCOUL were estimated at US$672 per ha.

"The Mabira forest reserve, on the shores of Lake Victoria hosts valuable wildlife, serves as a timber resource, provides ecosystem services for the water balance and the rainforests represents a tourist destination. Following a proposed plan for clearing a third of the reserve for agricultural use, the values of the forest were calculated by local researchers. This economic evaluation of the forest shows that from a short-term perspective, growing sugarcane would lead to more economic benefits than maintaining the forest reserve, with a return of 3.6 million USD/year in contrast to 1.1 million USD/year for conservation. However, sugarcane production is only optimal during a short time span - five years. When comparing both land use alternatives over the lifetime of the timber stock – 60 years, the benefits from the forest, and the ecosystem services it provides, exceed those of the sugarcane planting"

UNEP/GRID-Arendal, 'Forest vs. Agriculture – the case of the Mabira forest reserve, Uganda', *UNEP/GRID-Arendal Maps and Graphics Library*, 2008, < http://maps.grida.no/go/graphic/forest-vs-agriculture-the-case-of-the-mabira-forest-reserve-uganda > [Accessed 17 March 2010]

6. Despite the fact that *Catha edulis* is a highly profitable crop, it is considered a controversial or "illegal" crop in the country.

4.6.3 The opportunity costs

The difference between the benefits from the sustainable management of Mabira CFR and those that would have been provided by the agricultural activities is the opportunity cost of avoiding deforestation and/or degradation in Mabira (Table 6). The discounted values for the alternative activities were obtained for a period of 20 years at a real discount rate of 6.2 per cent, given a nominal rate of interest of 10 per cent and an average inflation rate of 3.8 per cent per annum.

Table 6. The opportunity costs of Mabira CFR

Activity	Discounted net benefit (USD $/ha)	Opportunity cost (USD $/ha)	Biomass density (tons/ha)	Carbon density (tons/ha)
Sustainable Forest Management	811		128	64
Agricultural production				
Land conversion from forest to cropland	404			
Returns from crops				
Annual crops	1,060	653		5
Perennial crops				2.6
Sugarcane by outgrowers	975	568		
Catha edulis	1,045	638		
Sugarcane by Metha Group	3,809	3,402		

In general, considering the short-medium term perspective, the on-site net benefits from forest management are lower than the potential net benefits of alternative land uses - one-time land clearing and agricultural production.

Although the long-term perspective may give a relatively different picture, it is important to note that people are profit maximisers and often interested in the short-term perspective. This implies that Mabira CFR has a high risk of deforestation and/or degradation especially with the increasing population pressure and demand for agricultural land and forest products. Further to consider is the pending request by Metha to have part of the forest for sugarcane growing.

"However, such a calculation by SCOUL is based only on a short-term gain as the economic life of a sugarcane stand is at the most five years. The economic life of the natural tropical forest stand can stretch over a 60-year period. When the present value of the standing crop of timber alone (excluding other uses) was compared to the present value of net benefits from sugarcane growing, conservation of the forest yielded a greater long-term benefit than sugarcane of USD 35.5million compared with USD 29.9 million from sugarcane growing. When the value of ecological services was added to that of the standing crop of timber, conserving the forest reserve as it exists registered a far higher net present value of USD 48.8 million."

UNEP/GRID-Arendal, 'Forest vs. Agriculture – the case of the Mabira forest reserve, Uganda', *UNEP/GRID-Arendal Maps and Graphics Library*, 2008, < http://maps.grida.no/go/graphic/forest-vs-agriculture-the-case-of-the-mabira-forest-reserve-uganda > [Accessed 17 March 2010]

4.6.4 The carbon stock equivalents

To convert the opportunity cost of reduced deforestation per hectare into a cost per tonne of carbon, information was obtained on the difference in carbon density between the forest and the alternative land use (Table 6). The average biomass density for Mabira was estimated at 128 tonnes per ha which is equivalent to carbon stock of 64 tonnes per ha[7]. Using the IPCC (2006) default carbon stock in biomass for crops after one year, the carbon stocks were estimated at 5 tonnes per ha yr^{-1} and 2.6 tonnes per ha yr^{-1} for annual and perennial crops respectively. This implies a difference in carbon stocks of about 60 tonnes per ha yr^{-1} indicating the avoided emissions of maintaining the forest.

For annual crops the opportunity cost per tonne of carbon would be around US$11 per ha and US$3 per tonne of CO_2. This is quite low compared to the carbon price in EU ETS in 2009, which was US$18.70 or the average price in the primary CDM of US$12.70[8]. The opportunity cost per tonne of CO_2 for large scale sugar cane by Mehta group works out about US$15 per tonne of CO_2 and so is less competitive. This assumes though that sugar cane can continue to give a good yield over a period of 20 years. If this is not the case as suggested in the study referred to in the box on the previous page, the opportunity cost would be lower.

7. The carbon stocks (ACG) were estimated using a conversion coefficient of 0.5 reported by the IPCC (2006)
8. http://siteresources.worldbank.org/INTCARBONFINANCE/Resources/State_and_Trends_of_the_Carbon_Market_2010_low_res.pdf

Conclusion

This country report aimed at providing a status review and feasibility assessment for REDD initiatives in the country through a review of available information, consultations and field visits. Although REDD processes in the country are not as far advanced as compared to the partner countries under this project (Brazil, Tanzania, Vietnam and Ghana), it is expected that REDD will provide a unique opportunity for Uganda to sustainably conserve forest biodiversity and generate real benefits for the country and its population.

The review of existing documents revealed significant levels of deforestation and degradation (1990-2005). In relation to REDD initiatives, there were several potential sites highlighted. Mabira CFR in particular was highlighted as one of the high risk sites for deforestation and degradation, with high levels of additionality and low opportunity costs. The site was therefore selected for further consideration as a viable site for REDD initiatives. Field investigations revealed that the major deforestation and degradation drivers included clearing for agriculture (mainly due to the existence of 27 enclaves), timber harvesting and charcoal burning. An assessment of the land use and land cover, and biomass changes between the period 1990 and 2005 indicated a positive trend following eviction of encroachers and restoration and intensified management activities.

Further, a quick estimate of the opportunity costs indicated positive values considering several alternative land uses, which implied that the on-site benefits are lower than the potential benefits of alternative land uses, indicating a high risk of deforestation and/or degradation. In addition, the differences in carbon stocks of sustainable forest management versus agricultural production indicated a high level of emissions that could be avoided. Hence, a focal area or hot spot for a REDD initiative.

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