THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

REVISED FOREST MANAGEMENT PLAN

FOR

MABIRA CENTRAL FOREST RESERVES

(MABIRA, NANDAGI, NAMUKUPA, NAMAWANYI, NAMANANGA & KALAGALA FALLS CENTRAL FOREST RESERVES)

FOR THE PERIOD JULY 2010– JUNE 2020

(REVISED 2017)

NFA
National Forestry Authority

FOREWORD

Whereas article 237 of the constitution of Uganda commits government to hold in trust for the people and protect forest reserves for ecological and touristic purposes for the common good of all citizens, section 28 of the National Forestry and Tree Planting Act, 2003 further provides that Central Forest Reserves must be managed in accordance with approved Forest Management Plans.

This Forest Management Plan also takes into account international instruments and arrangements arising out of the international forestry policy dialogue since the Rio Summit in 1992 including the United Nations Sustainable Development Goals (SDGs), which aim at transforming the lives of people globally by 2030. It is also in line with the national macro-economic policies like the Uganda Vision 2040, the National Development Plan II, Operation Wealth Creation and the Forestry Investment Plan.

The preparation of this Plan has been made possible with input from various stakeholders at local, sub-county, district and national levels including forest adjacent communities. The implementation of this Plan will be in line with the national development theme of "Strengthening Uganda's Competitiveness for Sustainable Wealth Creation, Employment and Inclusive Growth". This will accrue from improved forest health that ultimately results into improved livelihoods, increased revenue for Government and environmental stability.

The Plan particularly provides opportunities for local communities, civil society organizations, the private sector and other investors to participate and benefit from management of the Central Forest Reserves in the Mabira Management Plan Area.

Therefore, in accordance with Section 28 of the National Forestry and Tree Planting Act, 2003,
I approve this Forest Management Plan.

Hon. Cheptoris Sam
Minister of Water and Environment

ACKNOWLEDGEMENTS

This Forest Management Plan was updated through a participatory process involving a wide range of relevant stakeholders. To them all, we extend many thanks.

In particular we would like to appreciate the contribution of the Local Governments of Mukono, Buikwe and Kayunga Districts. We thank the District Leaders of these districts. We also thank the sub county local governments of Nama, Ntunda, Kimenyedde, Nagojje Najjembe, Kawolo, Njeru, Wakisi and Kangulumira for the input and guidance during the stakeholders' consultation.

Our gratitude also goes to the various partners, including though not limited to Government officials, Non- Governmental Organizations (NGOs), Community Based Organizations (CBOs), industrialists, private investors and more specifically local communities living close to the forests.

In a special way we would like to acknowledge the support given by the team at the Ministry of Water and Environment without which the preparation of this plan wouldn't have been possible.

To the team at the NFA headquarters, we thank you for the provision of the relevant data and information that enabled the updating of this FMP. We specifically acknowledge the following:
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The Supervisor, GIS and Mapping
The Supervisor, Forest Inventory,
The Range manager, Lake shore Range
The Supervisor, Mabira Central Forest Reserve

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The Undersecretary, Ministry of Water and Environment
The Director, Directorate of Environmental Affairs
The Contract Manager, Ministry of Water and Environment

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Michael Mugisa
Executive Director,
National Forestry Authority

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GLOSSARY

Term	Meaning
1. Authority	The National Forestry Authority established by section 52 of the National Forestry and Tree Planting Act, 2003
2. Biological diversity	The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. (IUCN, 1994).
3. Block	A section of a forest designated to represent a territorial division in a forest reserve.
4. Buffer Zone	A zone within a protected area, protecting particularly sensitive areas such as strict nature reserves from undue human pressure that may exist outside the protected area, usually by allowing some limited and controlled human use within the buffer (Grove, 1995).
5. Central Forest Reserve	An area declared to be a central forest reserve under section 6 of the National Forestry and Tree Planting Act, 2003.
6. Collaborative Forest Management	A mutually beneficial arrangement in which a forest user group and a responsible body share roles, responsibilities and benefits in a forest reserve or part of it or an agreement signed under the National Forest and Tree Planting Act, 2003 for the purpose of defining a legally binding agreement between the lead agency and a partner for the utilization and management of a forest/forest resource.
7. Compartment	A permanent geographically recognizable unit of forestland forming the basis of prescription and permanent record of all forest operations.
8. De facto rights	Rights, which are not necessarily given by law but the people, perceive them to be theirs by tradition. E.g. the "right" to collect firewood for domestic use
9. Deforestation	Change of land cover with depletion of tree crown cover to less than 10% (Hamilton, 1984).
10. De jure rights	Rights given to a people by the law e.g. forest produce in a private forest belongs to the owner
11. District Forest Service	Includes local Governments, service providers and farmers with responsibility for mobilizing and coordinating forestry extension services in the districts, and developing forestry activities on farms, around forest reserves and in private and customary forests, through support services and incentives for sustainable forest management (NFP, 2002).
12. Ecosystem	A community of all plants and animals and their physical environment, functioning together as an interdependent unit. (IUCN, 1994).
13. Endangered species	Any species that is in danger of extinction throughout all or a significant portion of its range (IUCN, 1994).
14. Enrichment planting	The practice of planting trees within a natural forest to supplement natural regeneration (IUCN, 1994).
15. Environmentally sensitive area	An area of land which is particularly susceptible to damage by forestry operations and where operations are prohibited or restricted: for example wetlands, watersheds, streamside buffer zones, conservation zones, recreation areas, areas near human settlements, sites of special ecological significance, habitats of rare or endangered species. (Grove, 1995).
16. Forest	An area of at least one hectare of land with a minimum tree canopy cover of 30% and a minimum tree potential height of 5 meters (derived from UNFCCC, 2001). It includes all alpine, tropical high and medium altitude forests, woodlands, wetland and riparian forests, plantations and trees, whether on land held in trust by government (gazetted Forest Reserves, National Parks and Wildlife Reserves) or non-gazetted land - mailo, leasehold, freehold or customary lands (Forestry Policy, 2001).

Term	Meaning
17. Forest degradation	The reduction of the capacity of a forest to provide goods and services. Capacity includes maintenance of ecosystem structure and functions (2nd Expert Meeting on Harmonizing Forest-Related Definitions Used by Various Stakeholders, 2002).
18. Forest ecosystem	Any natural or semi-natural formation of vegetation whose dominant element is trees, with closed or partially closed canopy, together with the biotic and abiotic environment (National forestry and Tree Planting Act, 2003).
19. Forest Encroachment	Activities that occupy a forest or part thereof without legal permission. It may include such activities as settlement, cultivation, grazing, etc.
20. Forest management	The practical application of scientific, economic, and social forestry principles to the administration of forests for specific forestry objectives (National Forestry and Tree Planting Act, 2003).
21. Forest Management Plan	A document that translates forest policies into a coordinated program for a forest management unit and for regulating production, environmental and social activities for a set period of time through use prescriptions, specific targets, actions and control arrangements ((Terminology of forest science. Technology practice and products. Society of American foresters, 1971).
22. Forest management unit (FMU)	An area of forest under a single or common system of forest management (Grove, 1995).
23. Forest Reserve (FR)	An area declared by law to be a central or local forest reserve (National Forestry and Tree Planting Act, 2003). For purposes of natural forests, forest reserves are placed in Category VI (Managed Resource Protected Area) of IUCN Categories for Nature Protection. This Category of protected area is managed mainly for the sustainable use of natural ecosystems.
24. Forest User Group	A group comprising members of a local community registered in accordance with CFM regulations.
25. Forestry	The management and conservation of forests and trees, and includes the management of land that does not have trees growing on it, but which forms part of an area reserved for or dedicated to forestry (National Forestry and Tree Planting Act, 2003). It includes all activities related to forests, tree growing, forest produce, forest conservation, forest management and forest utilization (Forestry Policy, 2001).
26. High conservation value forest	Parts of the forest with environmentally sensitive areas such as river banks, lakeshores, areas with species that are protected by law (local, national & international) area critical for the survival and identity of the local community
27. Inventory	A survey carried out to determine, in a given area, the constitution, extent and condition of a forest or areas reserved for forestry.
28. Local Community	Defined as "persons and households living in close proximity to a forest and identified by common history, common culture, or common residence and may, from time to time, include all the residents of a village which share a boundary with a forest.
29. Local Government or Local Councils	Means local government councils and administrative unit councils established under section 42 of Act No. 1(5) of the Local Government Act 1997.
30. Logging Waste	The off cuts, broken trees, branches, etc. that are generated during harvesting of trees for timber
31. Lop and top	All the wood that is left after a timber harvesting operation. It includes branches, rotten or damaged portions of the logs (off cuts) and slabs left after pitsawying.
32. Mean annual increment (MAI)	The total increment usually volume up to specified age divided by that age ((Terminology of forest science. Technology practice and products. Society of American foresters , 1971)
33. Management Plan Area	An area covered by FMP. It may be one forest reserve or a collection of reserves.

Term	Meaning
34. Natural forest	Forest areas where most of the principle characteristics and key elements of native ecosystems such as complexity, structure and diversity are present (Grove, 1995).
35. Non-timber forest product (NTFP)	All forest products except timber, including other materials obtained from trees such as resins and leaves, as well as any other plant and animal products (NFP, 2002).
36. Permanent Forest Estate (PFE)	Land that is set aside for forestry activities in perpetuity (Uganda Forestry Policy, 2001).
37. Prescription	A concisely written specification in a Forest Management Plan that translates an objective or part of one into an operational activity. (Terminology of forest science. Technology practice and products. Society of American foresters, 1971)
38. Production Forest	Forested areas, which are treated by using specific silvicultural practices. The stands are treated repeatedly and sometimes in order to achieve multi-purpose goals (European Forest Institute, 2002).
39. Production Zone	As for "production forest" but the area is part of the overall forest nature conservation Programme.
40. Protected Area	All land gazetted and held in trust by government, such as Forest Reserves, National Parks and Wildlife Reserves (Uganda Forestry Policy, 2001).
41. Savanna	Grassland dotted with trees. Grasses form the predominant vegetation type, usually mixed with herbs and shrubs, with trees scattered individually or in small clumps (TheFreeDictionary.com Encyclopedia).
42. Strict Nature Reserve	An area within a forest reserve set aside for species and habitat protection and in which only research, education and monitoring are permitted (National forestry and Tree Planting Act, 2003).
43. Sustainable forest management (SFM)	The management of forest resources so as to supply goods and services to satisfy the needs of present and future generations in perpetuity (Uganda Forestry Policy, 2001).
44. Sustained yield	Production of forest products on a perpetual basis, ensuring that the rate of removal of forest products does not exceed the rate of replacement over the long term. (IUCN, 1994).
45. Threatened species	Any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range (IUCN, 1994).
46. Tropical Moist Forests (TMF) - also known as tropical rain forests	Broadleaf forests found in a belt around the equator and are characterized by warm humid climates with high year-round rainfall. Uganda's TMFs belong to the Afro tropic Eco-zone with the flagship Albertine Rift forests that extend to Congo (DRC), Burundi, Rwanda, and Tanzania (TheFreeDictionary.com Encyclopedia). Normally forests are evergreen although some species may shed their leaves periodically.
47. Woodland	Land that has a crown cover (or equivalent stocking level) of more than 30% of trees not able to reach a height of 5m at maturity (FAO 2000a (FRA 2000 Main Report) but modified to read canopy cover of 30% instead of 10%).
48. Working circle	One or more parts of a working plan area not necessarily adjoining, having the same objectives, silvicultural system and prescriptions (Terminology of forest science. Technology practice and products. Society of American foresters, 1971)
49. Yield regulation	The determination of the yield and its expression in the management plan prescription including where, when, and how the yield should be extracted

ACRONYMS

AAC	Annual Allowable Cut
AOP	Annual Operational Plan
AWP	Annual Work Plan
BEL	Bujagali Energy Limited
BZ	Buffer Zone
^{0}C	Degree centigrade
CBO	Community Based Organisation
CDM	Clean Development Mechanism
CFM	Collaborative Forest Management
CFR	Central Forest Reserve
Cm	Centimeter
CPT	Compartment
CU.M(M^3)	Cubic meter
DBH	Diameter At Breast Height
DDP	District Development Plan
DEP	District Environmental Profile
DFO	District Forest Officer
DFS	District Forest Services
DLG	District Local Government
DSO	Departmental Standing Orders
EC	European Commission
ED	Executive Director
EI	Exploratory Inventory
EIA	Environment Impact Assessment
EPPF	Environmental Protection Police Force
EU	European Union
FSC	Forestry Stewardship Council
FD	Forest Department
FG	Forest Guard
FMP	Forest Management Plan
FOPENA	Forest Protection and Extension Network
FNCMP	Forest Nature Conservation Master Plan
FR	Forest Reserve
FRMCP	Forest Resources Management & Conservation Programme
FS	Forest Supervisor
GoU	Government Of Uganda
HQ	Headquarters
ITTO	International Tropical Timber Organization
ISSMI	Integrated Stock Survey and Management Inventory
Kg	Kilogram
LC	Local Council
LDU	Local Defense Unit

LFR	Local Forest Reserve
LN	Legal Notice
LRP	Locally Resident People
M	Meter
Mm	Millimeter
MPA	Management Plan Area
MoU	Memorandum of Understanding
MRV	Monitoring Reporting and Verification
MWE	Ministry of Water and Environment
NaFORRI	National Forestry & Resource Research Institute
NARO	National Agriculture Research Organization
NBS	National Biomass Study
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NFM & CP	Natural Forest Management & Conservation Programme
NGO	Non-Government Organization
NFTP	Non-Timber Forest Products
NPV	Net Present Value
PES	Payment for Ecosystem Services
PSP	Permanent Sample Plot
REDD	Reduction of Emissions from Deforestation and forest Degradation
RM	Range Manager
RP	Research Plot
SFM	Sustainable Forest Management
SI	Statutory Instrument
SM	Sector Manager
SNR	Strict Nature Reserve
SRS	Silvicultural Research Section
STEE	Short Term Establishment Experiment
TEV	Total Economic Valuation
THF	Tropical High Forest
TSI	Timber Stand Improvement
UGX	Uganda Shillings
UPDF	Uganda People's Defense Forces
USAID	United States Aid For International Development
USD	United States Dollars
UWA	Uganda Wildlife Authority
VSO	Volunteer Service Organization
WICO	Wood Industries Corporation

EXECUTIVE SUMMARY

Mabira Management Plan Area is made up of six (6) forests namely Mabira, Namakupa, Nandagi, Kalagala Falls, Namawanyi and Namananga. Namukupa, Nandagi and part of Mabira are situated in Mukono District while Namawanyi and Namananga Kalagala falls are located in Kayunga District. The biggest part of Mabira is situated in Buikwe district. These central forest reserves (CFRs) have a total area of 31,293ha and this Forest Management Plan (FMP) is for the entire MPA.

Content of the Plan

This FMP consists of two parts. Part 1 comprises of the general description of the MPA and is divided into six chapters (1-6). Part 2 is made up of six chapters (7-12) outlining the planned future management of the CFRs in the MPA. There is a plan for Monitorring the Ecosystem health and forest community interactions prepared separately from this plan.

Part 1 - General Description

Chapter 1 Gives the physical description of the MPA, that is:-

- Name, area, location and forest reserve boundaries,
- Local conditions, topography/altitude, drainage, geology/soils
- Climatic conditions – temperature, relative humidity and rainfall
- Vegetation of existing crop.

Chapter 2 Deals with socio-economic environment, giving an estimated total economic value (TEV) of the CFRs in the MPA as UGX 18,606,348,073,334 (USD 4,774,132,615). It lays out the markets for the forest resources, demand, availability projections and yield control. It identifies the stakeholders and defines their rights, responsibilities and benefits. It outlines threats to the forests by people and to people from the forests, conflicts and how to manage them, community relations and forest use. This chapter also includes the infrastructure (roads and buildings), staff, labour and housing.

Chapter 3 Environmental considerations:
Environmental consideration indicates the biodiversity status of the MPA in terms of fauna and flora richness. It covers tourism potential, the ecological functions – water shed rivers and streams, carbon sequestration, the soil and water function of the forests, and the social-cultural sites.

Chapter 4 History of management:
Outlines the past management plans giving the dates, objective of reservation and management from the first FMP of 1948-1957 to the last plan of 1997-2007. Silvicultural activities, harvesting, yield control, revenue and expenditure are also outlined.

Part 2 Planned Management

Planned management in Part 2 indicates proposed activities under specific operational areas (working circles) that are to be carried out concurrently during the 10-year implementation of the FMP.

Chapter 5 Sets out the basis of the plan and management objectives that will be adhered to during this period. The vision, mission and definite management objectives are clearly stated. The Forest Management Plan will remain valid for ten (10) years from 1st July 2009 to 30th June 2019 and will be reviewed after five (5) years (2014).

Chapter 6 Outlines the working circles that will be implemented during the course of management. These are:-

6.1 Production working circle will embrace all activities relating to technical operations in looking after the natural forest, to improve stocking and yield timber and non-timber forest products and their harvesting. Forest areas that are degraded or unsuitable for natural forest management will be converted to plantations.

6.2 Partnership and community working circle will encourage and promote participation of adjacent communities in forest management, through arrangements under collaborative forest management (CFM). These will particularly aim at improving the livelihoods of those communities as key stakeholders.

6.3 Conservation working circle will be implemented for protection and biodiversity conservation. Overtime, harvesting of various forest products was higher than the rate of replacement and some species were over harvested becoming rare or endangered. In this working circle efforts will be made to ascertain what is existing (through biodiversity inventory) and managing the resource as a whole.

6.4 Tourism working circle will entail NFA managed eco-tourism at Najjembe and the private sector run business operating under license. Non-consumptive forest management is becoming more important worldwide, this aspect will form an integral part of Mabira MPA management particularly taking into consideration the location of Mabira CFR and the adjoining Kalagala Falls CFR near River Nile.

6.5 Research and education working circle is intended to assist forest managers understand issues/problems related to the forest dynamics and their influence. Research as a tool of management, will help provide a solution or an option to the paper mulberry problem in Mabira Eastern block among other things.

Chapter 7 Examines potential technical, environmental and socio-economic impacts that may arise in the course of implementing activities under this FMP and possible mitigation measures suggested. Because Mabira CFR is known to be under high pressure for forest products, it is proposed to regularly carry out an off-reserve assessment of community activities.

Chapter 8 Deals with management and logistics and these include both human resource and equipment/tools to properly implement the FMP. In the course of data collection, it was noted that staff houses were in real bad condition hence urgent repairs/maintenance are absolutely necessary at the earliest.

Chapter 9 Is concerned with financial matters looking at revenue expectations and estimated expenditure during the FMP implementation. Estimated total revenue collection will be UGX **9,667,831,000**(Nine six hundred sixty seven million eight hundred thirty one thousand only).

The estimated total expenditure during the FMP period will be UGX **8,375,125,000** (Eight billion, three hundred seventy five million, and one hundred twenty five thousand only)

An activity schedule has been prepared that FMP implementers should follow when preparing annual operational plans – according to detailed annual expenditure.

Chapter 10 Emphasizes the necessity of monitoring and evaluation (M & E). NFA and key stakeholders are required to develop criteria and indicators (C & I) for field use, within the M & E framework. Until

such C & I are ready for use, those in Appendix 7 (a) and Principles and Criteria in Appendix 7(b) will be applied. Various administrative mechanisms e.g. regular and situational reporting are stipulated. Maintenance of FMP records is emphasized particularly the specified FMP copies. It is prescribed that in October each year, the Range and Sector Managers will update their FMP copies. Updated information will be sent to the ED/NFA and other FMP holders to update their copies. All copies shall be updated by 1st January the following year.

PART I:
GENERAL DESCRIPTION

CHAPTER 1: PHYSICAL DESCRIPTION

1.1 Name, Location, Boundaries and Area

1.1.1 Name, Location and Area

This Forest Management Plan (FMP) covers Mabira, Namukupa, Nandagi, Kalagala Falls, Namawanyi and Namananga Central Forest Reserves (CFRs). Namawanyi, Namananga and Kalagala Falls are situated in Kayunga District while Namukupa, Nandagi and part of Mabira fall in Mukono district. The bulk of Mabira CFR is situated in Buikwe District. The forest management plan area (MPA) lies north of Kampala along Jinja road starting at 45km (Nandagi CFR) on the extreme west to 58Km to the East that is 28Km to Jinja as shown in **Figure 1**.

The geographical location of Mabira, Namukupa, Nandagi, Namananga and Namawanyi forest reserves is between latitude 0^0 22'and 00 35' N and between 30^0 56' and 33^0 02'East, while Kalagala Falls occurs between latitude 0^0 35' and 0^0 37' N and between longitude 33^0 03' and 33^0 05' E.

The MPA covers a total area of 31,293 hectares as indicated in **Table 1** and **Figure 1.**

Table 1: Distribution of the CFRs within the districts of Mukono, Buikwe and Kayunga

	Name of CFR	Area(Ha)	Sub-county	County	District
1.	Mabira	29,974	Wakisi, Nagojje, Najjembe, Kimenyedde, Nama	Buikwe, Nakifuma, Mukono Ntenjeru	Buikwe/Mukono
2.	Namaukupa	280	Ntunda	Nakifuma	Mukono
3.	Nandagi	479	Nama	Mukono	Mukono
4.	Kalagala falls	104	Kangulumira	Ntenjeru	Kayunga
5.	Namawanyi	325	Kangulumira	Ntenjeru	Kayunga
6.	Namananga	131	Kangulumira	Ntenjeru	Kayunga
	Total	**31,293**			

1.1.2 Boundaries

The total external boundary length of the CFRs in the MPA is 378.7Km comprising both the cut line and the natural boundary. The total cut line boundary length is 366.7 km while the natural boundary is 12 km as indicated in **Table 2**.

Except for Kalagala falls CFR where only 6 km of boundary were planted with pillars in 2014, the external boundaries of the other CFRs in the MPA were last opened in 2000. As a result, some corner cairns and direction trenches have disappeared including those marking the boundaries with enclaves.

Senna spectabilis planted in 2000 still appears at some corners and along the boundary lines. Recent planting of *Eucalyptus* sp and *Araucaria* sp has been done along some boundaries of compartments 171 and 176. In 2006, the boundaries of compartment 234 and Kalagala Falls were opened and planted with Mvule seedlings.

Table 2: Boundary length of the respective CFRs

Central forest reserve	Cut line (km)	Natural Boundary (km)	Total Length (km)
Mabira	301.3	-	301.3
Nandagi	14.4	-	14.4
Namukupa	7.8	9.0	16.8
Namawanyi/Namananga	37.2	-	37.2
Kalagala falls	6.0	3.0	9.0
Total	**366.7**	**12.0**	**378.7**

The details about each of the CFRs are contained in the profiles in **Appendix 2**

Figure 1: Map of Mabira Forest ecosystem showing the various CFRs

1.2 Legal Status, Ownership and Privileges

1.2.1 Ownership

Forest Reserves (FRs) are protected in trust for the people in accordance with Article 237 (2) (b) of the Constitution of the Republic of Uganda (1995). These forests are managed as Central Forest Reserves under the current Forest Reserves (Declaration) Order, (SI) 1998 No. 63. The management and control of these CFRs are vested in the National Forestry Authority (NFA) under the National Forestry and Tree Planting Act, 2003. **Table 3** gives details of relevant legal instruments from first gazettement.

1.2.2 Legal status

Mabira and Namakupa forest reserves were first gazetted as central forest reserves together under legal notice No. 87 of 1932 with an area of 29,592ha. In Legal Notice No. 41 of 1948, the two reserves were gazetted with an area of 30,003ha. Under the same legal notice, Nandagi was first gazetted as a central forest reserve (CFR) with an area of 479ha. In Mabira CFR, a number of leases were granted in some parts of the forest and considering the length of the leases before their expiry, it was decided that these leases be excised from the main body of the reserve. Thus under Legal Notice No. 78 of 1962, Mabira forest reserve was regazetted with an area of 29,974ha. Under the same legal notice, Namukupa was separated from Mabira and gazetted with an area of 280ha while Nandagi was regazetted with an area of 479ha. Kalagala Falls, Namawanyi and Namananga CFRs were originally local forest reserves (LFR) managed by Buganda kingdom. They were transferred to the central Government under Statutory Instrument No. 176 of 1968. Mabira Mobile Police Post (MMPP) covering an area of 10 hectares was established in compartment 188 of Mabira CFR, but its status has never been legalized.

Table 3: Legal Status and Ownership of Mabira Forest CFRs from 1st Gazettement

Name of CFR	Year of first gazettement	Subsequent gazettements	Remarks
Mabira & Namukupa	Legal notice (LN) No. 87 of 1932 with an area of 29,592 Ha	LN No. 41 of 1948	Second gazettement, size increase 30,003ha for the two reserves
		LN No. 78 of 1962	LN No. 78 of 1962 for Mabira CFR area of 29,974
		LN No. 78 of 1962	Namukupa was separated from Mabira and gazetted with an area of 280ha
Nandagi	LN. No. 41 of 1948 with an area of 477ha	LN No. 78 of 1962	Nandagi was regazetted with an area of 479ha.
Kalagala falls, Namawanyi/Namananga	1932	Statutory instrument (SI) No. 176 of 1968	Kalagala Falls, Namawanyi/Namananga as LFRs

Source: SI 1998 No.63. The Forest Reserve (Declaration) order 1998
Boundary plan of former Forestry Department (FD) as gazetted in SI 1998 No.63.

1.2.3 Rights and Privileges

Subject to the National Forestry and Tree Planting Act 2003, Section 33(1), a member of the local community may go into the reserve, cut and take free of charge any dry wood or bamboo in reasonable

quantities for domestic use. Under Section 33(2) no materials however may be collected in the strict nature reserves or from sites of special scientific interest. Domestic animals are allowed to visit water and salt licks in the reserve on specific arrangements with NFA, but grazing will require a licence. Local communities have specific sites in the forest reserve with special cultural attachments, which include traditional Wanende tree, Kalagala falls cultural sites, Kirugu water spring, among others.

1.3 Topography and Altitude

Much of the Mabira lies between 1,000 - 1,250 m a.s.l with 5% of the area lying within 1,250m to 1,340m (FD, 1994). The topography of the forest is characterised by gently undulating plateau from flat topped hills to wide shallow valleys occupied by swamps.

The southern part of Mabira CFR occurs at or near the watershed of rivers and streams which enter Lake Victoria to the south and Lake Kyoga to the north. This narrow watershed consists of flat-topped hills which occur at almost the same altitude. Hills such as Dangala, Namusa, Ntunda, Wankobe and many others all rise to about 1340 meters above sea level (a.s.l), the highest being Najjembe Hill at 1356 meters a.s.l. The scenery is that of a gentle slope towards the north where the isolated hills like Namukupa rise to 1070 meters a.s.l. The flat-topped hills that occur all over southern Buganda Kingdom are remnants of the earlier peneplain uplifted by tectonic movements which lowered the land south of Mabira and which was filled up by river water from the east and west to form present Lake Victoria (Pallister, 1957).

1.4 Soils, Geology and Drainage

1.4.1 Soils

The soils of Mabira forest belong to the ferrallitic types which are the final stage of tropical weathering. They are referred to as Buganda catena and consist of red soil of incipient laterisation on slopes and black clays in the valley bottoms often overlain by a few centimeters of peat produced by rotting swamp vegetation. According to Cheney (1960), the soils of Buganda catena are not characterized by the parent rocks but by the topography which produces four catenas namely shallow lithosols, red latosols, grey sandy soils and grey clay soils.

Shallow lithosols occur on the highest ridge crests consisting of grey and grey brown sandy loams with laterite concretions on top of the ridges and upper slopes.

Red latosols cover much of the Mabira CFR and surrounding areas. They tend to have a profile of 30 centimeters of brown sandy or clay loam overlying uniform orange-red clay to a depth 3-5 meters below which occurs yellowish-brown and sometimes pure white clay. The red-clay loams result from kaolinite contained in it as well as the ferruginous coatings of the crumbs which prevent compacting. The clay sub-soil contains tiny cavities (holes) supposed to have come from activities of micro-fauna such as ants, termites and worms. Soils of the same structure are usually found on similar slope positions irrespective of the nature of underlying rock and also due to the drift-like nature of the parent material. The influence of the parent rock can only be observed when the rock is not far from the surface.

As a result of long periods of laterisation of this catena both peat and sheet ironstone are common on the higher ridge crests and brows. The sheet materials develop best on the flattish ridge crests of the ancient mid-tertiary land surface, especially those of the main watershed in the southern part of Mabira. However laterisation took place throughout all geological periods depending on favourable conditions at any time from Mid-tertiary or earlier to the present day. More recent forms of laterisation are often found

in saddles and seepage lines. Laterisation can also be observed in deep cutting on a semi-inundated soil horizon below the loamy red earth.

The red soils of Mabira especially the East block, are part of extremely fertile soils of Buganda catena, not only because of their inherent richness in mineral nutrients for plant growth, as they are driven from amphibolite rocks, but also due to the favourable climatic conditions and great depth of root room. It is the amphibolite rocks which confer the bright red colour to the soil type of Mabira because they are richer in bases than granites and schists, commonly found all over the country. The top soil is dark brownish –red clay about 30cm deep, merging into bright red porous clay sub soil often more than six meters deep. When the rock occurs near the surface, the soil above is usually yellowish-brown with black topsoil, highly leached and acidic and can be infertile due to high acidity as well as deficiencies of nitrogen, phosphorus, and sulphur nutrients.

Grey sandy soils appear at the base of slopes of the catena. These soils may be as a result of hill-wash or river alluvium. Below the sand, top soils are sandy clays of a very pale grey colour and mottled orange brown.

Grey clay soils occur along river and stream courses such as along rivers Musamya in East and Ssezibwa in West blocks respectively, particularly where valleys carry papyrus vegetation. Below this clay are sandy and sometimes pebbly clays. While such soils are under water for most of the year, surface peat accumulation is no more than five centimeters thick. The swamp soils and those of the lower reaches of Buganda soils catena are acidic in nature (pH: 3.8-4.8) and are deficient in all plant nutrients, magnesium and sulphur being exceptions.

1.4.2 Geology

The rock formation of southern Buganda, on some of which Mabira forest occurs, have been described (Pallister, 1959) as consisting of Buganda-Toro system, which are made up of granitic gneiss and granites of that system. Metamorphosed sediments such as schists, phyllites, quartzites and amphibolites overlie them. This type of rock formation tends to be uniform and gives some resistance to erosion, except along joints and fracture planes. Since these rocks occur and have been under Equatorial Climate and humid conditions, they have been greatly affected by chemical weathering to considerable depths. It is not uncommon to find depths of 10 meters or more exposed by road works where no parent rock material exists. However, the overlying metamorphosed rocks, sandstones and amphibolites tend to resist erosion except where they alternate with soft and easily eroded schists.

The metamorphosed amphibolites and sandstones have been folded to form elongated bands resulting in the types of hills and valleys found in the area.

Parts of the forest in the west block, such as Waluke, Wantuluntu and Ssezibwa, occur outside the Buganda-Toro rock series on undifferentiated gneiss, a kind of rock formation which covers the largest area of Uganda rock series.

1.4.3 Drainage

Mabira ecosystem is part of the watershed area for local and international waters of Lake Kyoga, Victoria, and rivers Nile and Ssezibwa that flow to Lake Kyoga with tributaries including Walekekata, Kasala, Luzibwe, Katogo, Nakasagazi, Namamiya, Kinyanyo, Kizibigi, Nyansa, Mayanja, Lulimba, Mulungu, Waluke, Wakisu, Namokomo, Wabuyimba, Nakalasa, Jugula, Kasininya, and Musamya

flowing into river Ssezibwa. In the eastern bloc rivers Waliga, Kasate, Nakwanga, Kitigoma, Nakyeyedo, Burunginjuku, Kyetinda, Buwola, Nkuse and Mubugwe flow into river Nile as shown in **Figure 2**.

The streams and rivers occupy narrow valleys that are characteristics of youthful stages of river formation, but widen as the slope becomes less steep and eventually become wider before entering the lakes north and south of the CFR. The drainage of the forest is rather unusual. Instead of rivers flowing into Lake Victoria, whose shores lie just 20 km south from the forest boundary; their drainage through the swamp is generally away from the lake northwards to Lake Kyoga.

Figure 2: Drainage map for Mabira ecosystem

1.5 Climatic considerations

There is an equatorial type of climate characterised by a bimodal pattern of rainfall with two wet seasons i.e. March-May and September-November. The mean annual rainfall is 1300mm which is generally well distributed throughout the year

The general climate of the zone typically displays comparatively small seasonal variations of temperature, humidity and wind throughout the year. Although the temperature is typically of the equatorial region, proximity to Lake Victoria and the altitude of more than 1000m a. s. l have a moderating effect on temperatures.

1.5.1 Rainfall

There is a dry season between late December and early March and another short one in June-July but both are frequently broken by thunderstorms. The zone, therefore, has a rainfall regime that is well

distributed throughout the year, but with peaks in April-May and October-November. Much of the rainfall comes in the April-May period, the amount received being between 1375mm and 1524mm annually with the highest falls occurring in the southern part of the reserve. There is a general decrease in rainfall, both in frequency and amount from the south to the north. While the south gets rain on an average of 120 days, the northern part may have 90-100 rainy days. As alluded to earlier, the high altitude results in more orographic afternoon thunderstorms compared with low lying areas to the East and North. It is most unlikely that there is any month during the year when rainfall is less than 25mm.

1.5.2 Temperature

The mean annual temperature is about 21-25^{o}c with ranges of minimum of 16-17^{o}c and maximum of 28-29^{o}c. Very high temperature seasons as such are very rare but the warmest months are January- February and the coolest are July - August.The highest monthly maximum temperatures of 27^{0} C tend to occur during the first quarter of the year (January to March) coinciding with the main dry season. The lowest minimum temperature 22^{o}C, occur during the months of July and August. This phenomenon also coincides with the cold weather in the southern hemisphere. February and early March marks the period of highest temperatures although they could occur during the month of January.

The daily variation is of the order of 10^{o}C to 13^{o}C for the whole region of South Buganda but may be slightly lower for Mabira as a result of ameliorating influence of the forest environment and the on shore Lake breezes. The forest lies within the Lake Victoria climatic zone whose extent is determined by diurnal variation in temperature and the inland penetration of the onshore lake breezes during the day. At the lakeshore, the diurnal variation is about 7^{o}C that increases to about 11^{0}C at the line of maximum penetration of the onshore breeze from 50 to 80 kilometers from the lake edge (Atlas of Uganda, 1967).

1.6 Vegetation and Existing Crop

The vegetation of Mabira was classified as “medium altitude moist semi-deciduous” (Lang-Dale-Brown & Osmaston, 1960), but the forest has greatly been influenced by human activities (i.e. exploitation, cultivation and grazing) for a long time that it is regarded as secondary forest resulting from and constantly being influenced by such activities. It is characteristic of vegetation types representing sub-climax or human altered plant communities. Accordingly, three vegetation sub-types have been recognized, namely, young or colonizing forest, mature mixed forest and *Celtis* mixed forest.

a) Colonizing forest

This type includes KY and KP (FD, 1993) meaning young mixed and mixed poor forest types respectively. The young mixed forest is small in area and covers about 2.7% of the area and includes all the areas of Mabira, which have been encroached upon in the past or have been degraded through uncontrolled harvesting. Since 1989 when the government of Uganda supported evictions in Mabira, there has been some restoration of the forest ecosystem. The forest appears young and it lacks characteristics of a mature forest, i.e. large stems of the usual species found in a mature forest. However, most species that occur in mature mixed forests are found in this type although in reduced numbers per hectare such species as *Celtis, Albizia, Antiaris, Chrysophyllum* which are typical of the canopy as well as *Funtumia, Trilepisium* and *Diospyros* being the under storey species also occur. There appears no reason to regard this forest type as distinct from the mature mixed forest which makes up the largest area of the forest. The difference is only in the numbers and heights of individual trees. The forest is characterized by trees of relatively short boles and large spreading branches which come as a result of more crown space during the early stages of growth. Selective harvesting of the

high value species, the Mahoganies, *Holoptelea grandis*, and *Olea welwitschii* has greatly reduced the economic value of such forest type at least temporarily.

The colonizing secondary forest in the Eastern block is characterized by natural regeneration succeeding the invasive dominant paper mulberry *(Broussonetia papyrifera).*

Maesopsis eminii, a species that usually dominates the colonizing forest in Mabira is notably rare or scarce. In the eastern block, it is found in the northern part of the forest because it was the only species used to plant up the encroachment areas in mid 1960s. In other areas, there is very little of it except in the compartments in the north and north-west of the eastern block where it occurs in small numbers which were planted for seed production but have now grown too old to produce any reasonable quantities of seed. Like Mahogany, *Maesopsis* is much sought after by the timber trade, which engenders selective felling and conversion of the species. Over the years, most of the old trees have been removed leaving no trees to provide seed for natural regeneration. The inventory data (1993) show that *Maesopsis* was not recorded in thirty (30) compartments out of sixty-one which were inventoried. It appears that *Maesopsis* is no longer dominant in any type of natural forest, contrary to what is stated by several researchers (Howard, 1991).

In regard to the royalty or fee groups, group 1 which consists of *Meliaceae* species such as *Milicia excelsa, Holoptelea grandis* and *Olea welwitschii*, make up a very small percentage of the growing stock (only 0.06%), while the second group constitute as much as 47.5% of the growing stock. The remaining groups three and four make up the largest number of trees representing 52.4% of all the trees in all fee groups. The near absence of economic group 1 as well as *Maesopsis* in many compartments, except where it has been planted, indicates that the forest has already been creamed of its valuable species. Apart from seedlings seen growing under *Broussonetia papyrifera* and near the forest stations, no trees of *Milicia excelsa* were recorded in this type of forest. This means that natural regeneration of this forest type will depend on seeds brought in by bats and other seed dispersal agents from other parts of the forest where *Milicia* still exists or from outside the forest reserve.

The forest types and their growing stock which were classified as mixed forest, poor or mixed forest young or even the encroached on areas, have the same specific composition which is a result of unregulated exploitation and large scale encroachment in the recent past. There are no ecological differences to separate them as they are all poor in species composition and poor in the number of trees of all diameter classes. The forest appears young because it is constantly being depleted of mature trees.

A notable contribution to the colonizing forest is that made by *Broussonetia papyrifera,* brought into the country by forest researchers. The seed was collected from the demonstration area at the Forest Research Institute Dehra Dun, India, (Batch number S. 61 of Silvicultural Research Section Entebbe). The seed was sown on 5th June 1956 at Mutai nursery, germination was reported as "excellent" growth rates have been very good at Mutai that has less precipitation and less soil fertility compared with Mabira Forest. Growth rates of 3.8 meters high and dbh of 2.8 cm per annum were recorded for the first six years. This exotic species has now covered as much as between 40-80% of the tree composition in Mabira CFRs the highest being in the formerly encroached upon areas of Namawanyi and Namananga CFRs. While this exotic tree is clearly invasive, it is not considered a threat to natural regeneration but acts as a nurse tree to the shade tolerant species. *Broussonetia papyrifera* has also quickly taken up the area which would otherwise be invaded by pioneer grasses like *Imperata cylindricum* which discourages regeneration and growth of natural tree species. It has been noted that although *B. papyrifera* invades cleared forest sites, it does not last long as it does not grow under the shade of natural forest trees. In areas where there has been minimal anthropogenic disturbance, *Broussonetia*

sp is slowly being replaced by indigenous species and this is demonstrated by the results from diagnostic sampling exercise that was carried out in the eastern block of Mabira in 2006 as shown in **Appendix 3a**. Results from a similar exercise, as shown in **Appendix 3b**, carried out for the update of this FMP in Namananga and Namawanyi CFRs indicated that the rate of regeneration of indigenous species in the two CFRs is being affected by illegal charcoal production, firewood and pole harvesting. However, the rate of succession is more prominent in compartments that are close to the natural and undisturbed forest than the peripheral compartments of the eastern block. In order for these compartments to regain their natural status, it is necessary to enhance the succession through enrichment planting with indigenous tree species.

b) Mature Mixed Forest

The mature mixed forest type occupies the largest area and constitutes 52% of the area of Mabira. It is indeed a mixed forest with 229 tree species (Howard, et.al.1996) which have been noted to grow to timber size i.e. trees which grow 6 or more meters tall with a bole of 30 cm dbh (Eggeling & Dale, 1951). It is nevertheless dominated by *Celtis genus* making up 20% of the growing stock which includes seedlings and saplings less than 10 cm dbh. It also contains a good number of species found in colonizing forest type, namely *Albizia coriaria, A.grandibracteata* and *A. zygia*. Other species of the canopy include *Antiaris toxicaria* and *Chrysophyllum* species. The lower canopy species are dominated by *Trilepisium madagascariensis, Diospyros abyssinica* and *Funtumia africana*. The dominance of *Celtis* is outstanding as its species make up the highest number of growing stock of all sizes from seedlings all through to the largest over mature canopy giants. The abundance of Celtis species in this forest type may be due to the fact that they have not been among the most favoured species like those of *Entandrophragma, Maesopsis, Milicia* or *Olea*. They have for long period not been favoured by selective exploitation and, therefore, were able to regenerate with less competition. However, *Celtis* is the climax genus of Mabira Forest and many other forests of South Buganda region (Webster, 1961).

From the economic viewpoint, the species of group 1 have been illegally removed from the forest and the current stock makes up a small proportion of only 2% of the growing stock. The degradation of the forest with regard to the most valuable species such as *Milicia excelsa* (Mvule) and species of *Meliaceae* is clearly demonstrated by the absence of *Milicia excelsa* that used to be a prominent feature of the landscape throughout the district of Mukono. Mvule is now a rare tree, largely occurring outside the forest. The remaining large trees were sighted in the Strict Nature Reserve (SNR) of Namaganda area.

Species of economic group two (II) are the most important component of the crop as they contribute as much as 68% of the number of large trees over 50 cm dbh. The species that make up this group are characterized by large and tall trees of mixed forest canopy, namely *Albizia ferruginea, A. glaberrima, Alstonia boonei*, *Antiaris toxicaria* and *Celtis mildbraedii*. They dominate the top storey of the canopy and contribute a large share of the harvestable volume.

The mixed forest type has a large number of species that have been put in economic group III & IV. These are species of low market value that occur in small numbers per hectare. They occur in the lower canopy layer and are dominated by *Ficus spp* (*Ficus* has 21 species alone in Mabira forest), *Trilepisium madagascariensis, Lasiodiscus mildbraedii, Teclea nobilis* and *Crossonepilis africanus*. Many other species occur in small numbers and contribute small amounts of volume individually but as a group they make up a substantial volume, especially in the 30 cm to 50 cm dbh size classes. From the samples taken during the inventory of 1992-93, both groups make up 48% of the numbers of trees per ha and contribute 25% of the volume of trees over 50 cm dbh and above.

Field observations and analysis of inventory data indicate a predominance of economic group II species in the mixed forest type. This type being intermediate between colonizing and mature *Celtis* dominated, also

the most important ecologically, as it contains a large number of species. Therefore, it contributes substantial quantities of plant species that are able to support more species of fauna and flora which require this environment for survival.

c) Celtis Dominated Forest Type

The forest dominated by *Celtis genus* with six species, namely, *Celtis adolfi-fridericii, C. Africana, C. durandii, C. mildbraedii, C. wightii and C. zenkeri,* is a truly *Celtis* forest. All the species of C*eltis* together make up 51% of all trees of economic group two. As this group usually dominates the top storey, it gives the composition and character of *Celtis* dominated forest. The *Celtis* species are normally associated with *Albizia glaberrima*, *A. ferruginea, Antiaris toxicaria* and *Chrysophyllum* species that contribute about 16% of the growing stock. *Celtis* type has the usual under storey species consisting of *Trilepisium*, *Lasiodiscus* and *Trichilia. Holoptelea grandis* is another occasional associate of this type especially in the eastern block. As *Holoptelea* is one of the most valuable species, it has been selectively exploited and it is inadequately represented even in the eastern block where it used to dominate in some localities.

The fact that this forest type contains a lot of *Celtis* trees of all sizes makes it less productive in terms of timber of economic value and biodiversity. Apart from compartments which constitute the nature reserve and buffer zone around the SNR, all other compartments forming the production working cycle need to be silviculturally managed to keep them at the mature mixed forest seral stage-the stage that promotes commercial valuable species and which contains a variety of species in the ecosystem.

CHAPTER 2: SOCIO-ECONOMIC ENVIRONMENT

2.1 Total Economic Value (TEV)

Forests are complex ecosystems that generate a range of goods and services. Total Economic Valuation (TEV) therefore accounts for both use and non-use values of the forest and elaborates them into direct and indirect use values, option, bequest and existence values.

Lack of knowledge and awareness of the total value of the goods and services provided by forests normally obscures the ecological and social impact of the change of land use from forestry to other forms of land uses. The TEV framework helps to understand the extent to which those who benefit from the forest or its conversion also bear the associated management costs or opportunities foregone.

Various valuation tools have been developed to estimate the monetary value of non-marketed goods and services (Lette & de Boo 2002). Munasinghe's classification of major value categories has proved to be a useful analytical tool to link value categories and their underlying environmental goods and services with specific valuation tools (Munasinghe 1992; Lette & de Boo 2002) as shown in **Appendix 4.**

While the direct use value of goods and services traded on the market can be easily translated into monetary terms by taking their market prices, there are a lot of other goods and services often conceived as having direct use values. These functions can be better valued by means of other valuation tools (e.g. Related Goods Approach, Hedonic Pricing or Travel Cost Method). The regulatory functions of forests from which indirect use value is perceived can also be valued using valuation tools (e.g. Replacement Cost Technique, Production Function Approach). To capture option, bequest and existence values, Contingent Valuation Method (CVM) is used to estimate the monetary value of environmental amenities (Lette & de Boo, 2002).

Using various valuation methods, **the total economic value of the CFRs in Mabira MPA is estimated to be UGX 18,606,348,073,334 (USD4, 744,132,615)** as shown in **Table 4.**The details of how the calculations were done are shown in Appendix 3. However, it should be noted that due to limited resources in terms of funds and time, the primary data used was insufficient and the calculations were majorly based on secondary data.

Table 4: Summary of values

Annual Stream of Benefits	**Amount/Year**	
	UGX	**USD**
(i) Timber	1,119,655,250,000	319,901,500
(ii) Poles & Firewood	706,986,000	201, 996
(iii) Non – Timber forest products (NTFP)	883,760,283,000	252,502,938
(iv) Carbon storage and sequestration	30,868,408,800	8,819,545
(v) Pharmaceutical values	2,300,035,500	657,153
(vi) Domestic water supply for communities	1,006,885,350,000	287,681,529
(vii) Watershed protection	30,995,716,500	8,855,919
(viii) Ecotourism value	39,429,180,000	11,265,480
(ix) Option/existence values	218,351,000	62,386
Total	**3,114,819,560,800**	**889,746,450**
Net Present Value of Annual Benefits Streams	**Amount**	
	UGX	**USD**
(i) Timber	9,330,460,416,667	2, 665,845,833
(ii) Poles & Firewood	5,891,550,000	1,683,300
(iii) Non-timber forest products	364,669,025,000	2,104,191,150
(iv) Carbon storage and sequestration	257,236,740,000	73,496,211
(v) Pharmaceutical values	19,166,962,500	5,476,275
(vi) Domestic water supply for communities	8,390,711,250,000	2,397,346,071
(vii) Watershed protection values	236,392,537,500	67,540,725
(viii) Ecotourism value	328,576, 500, 000	93,879,000
(ix) Option/Existence values	1,819,591,667	519,883
Total	**18,606,348,073,334**	**4,744,132,615**

2.2 Potential for timber and non-timber products

The production zone of Mabira CFR has been earmarked as a source of sustainable supply of round wood for Uganda's plywood and veneer industry. Nileply (U) Ltd, one of the producers of plywood and veneer in the country was licensed to source their logs from Mabira CFR in compartment 222 but the exercise was halted. Together with furniture grade and construction timber, the direct sustainable round wood value can be estimated at USD 605,000 per year (from a sustainable yield of 14,000m^3 per year). **Table 5** is an extract from **Appendix 5** and it summarizes the EI results by compartment.

Table 5: Volume (m^3/ha) distribution among the top diameter (cm) classes

Compartment Number	**Area (ha)**	**Stocking m^3/ha**	
		Trees >50cm	**Trees >70cm**
188	472	126.03	81.60
223	393	120.98	79.68
192	542	120.39	71.04
221	483	118.02	64.64
217	554	115.38	68.77

195	868	113.66	80.20
178	667	113.52	69.33
225	419	105.73	75.99
218	414	105.02	60.25
228	411	104.66	62.02
229	634	104.14	64.81
230	378	104.14	64.81
177	465	103.51	63.15
232	419	98.48	60.74
224	575	95.68	51.15
231	483	95.26	54.54
176	334	92.15	63.09
227	347	86.99	47.92
193	534	85.65	38.34
222	444	84.74	49.71
187	372	84.19	45.66
219	280	81.06	46.26
197		71.93	44.42
220	341	68.48	47.21
186	298	56.35	36.80
233	363	46.83	32.63
185	679	45.63	26.80
184	611	24.50	12.04
Total	**13,506**		

Source: Extracted from Stand table of total volume (m^3/ha) Mabira EI 2002

2.2.1 Timber supply

The production zone of Mabira has been earmarked for the sustainable supply of forest products such as saw logs for timber and veneer. The commercial round wood volume (mature stock 2006) for the production of timber/ veneer is estimated at 1,209,810 m^3 which was valued at about 96 billion shillings i.e. using the current rate of UGX 80,000 per m^3. An equal amount of volume from lops and top (branch wood and others) can be used for the production of charcoal or firewood. As regards charcoal, there is 1,209,810 m^3 that is equivalent to about 846,867 tons valued at nearly UGX 30 billion.

The future value of the young crop is estimated at 2,183,279 m^3 valued at UGX 175 billion using current prices.

The production zones of Mabira have been earmarked as a source of sustainable supply of round wood for Uganda's plywood and veneer industry. In 2007, Nile Ply Ltd, the only producer of plywood and veneer in the country with a total investment of more than US$15 million was licensed to source the veneer logs from Mabira forest. Together with furniture grade and construction timber, the direct sustainable round wood value can be estimated at US$ 605,000 per year (from a sustained yield of 14,000 m^3 per year).

The forest is situated in one of the most densely populated parts of the country (255 people per km^2 in 2002). Therefore, the demand for various forest products has been increasing. They include firewood, building poles and non-timber forest products for local people. The rattan cane industry is one of the fastest growing commercial non-timber forest product industries in Uganda. Local artisans mainly deal

in this industry. A report by the inter-ministerial committee in 2006, on assessing the request by Mehta Group to grow sugarcane on part of Mabira forest reserve land estimated that Mabira provides UGX 910 million for the local people's livelihoods annually.

According to the exploratory inventory carried out in Mabira CFR in 2002, the stocking was found to be as shown in **Table 6.**

Table 6: Mabira forest tree stocking

	Diameter classes (cm)				Cumulative totals		
	10-30	**30-50**	**50-70**	**70+**	**10+**	**30+**	**50+**
Trees stocking(No./ha)	307	62	18	10	397	90	28
Tree volume (m^3/ha)	34	40	35	56	165	131	91

However, this study was carried out only in the production zone of the forest. The total area of the production zone of Mabira forest reserve is approximately 8,060ha. The stocking of the production area is as shown in **Table 7**.

Table 7: Stocking of the Production Zone of Mabira CFR

	Diameter classes (cm)				Cumulative totals		
	10-29.9	**30-59.9**	**50-69.9**	**70+**	**10+**	**30+**	**50+**
No of trees in the production zone (number)	2,474,420	499,720	145,080	80,600	3,199,820	725,400	225,680
Tree volumes in the production zone (m^3)	274,040	322,400	282,100	451,360	1,329,900	1,055,860	733,460

2.2.2 Composition and condition of the growing stock

The 2002 Exploratory Inventory assessed all tree species in each of the 2265 plots representing 13,208.8ha in 28 compartments. Twelve (12) of the compartments were in the east block, three of which were from the formerly encroached area and 16 in the west block of the production WC.

All trees whether timber producing or not, were included in the assessment. The stand table of the total volume (m^3) for all the trees of the different species is shown in **Appendix 5 a & b**. The diameter classes do not include poles below 10cm, nor were seedlings and saplings recorded in the assessment as indicated in **Appendix 5 c.**

i) Group 1-the inventory shows the very low presence or volume of all trees of the high value timber species. Only *Holoptelea grandis* shows some adequate volume particularly in the big diameter classes 40-50 to 70+. It is however surprising that this species has very low volume in the lowest diameter classes below 40cm.

ii) Group 11- the dominance of the *Celtis* species is very prominent with about 50% of the total volume in the group. This is followed by *Albizia spp* 13%, *Antiaris toxicaria* 10% and *Funtumia spp* 8%. *Maesopsis eminii* has very low presence and is not present in diameter classes 60-70 and 70+cm.

iii) Group 111 – *Ficus spp* leads in this group closely followed by *Trilepisium madagascariensis*. *Broussonetia papyrifera*, which does not belong to this group, is put in for comparison to show it has large trees in the top diameter classes.

Appendix 5a shows the distribution of volume (m^3/ha) of the different selected species among the various compartments. Analysis of results in this table also indicates a very low stocking among the group 1 species, and total absence in some compartments (Cpts 178,184 and 185) that are in the formerly encroached area. The low volume of *Broussonetia papyrifera* in Cpt 178 has allowed *Milicia excelsa* and *Entandrophragma spp* to grow but its high volume has kept these species out in Cpts 184 and 185. The volume of *Maesopsis eminii* is very low and the species is absent in nine compartments. *Broussonetia papyrifera* is dominant in eight of the nine compartments in the western block. On the other hand the most dominant species are *Celtis* spp, *Albizia* spp, *Antiaris toxicaria* and *Ficus* spp.

Figure 3 shows management of Mabira CFR zoned into compartments.

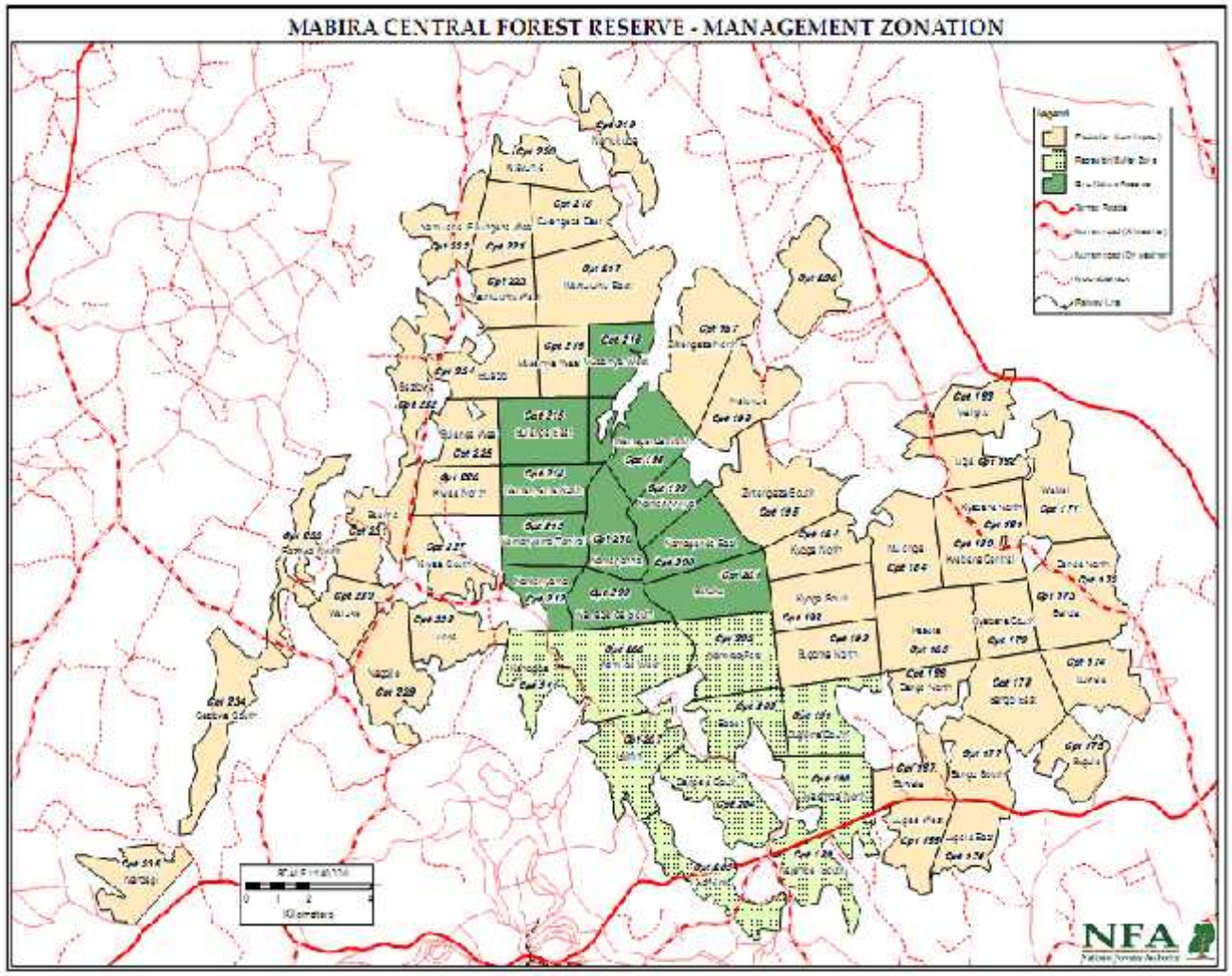


Figure 3: Map showing management zones in Mabira CFR

2.2.3 Non-Timber Products

a) Firewood

Mabira group of CFRs have for long been a source of fuel wood (firewood and charcoal) for both industrial and local community use. At the moment, firewood collection on industrial or commercial scale is not allowed but local communities collect firewood especially dead wood. Previously, when the industrial sector was allowed to collect the firewood, they collected both fresh and dead trees and the operation was somewhat organised.

Firewood for domestic and commercial purposes is supposed to be got from dry wood (mainly the branches or logging residues) and the women usually do this. Where men are involved, the firewood is for distilling alcohol. Supplies are normally adequate during the dry season but diminish during the rainy season.

b) Charcoal

Charcoal production is carried out illegally in all the CFRs and this is highly pronounced in the small reserves of Namananga, Namakupa and Namawanyi than in Mabira and Nandagi. Much of Kalagala falls has been leased to a private investor and charcoal burning is highly prohibited. The charcoal produced is of very low calorific value being mainly from the paper mulberry locally known as *enkulaido*. The charcoal is mainly sold to urban areas of Lugazi, Najjembe, Buikwe, Bukoloto, Kangulumira, Nakifuma and Mukono.

c) Poles and fencing posts

Poles are harvested from young trees of 5-15cm dbh depending on their use, durability and strength. The poles are used for domestic purposes mainly for construction of residential houses. Men and boys do harvesting. Like timber, supplies of most pole species are decreasing and one has to walk long distances to get them.

On the other hand, fencing posts are mainly harvested from palm trees although some people use them for construction of houses as well.

d) Sticks for roasting meat

Large quantities of sticks are used for roasting meat for sale in the nearby roadside markets of Najjembe Namawojolo and Bukalambo. The main species used for this purpose is *Acalypha neputunica*, a shrub species found in Mabira. Although there is no accurate data on the volume of sticks used per day, it is estimated that 3,000 stems are harvested on a daily basis which are cut into about 18,000 smaller sticks. Whereas the effect of this extraction is not yet established, it is clear that unless it is controlled, the impact will have serious negative consequences on the forest ecosystem.

e) Seeds and wildings

The collection of seeds and wildings of indigenous tree species has become a widespread practice among the forest-edge communities around the CFRs largely for sale. The main species collected are *Maesopsis eminii, Albizia spp, Terminalia spp, Prunus africana, Warbugia ugandensis* and *Cordia milenii.*

The seeds of manly *Maesopsis eminii, Prunus Africana* and *Terminalia* spp, are sold to nursery operators from Mbale and Mukono.

The majority of the wildings collected from the CFRs are sold to nursery operators in Mukono district while the adjacent communities planted a small proportion. It is estimated that about 1,500 kg of seed is collected from the CFRs per year.

f) Handcraft Materials

Handcraft materials (climbers, rattan canes, papyrus reeds, palm leaves) are harvested illegally from the CFRs. Some of the handcraft materials including palm leaves are harvested for making baskets and mats. Harvesting is mainly done by women though men and children are also involved on a small scale. The resource is harvested in head loads. Some individuals collect these materials for direct sale; others collect for domestic use while the rest especially the women's group harvest the materials and process them further into other products such as mats, baskets etc. Most of these materials have reduced while others like rattan canes have been depleted totally.

g) Herbs/Medicinal Plants

The CFRs are a source of medicinal plants and herbs to the neighboring communities. Medicinal plants are mainly harvested by herbalists engaged in commercial treatments and those who collect medicinal plants for day-to-day domestic use. Harvesting involves collection of plant leaves, bark, flowers, fruits, seeds and roots. Some of the commonly harvested herbs/plants are *Vernonia* (omululuza), ebombo, *Spathodea companulata (*kifabakazi,) *Prunus africana (*ntasesa*), Albizia coriaria (*omugavu*),* and *Mondia whytei (*omulondo*).*

h) Sand

The CFRs are a source of sand that is used for domestic purpose especially cleaning of household items such as plates, saucepans etc. It is collected, in small quantities, from water points in the forest because at these sites the sand is cleaner and this is done almost on a daily basis. The community members regard the supplies as adequate. Girls and housewives are involved in the collection. However commercial sand collection by trucks or tractors is also done illegally.

i) Forest food

Forest foods such as edible plants, wild meat, honey, mushrooms and insects act as a safety net especially during times of famine. Some community members collect wild food from the CFRs mainly for domestic use. These foods are harvested mainly by collecting fruits, seeds, leaves, digging out tubers, mushrooms, insect sand honey. Women and children are mostly the ones involved. The off take levels cannot be ascertained due to lack of knowledge on the available quantities and monitoring procedures. Most of these foods are seasonal in nature and there are no specific harvesting restrictions.

Harvesting of wild meat is done through hunting. Animals are killed using spears, bows and arrows, traps/snares and hunting dogs. Men and boys do the hunting. Apparently there are specialist families who are particularly skilled at hunting. Within these families, all male members are hunters.

j) Thatch grass and fodder for grazing

Grass from the CFRs is used for livestock grazing within the forest and also is cut and collected as fodder for zero grazing. This is done on a daily basis by livestock owners.
The grass in flower is cut and collected for making sweeping rooms. Some families collect grass for thatching houses especially the shrines used by traditional healers.

k) Rattan canes

Use of rattan canes for handcrafts has developed considerably, as has use of leaves of a wild palm, *Phoenix reclinata,* for making floor mats. Harvesting is mainly done by women though men and children are also involved on a small scale. Some individuals collect and sell them raw while others collect for domestic use. The women's group harvest the materials and process them further into other products such as mats, baskets etc. Unfortunately, NFA has no quantified volume of the products taken out and their value. Rattan canes occur naturally and some have been planted in compartments 229 and 230 by CFM partners.

l) Water Resources

The CFRs are the only large forests in the bio-geographical zone of the Lake Victoria Crescent and are an important area for conservation. These forests are sources of water for both domestic and industrial uses. Communities adjacent to the CFRs including enclaves are totally dependent on water from these forests. The water supplied by NWSC in the major urban centres such as Lugazi, Njeru and Kangulumira is filtered by these forests. The three (3) hydropower dams of Owen falls, Bujagali and Isimba benefit from the waters that come from the rivers and streams originating from these CFRs.

2.2.4 Eco-tourism

The Eco-tourism potential in the whole of Mabira MPA is great consisting of attractions such as River Nile, Kalagala and Griffin falls, caves of Nakalanga, Kiwaala falls cultural heritage, the undulating hills and the wide valleys around the Lake Victoria crescent. Local people attach great importance to culture, the trees, falls and caves where they go to worship and dance. The sites include among others, Buwola, Dangala, Kasokoso, Sese, Namusa, Namaganda, Nakalanga, Maligita, and Kiwaala.

According to the Integrated Tourism Master Plan, 1993, Mabira ecosystem is classified under the Capital Area Zone of the Secondary Tourism Zone. The destination is ideal for visitors because of its association with the source of the Nile, and its proximity to the Kampala-Jinja-Mukono-Entebbe urban areas.

In particular, Kalagala Falls CFR which is located along the River Nile in Kayunga District has a tourism potential of beautiful falls. Adrift has been licensed to operate an ecotourism business in part of this CFR.
As part of Kalagala-Itanda offset, it is planned to link Mabira to Kalagala Falls and the source of the Nile to promote Mabira ecotourism.

Visitors to Mabira CFR generally take nature walks that last between 30 minutes and three hours. The forest contains an impressive diversity of trees (358 species) and bird species (312 species). It also has three primate species that include red tailed monkeys, vervets, and mangabeys (for which habituation

will soon take place). Mabira has two principal ecotourism poles: NFA's ecotourism center to the north of the Jinja Road and the high-end Rain Forest Lodge to the south of the road.

The Mabira ecotourism center, which was built in 1996 with support from the European Union, caters mostly for day visitors, tourists with a limited budget, and school groups interested in exploring the forest. It contains three trails, which can be used for hiking or mountain biking. There are five tour guides available to provide tours. There is also a small restaurant run by women from the local community, a campsite, a small recreational area, and three bandas that are quite dilapidated. The Rain Forest Lodge is owned by Geo Lodges, a Ugandan hospitality group that owns four lodges spread across the country (the others being in or near national parks). Operating on a 25-year licensing agreement from NFA, it contains 12 cottages built to blend into the natural environment. Catering to more affluent Ugandans and international travelers, cottages costs over US$200 per person per night (including all meals and nature walks provided by their own guides). They also receive many day visitors.

A third pole of tourism that is starting to emerge is in the Griffin Falls area, around 10km from the ecotourism center. The MAFICO community group offers forest canopy zip line, guided hiking or biking tours and accommodation in a banda, dorm, or campsite. The group has a MoU with NFA that allows them to operate freely within the forest reserve.

The compartments under the eco-tourism working circle are indicated in **Table 8** and the current tariffs charged are indicated in **Appendix 6**

Table 8: Ecotourism compartments and activities

Compartments	Area (Ha)	Activity
187	362	• Bird, watching
189	334	• Mangabey tracking • Walking trail (18km)
190	566	• Najjembe Eco-tourism centre • Walking trail (4km) • Campsite • Mangabey tracking
204	525	• Cycling trail (7km)
206	610	• Cycling trail (6km)
207	402	• Cycling trail (7km) • Zip line
208	473	• Cycling trail (8km) • Zip line • Canopy walk
211	378	• Community tourism
Kalagala falls	104	• Wild water rafting, speed boats, lodging, overland camping, Kayaking ; by Adrift
Total	**3,754**	

2.3 Markets, Growth Statistics and Yield of Forest/Timber Products

2.3.1 Markets

Mabira group of forests lie within close proximity to Kampala, Mukono, Wakiso, Lugazi, Kangulumira, Nakifuma, Njeru and Jinja towns. These mushrooming urban centres and associated developments there in such as schools and industries present various sources of growing demands of manifold nature and extents for forest products and services. As the population in these towns increases as shown in **Tables 9 & 10**, the demand for forest products to meet domestic, commercial and industrial requirements will continue to rise. These products include; timber for construction and carpentry, charcoal and firewood for both domestic and industrial uses, craft material and herbal medicine.

With the booming building industry and the mushrooming carpentry workshops over the past two decades or so, the demand for sawn timber has been rising considerably each year. Because of this, Mabira CFR located in between Kampala, Mukono, Lugazi, Njeru and Jinja towns, has been experiencing increasing demand and pressure, as forests on private land get depleted. In addition to timber, demand for other forest products like charcoal, firewood, crafts materials and herbal medicine is increasing.

Local communities especially those in the sub counties surrounding the Mabira group of forests take large quantities of fuel wood from the reserves, wood energy still being very important in the livelihoods of rural and most urban populations. In addition, they also engage in various commercial activities such as cottage industries like brick making, baking, brewing, restaurants and roadside barbeques which consume substantial quantities of wood from these forests.

Domestic consumption will continue to rise as Uganda's rapid population increase of about 3.4% continues). Illegal harvesting of timber, firewood and many other products in many compartments, coupled with encroachment in the past have drastically reduced the economic value of the forest.

Table 9: Population of surrounding districts by sex

No.	District	Females	Males	Total
	Buikwe	222,963	213,443	436,406
	Kayunga	189,669	180,541	370,210
	Mukono	307,927	291,890	599,817
	Kampala	793,572	722,638	1,516,210
	Jinja	240,647	227,609	468,256
	Wakiso	1,054,919	952,781	2,007,700
	Total	**2,809,697**	**2,588,902**	**5,398,599**

Source: National Population and Housing Census 2014(Provisional results)

Table 10: Population of sub counties closest to Mabira group of forests by sex

District	Sub county	Total Females	Total Males	Total Population
Buikwe	Kawolo	20,154	20,242	40,396
	Najjembe	16,612	16,798	33,410
	Njeru Town council	42,287	38,765	81,052
	Wakisi	20,941	20,091	41,032
	Sub total	99,994	95,896	195,890

District	Sub county	Total Females	Total Males	Total Population
Kayunga	Kangulumira	27,890	25,449	53,339
	Sub total	27,890	25,449	53,339
Mukono	Kimenyedde	18,639	17,232	35,871
	Nagojje	17,365	17,241	34,606
	Nama	28,168	26,831	45,999
	Ntunda	7,491	7,691	15,182
	Sub total	71,663	68,995	131,658
	Grand Total	**199,547**	**190,340**	**380,887**

Source: National Population and Housing Census 2014(Provisional results)

2.3.2 Growth Statistics and Yield of forest products

a. Growth Statistics

In order to monitor forest growth dynamics and yield, information derived from assessment of Permanent Sample Plots (PSPs) is vital. PSPs were initially established in production zones at an intensity of 0.8% representing a sample of 125 ha; this was later reduced to 0.08% representing a sample of 1,250 ha primarily to cut on costs for establishment, maintenance and assessment. Information from PSP assessment guides management to estimate the sustainable quantities of products to be harvested and determine harvesting cycles. The assessments provide information regarding recruitment, growth rates of trees and volume increment. Whereas growth rates and recruitment levels are used to guide the choice of species for enrichment planting and restoration of degraded parts, volume increment guides forest managers to determine the annual allowable cut. In Mabira there are 12 PSPs that are being maintained out of the existing 14. The location of the remaining 2 PSPs is unknown. The last PSP assessment carried out in 2010 on 10PSPs indicated that the average growth rate of trees (in terms of dbh increment) was 0.8 cm/year although the fastest was 1.8cm/year while the slowest growing species had a growth rate of 0.2 cm/year.

The assessment considered three categories i.e. fast, intermediate and slow growing species are indicated in the **Table 11**:

Table 11: Categorization of sampled tree species according to growth rates

S/N	Fast growing species (Average growth>1.0 cm/yr.)	Intermediate growing species (Average growth 0.4-0.9cm/yr.)	Slow growing species (Average growth 0.1-0.3cm /yr.)
1	*Monodora myristica*	*Chrysophyllum albidum*	*Celtis wightii,*
2	*Lovoa trichilioides*	*Celtis gomphophylla*	*Polyscias fulva*
3	*Ficus mucuso*	*Holoptelea grandis*	*Maerua duchesnei*
4	*Celtis zenkeri*	*Albizia gummifera*	*Phyllanthus discoides*
5	*Broussonetia papyrifera*	*Trichilia dregeana*	*Dichrostachys glomerata*
6	*Albizia zygia*	*Albizia glaberrima*	*Macaranga kilimandscarica*
7	*Ficus exasperate*	*Alstonia boonei*	*Funtumia africana*
8	*Antiaris toxicaria*	*Milicia excelsa*	*Macaranga schweinfurthii*
9	*Baikiaea insignis*	*Khaya anthotheca*	*Mimusops bagswawei*
10	*Newtonia buchananii*	*Ficus sur*	*Lasiodiscus mildbraedii*
11	*Trilepisium madagascariensis*	*Funtumia elastica*	*Trichilia prieureana*
12	*Cordia milenii*	*Canarium schweinfurthii*	*Lannea welwitschii*
13	*Ritchiea albersii*	*Alangium chinese*	*Teclea nobilis*
14	*Craibea brownie*	*Cordia africana*	*Harrisonia occidentalis*
15	*Celtis mildbraedii*		*Sclerocroton ellipticus*
16			*Parkia filisiodea*
17			*Tabernaemontana holstii*

b. Yield

Results from PSP assessment in Mabira for the period 2001 -2010 indicate that the Mean Annual Increment (MAI) in the production zone is 14m³/ha/yr. This means that a total volume increment of 294,000m³ would be produced annually from the production zone of 21,000ha in Mabira CFR.
From the above assessment a number of harvesting cycles, under a polycyclic system, with varying annual allowable cuts (AAC) are suggested as detailed in T**able 12** below.

Table 12: Volume increment and AAC for the various polycyclic harvesting cycles in Mabira CFR

S/N	Harvesting cycle (Years)	Annual Volume increment (m³/ha/yr.)	Annual Allowable Cut(AAC)m³/yr.
1	15	1.00	19,600
2	20	0.70	14,700
3	25	0.56	11,560
4	30	0.50	9,800
5	40	0.35	7,350
6	75	0.20	3,920
7	80	0.19	3,675
8	90	0.16	3,267

Source: Twinomuhangi L. (2011)

From the information given in **Table 12,** the longer the harvesting cycle the lower the annual volume increment and allowable cut and the reverse is also true. A 30 year harvesting cycle with an AAC of 9,800m³ /year is recommended.

The exploratory inventory data of 2002 indicates that the total harvestable volume from the production zone in Mabira CFR is estimated to be 14,734m³ as shown in **Appendix 5.**

2.4 Stakeholders and Partnerships

2.4.1 Stakeholders

Stakeholders are persons or a group of persons with direct or indirect interest in forest resources and whose activities can impact on that resource or is being impacted on by the resource. They may have negative or positive impact on the management of the Mabira Forest ecosystem. They also have various influences and will have a role to play and returns to gain.

Due to the importance of the CFRs in the MPA as the largest block of forests in the Lake Victoria crescent and also because of their high biodiversity value, there are many stakeholders interested in them. Therefore, in accordance with Section 28 of the National Forestry and Tree Planting Act 2003, consultative meetings were held with stakeholders from the neighbouring sub-counties of Najjembe, Wakisi, Kangulumira, Nagojje, Ntunda, Kimenyedde, Nama, Kawolo and Njeru. Representatives from Mukono, Buikwe and Kayunga District Local Governments and other relevant stakeholders such as CBO's, NGO's, Tourism operators, Civil Society, Researchers, Licensees, SCOUL/Tea Corporation of Uganda and Local communities. These stakeholders have varying interests and benefits; they claim certain rights and play various roles as summarized in **Table13**.

Table 13: Stakeholders' proposed rights, roles/responsibilities and returns/benefits

Stakeholders	Rights	Roles/Responsibilities	Returns/Benefits
Ministry of Water and Environment	• Provide policy guidance, • Create an enabling environment for investment • Inspect, regulate and monitor the operations of private companies in the Water and Environment sector	• Policy formulation • Oversight(supervision) • Funding forest related projects • Sourcing for funding • National Planning • Regulation • Inspection • Technical support • Coordination • Standard setting	• Existence of forestry policies • Institutional satisfaction/Prestige • Grants • Protection of Water sheds for power generation, water for domestic use and industries
Ministry of Energy and Mineral Development	• Provide policy guidance, • Create an enabling environment for investment • inspect, regulate and monitor the operations of private companies in the energy sector	• Formulate policies, laws, regulations, standards and guidelines for sustainable production and provision of energy from various sources. • Develop and promote biomass energy conservation technologies • Promotion of energy substitution (solar, hydro power, petroleum, etc.)	• Strategically managed and promoted development of Uganda's energy resources for social and economic development. • Sufficient water for power generation resulting from protected water catchments • Adequate space for power transmission
Ministry of Finance, Planning and Economic Development	• Formulate policies that enhance stability and development • Mobilize local and external financial resources for public expenditure and oversee national planning and strategic development initiatives for economic growth.	• Provision of policies, standards and guidelines and information • that are needed for planning • Sector budget allocations to ensure coherence of forestry policy and practices • Oversee the NFA performance contract • mobilize funds and other resources • Macro-economic stability through ensuring sustainable natural resources through extraction levies and licenses. • Implementation of social and environment assessments to Facilitate planning and economic stability. • Provision of incentives and disincentives (Economic Instruments)for forestry development	• A well planned economy with sufficient public resources effectively used and duly accounted for the benefit of all Ugandans.
Ministry of Tourism Wldlife	• Formulate policies that enhance stability	•	•

and Antiquities	and development • Mobilize local and external financial resources for public expenditure and oversee national planning and strategic development initiatives for economic growth.		
NEMA	• Free access to monitor • Partners in FMP implementation	• Carry out EIAs in land use projects • Technical advisors on environment • Supervision of all environmental issues including monitoring	• Proper land use • Proper environmental management • Institutional satisfaction/Prestige
NFA	• Management and control of CFR • Custodian of the CFRs	• Licensing • Carry out livelihood assessments of current and proposed forest use initiatives e.g. CFM • Proper management of the CFRs. • Lead agency in the FMP implementation • Co-ordination • Revenue collection • Provision of technical advice to all stakeholders ▪ Restoration in case of deforestation ▪ Sensitization ▪ Provide quality forest products and services ▪ Protection ▪ Maintain forest boundaries	• Revenue • Shared responsibilities • Mabira ecosystem managed and conserved to satisfaction of key stakeholders and partners. • Employment • Prestige
District Forest Service/District Local Governments	Partner in forest management	• Participate in forest management • Mobilization and sensitization of communities. • Collaboration in plan implementation. • Integrate FMP proposals into the Sub county and district development plans • Promote interventions for improving land management and land productivity outside the CFRs • Undertake resource use planning and implementation of land use plans outside the	• Opportunities for employment among the communities • Tax revenue from forest products and services • Prestige • Improved infrastructural development • Ameliorated climate/environment • Sustainable management of natural resources outside the CFRs • Improved livelihoods of the people

		CFRs • Support value addition to natural resources and agricultural products • Develop and implement bylaws • Develop and implement management plans for the wetlands within Mabira ecosystem • Regulating access and use of river banks highlands and other fragile ecosystems • Carry out livelihood assessments of current and proposed forest use initiatives e.g. CFM • Conduct inventories and map forest resources outside CFRs • Conduct inventories and map wetland resources outside CFRs • Mobilize private forest owners and sensitize them about the NFTPA(2003) and requirements for management of forests on private land • Facilitate the development and implementation of management plans for private forests • Provide incentives for development of or management of forests/ trees on private land • Provide incentives for environmental restoration for formerly degraded lands • Secure employment for the locals in investment and development programs in Mabira ecosystem • Promote value addition and marketing of local produce and products with high economic returns but do not negatively impact on the environment	• Harmonious relations amongst the communities, DLGs, NFA, Private Investors and other stakeholders
Local communities	Access to permitted resources	• Partnership in forest management(CFM) • Control illegal activities • Labour source • Institutional memory	• Income and improved community livelihood. • Free firewood and other NTFP& services • Employment

Licensees(Adrift, Geo lodges, MAFICO, Tree Growers)	• Access to resource development facilities • Partner in FMP implementation	• Respect the integrity of the forest. • Comply with license conditions • Cooperate with other stakeholders/partners	• Financial income • Ownership of forest resources and services agreed upon
Tourists	• Access to the tourist attractions	• Adhere to tour guidelines • Pay for services offered	• Enjoy nature's beauty
Development partners(Donors)	Provision and control funds	• Technical advice • Monitor proper use of funds • Help train NFA staff and other stakeholders	• Help develop resources and building ability of stakeholders • Contribution to universal conservation of biodiversity & environment
Civil Society Organisations/ NGOs /CBOs	• Advocacy	• Community mobilization& sensitization • Collaborating with NFA and other partners • Lobbying and advocacy.	• CFRs properly managed (moral satisfaction) • Donations • Employment • Empowered communities
Parliamentarians& other political leaders		• Lead by example • Enact laws and policies • Community mobilisation & sensitization • Conflict management • Monitoring & supervision • Oversight	• Prestige • Improved community livelihoods • Improved infrastructural development • Increased income
Researchers & Academic Institutions	• Access to data/information	• Carry out research • Provide technical advice • Disseminate findings • Teaching the students to appreciate the importance of forest conservation • Lobbying and advocacy for sustainability of the forest •	• Provision of solutions to problems • Access to research sites • Source of specimen • Broadening scientific knowledge • Sites for field work • Firewood • Timber for construction and furniture •

UWA	• Partners in FMP implementation	• Sensitization of communities on wildlife related issues • Vermin control	• Institutional satisfaction
Law enforcement agencies(UPDF &Police)	• Access and search	• Enforce law and order • Sensitization of communities	• Employment • Peaceful and orderly environment •
Industrialists (SCOUL, Uganda Tea Corporation, BEL etc.)	•	• Proper disposal of industrial wastes/effluents • Diversification of energy sources • Contribute towards the protection of forests (provision of seedlings, energy saving technologies, tree planting etc.) • Provision of employment to forest adjacent communities	• Absorption of toxic gases from their factories • Reliable rainfall(climate amelioration) • Clean environment • Forest products (firewood, timber)
Buganda Kingdom		• Sensitization • Partners in FMP implementation	• Sustainability of the forests (Cultural heritage) ▪

2.4.2 Partnerships

Partnership is an agreement to cooperate in order to advance the partners' mutual interests mobilising their strengths and resources in a transparent and equitable manner. It avails opportunity to solve complex problems that no single institution can resolve with less resources spent. It is also a process of availing opportunities for interested people to be heard or influence decisions that affect them.

NFA has entered into a collaborative forest management arrangement with some forest adjacent communities, who are organized into community-based organizations (CBOs), in accordance with the current forestry policy and legal framework. There are two CBOs; Nagojje Community and Biodiversity Association (NACOBA) and Conserve for Future Development Association(COFSDA) that have signed CFM agreements with NFA in Mabira CFR to co-manage compartments 229 and 176 respectively. However, at the time of updating this FMP, both of these agreements had expired and require review and renewal. Two other communities had expressed interest in CFM in the western part of the CFR. These were Wabulongo-Kawatutu Community Association (WAKACA) and Kirugu Biodiversity Conservation Group. Unfortunately they lost interest along the way. Plans are underway to scale up CFM arrangement in all compartments adjacent to the communities starting with compartments 171,173, 183, 188, 211, 219 and 233 with priority given to communities in the enclaves.

Private tree growers have been allocated land in Nandagi and Kalagala falls for plantation development. These have planted mainly Pine, Eucalyptus and Terminalia for poles and timber.
In addition, NFA has licensed private investors to run ecotourism businesses in both Mabira and Kalagala falls CFRs. These are Geo lodges, MAFICO and Adrift.

2.5 Threats and Conflicts

2.5.1 Threats

The survival and relevance of Mabira forest ecosystem is facing increasing threats from unsustainable human activities. Some of the threats include: unsustainable forest harvesting; agricultural encroachment; population pressure; land grabbing; political interference; degradation of habitats through pollution and conversion; invasive alien species and inadequate funding to mention but a few.

Table 14 shows the details of the threats as identified by stakeholders during the consultation process.

Table 14: Threats to the CFRs as identified by stakeholders

S/N	Threats	Causes	Effects to the communities	Effects to the forests	Solutions
1	Unsustainable forest harvesting	▪ Illegal forest harvesting ▪ High demand for products (timber, firewood) ▪ High population ▪ Poor governance ▪ Corruption ▪ Unemployment ▪ Poverty ▪ Ignorance/lack of awareness ▪ Greed ▪ Search for land for farming ▪ Involvement of environmental police in illegal activities	Positive ▪ Improved livelihoods ▪ High income Negative ▪ Unreliable rainfall for agricultural production ▪ Population influx (migration) ▪ Reduced access to forest products and services ▪ Increase in resource use conflicts ▪ Creates negative perception/ attitude towards the forest as communities think that their role in forest protection has been taken over by EPPF	▪ Deforestation ▪ Biodiversity loss ▪ Extinction of certain species	▪ Sensitization ▪ Law enforcement ▪ Restoration planting ▪ Substitution of certain species ▪ Promotion of tree planting on farm land ▪ Replant cleared trees ▪ Provide employment opportunities ▪ Alternative energy sources ▪ Afforestation and re-afforestation ▪ Enforcement ▪ Community participation ▪ Institutional strengthening NFA, District, Sub-county ▪ Clarify on the chain of command for EPPF
2	Agricultural encroachment	▪ Unclear forest boundaries ▪ High population ▪ Poor agricultural practices (lack of agro inputs ▪ Political interference ▪ Poor implementation	Positive ▪ Improved livelihoods ▪ Increased income Negative ▪ Intra community conflict ▪ Reduction or loss of forest products and services ▪ Climate change	▪ Forest degradation and deforestation ▪ Biodiversity loss ▪ Soil erosion	▪ Open and regularly maintain boundaries ▪ Sensitization ▪ Regular patrols ▪ Law enforcement ▪ Eviction of encroachers ▪ Promote use of appropriate agricultural technologies ▪ Promotion of CFM ▪ Political will

		of policies ▪ Poor governance			
3	Population pressure	▪ Early marriages ▪ Migration ▪ High fertility ▪ Polygamy ▪ Cultural and religious beliefs ▪ Ignorance ▪ Unemployment	▪ Scramble for resources ▪ Scarcity of resources ▪ Conflict over use of resources ▪ Outbreak of diseases	▪ Forest encroachment ▪ Un sustainable use	▪ Enhance Family planning ▪ Sensitization and education ▪ Creation of employment opportunities ▪ Intersect oral planning and coordination ▪
4	Illegal acquisition of land titles in the forest/land grabbing	▪ Poor governance ▪ Poor policy implementation ▪ Corruption	▪ Reputation/Deprivation of access and user rights	▪ Degradation and deforestation ▪ Reduction of forest cover ▪ Change of land use	▪ Sensitization ▪ Cancellation of illegal land titles ▪ Prosecution ▪ Eviction ▪ Institutional/sectoral coordination (MWE/NFA& Ministry of Lands Housing and development/ Uganda lands commission)
5	Infrastructural development e.g. Roads, power lines, dams, industries, etc.	▪ Poor planning ▪ Lack of inter-sectoral planning	▪ Access to improved infrastructure and markets ▪ Loss of forest benefits	▪ Forest degradation/ deforestation ▪ Habitat fragmentation ▪ Biodiversity loss	▪ Coordinating planning for infrastructural development (MWE, NFA, UNRA, Min of works and transport, UETCL, UEDCL, ERA, Railways, NWSC, NEMA)
6	Political interference	▪ Corruption ▪ Greed ▪ Nepotism ▪ Poor	▪ Conflicts ▪ Short term /selfish benefits ▪ Lawlessness	▪ Forest degradation and deforestation ▪ Biodiversity loss	▪ Restoration of good forest governance ▪ Respect of rule of law ▪ Discipline/prosecute

		governance (Lack of respect for institutions/ systems) ▪ Unclear forest boundaries			offenders ▪ Eviction of encroachers ▪ Cancellation of illegal land titles ▪ Re-opening and maintenance of forest boundaries
7	Inadequate funding	▪ Poor priority setting ▪ Budget deficit ▪ Poor governance	▪ Loss of employment ▪ Loss of services	▪ Inadequate forest management and protection	▪ Resource mobilization ▪ Improve Institutional reputation/image ▪ Lobby government for increased budget allocation ▪ Accountability/transparency
8	Hostilities of some communities	▪ Corruption ▪ Nepotism ▪ Scarcity of resources ▪ High demand for forest product and services ▪ Unemployment	▪ Short term and selfish benefits ▪ Loss of life and property	▪ Forest degradation and deforestation ▪ Encroachment ▪ Biodiversity loss	▪ Sensitization ▪ Initiate CFM ▪ Prosecute offenders ▪ Discipline errant staff
9	Invasive species - *Broussonetia papyrifera* (paper mulberry)	▪ Encroachment/ habitat modification ▪ Poor forest management practices	▪ Reduction of preferred species ▪ Increased biomass including fodder	▪ Reduction in biodiversity ▪ Increased forage for wildlife	▪ Control the spread of the invasive species ▪ Putting the species to industrial use.
10	Uncontrolled brick making and sand mining	▪ Demand for building materials ▪ Poor regulation ▪ Poor law	▪ Revenue ▪ Creation of breeding grounds for mosquitoes causing malaria ▪ Causes insecurity	▪ Reduction in biodiversity ▪ Habitat degradation ▪ Loss of forest	▪ Regulate off take levels ▪ Enforce environmental laws ▪ Put in place mitigation measures ▪ Diversify sources of

		enforcement		cover	building materials
11	Unclear forest boundaries	▪ Insufficient funding ▪ Land disputes	▪ Continuous conflicts ▪ Loss of property ▪ Uncertainty over ownership (Cannot develop their own land for fear of eviction)	▪ Encroachment ▪ Loss of biodiversity ▪ Deforestation ▪ Degradation	▪ Open and maintain the boundaries ▪ Erect permanent forest boundary markers (pillars, directional trenches, live markers and cairns) ▪ Community sensitization ▪ Lobby government for funds ▪ Resource mobilization
12	Urbanization	▪ Population increase ▪ Un employment ▪ Creation of more administrative units ▪ Poor planning and governance	▪ Increase proximity to services ▪ Employment	▪ Encroachment ▪ Loss of biodiversity ▪ Deforestation ▪ Degradation ▪ Pollution	▪ Proper planning ▪ Law enforcement ▪ Community sensitization ▪ Creation of employment ▪ Family planning ▪ Provision of alternative energy sources
13	Industrialization	▪ Government policy	▪ Employment ▪ Improved infrastructure ▪ Improved services	▪ Encroachment ▪ Biodiversity Loss ▪ Deforestation ▪ Degradation ▪ Pollution	▪ Proper planning ▪ Respect of law ▪ Good governance ▪ Alternative sources of energy for factory workers
14	Uprooting planted trees	▪ Animal rearing ▪ Community farming ▪ Poor monitoring ▪ Poor tending operations ▪ Infrastructural developments	▪ Land for agriculture ▪ Conflicts	▪ Poor tree establishment ▪ Forest degradation ▪ Biodiversity loss	▪ Community sensitization ▪ Regular forest patrols/protection ▪ Control/eliminate Taungya ▪ Improve monitoring operations ▪ Plan infrastructural developments

					▪ Better management enforcement ▪ Adhere to CFM agreements
15	Forest fires	▪ Drought ▪ Community ▪ Hunters ▪ Herbalists ▪ Natural fires ▪ Malice	▪ Loss of life and property ▪ Loss of benefits (products and services from the forest)	▪ Deforestation ▪ Biodiversity loss ▪ Extinction of certain species	▪ Enforcement ▪ Community sensitization/ training ▪ Forest fire protection (maintenance of fire lines/breaks) ▪ Community tree planting ▪ Controlled early bush burning
16	Diseases and pests	▪ Poor agriculture practices ▪ Poor species selection during planting ▪ Poor silvicultural/ management practices ▪ Climate change ▪ Ignorance ▪ Lack of technical support	▪ Poor yield ▪ Loss of revenue	▪ Decline in productivity ▪ Forest degradation	▪ Provide improved/resistant varieties ▪ Ensure technical guidance ▪ Pests/disease management/control
17	Vermin	▪ Degradation/ Loss of habitat	▪ Crop loss ▪ Loss of life ▪ Loss of revenue ▪ Reduction in time for other economic activities ▪ Increase in the rate of School dropouts	▪ Aid regeneration: seed dispersal ▪ Damage planted seedlings ▪ Forest destruction due to negative attitude of communities	▪ Vermin control ▪ Planting of unpalatable crops

2.5.2 Conflicts and Grievances

There are a number of conflicts and grievances that were identified during stakeholder engagements that were largely to do with forest use and access to resources. Conflict also exists between NFA staff and local community members as well as among the various resources users, over access and rights to resources or the lack of it.

Conflicts among the various stakeholders, especially local communities arise from the denial of access to and competition for the basic resources, especially building poles, timber and firewood. The most common conflicts are given in **Table15** and include conflicts over perception of forest ownership, competing forest uses and uncoordinated land use developments. For instance there exists a conflict between herbal medicine collectors and timber harvesters as the latter cut down the whole tree whereas the former harvest part(s) of the tree leaving it standing for further use. On the other hand Buganda kingdom still perceives the forests as kingdom property.

These conflicts are compounded by mutual suspicion between some NFA staff and local communities that have developed over the years. Some NFA staff see local people as a huge liability on the forest resource through their unsustainable exploitation. The local people on the other hand regard NFA staff as, remorseless workmen whose interest lies solely in managing the forest for revenue collection. In certain cases some NFA staff are accused of abetting illegal forest resource harvesting. The recent deployment of Environment Protection Police Force (EPPF) has not improved community relations with NFA. Communities reported that the EPPF are involved in illegal activities either by conniving with illegal harvesters or directly dealing in illegal forest produce harvesting thereby creating more conflicts of interest in the protection of the CFRs. In addition, there are other conflicts over forest boundaries, revenue/benefit sharing, and selective application of the law by NFA, land ownership and use and legal status of the forest.

Table 15: Conflicts and Grievances in the MPA as identified by stakeholders

Conflict/Grievance	Causes	Recommendations
Perception of ownership(NFA/ NEMA/ LG/Buganda Kingdom)	▪ Unclear policies ▪ Uncoordinated activities among government agencies (e.g. NFA, NEMA)	▪ Policy harmonization ▪ Sensitization on ENR policies ▪ Open and maintain boundaries ▪ Coordination among ENR agencies ▪ Collaboration with Buganda kingdom
Competing forest resource uses (e.g. cultural sites, forest land)	▪ Scarcity of resources ▪ Failure to follow the guidelines ▪ Income inequality ▪ Population pressure ▪ Lawlessness ▪ Poverty ▪ Unemployment ▪ Greed	▪ Provide alternative energy sources e.g. Bio-gas ▪ Sensitization/awareness creation ▪ Improve land productivity ▪ Promote tree growing on farm ▪ Domesticate medicinal trees and craft materials (rattan)
Unplanned / un coordinated development	▪ Political interference ▪ Lawlessness ▪ Failure to follow the guidelines ▪ Corruption ▪ Unclear forest boundaries ▪ Failure to guide communities on land use (out growers use their land for sugarcane and encroach for food production)	▪ Harmonization of the policies ▪ Make strategic plans ▪ Institutional coordination
Poor disposal of industrial effluents/wastes (NFA, NEMA, DLGs community vs SCOUL)	▪ Failure to adhere to regulations by SCOUL ▪ Weak enforcement by NEMA	▪ Coordination between NFA and NEMA ▪ Penalize SCOUL for non-compliance

2.6 Community use of forest products

The National Forestry Policy, 2001 commits Government to work towards *"an integrated forest sector that achieves sustainable increase in economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable"* (GoU, 2001)[1].
Forest reserves are held and protected in trust by the government for the people for the common good of all citizens*[2].

The CFRs are important sources of fuelwood and poles, water for domestic and commercial use (especially for brick making and local beer brewing) and for watering domestic animals. Communities living near wetlands use the water for small-scale irrigation largely for production of vegetables and fruits during the dry seasons. The other products obtained from the CFRs are grass for thatching and mulching, craft materials (papyrus, palm leaves), herbal medicine, mushrooms, fibres, clay, sand, forest food and honey. Hunting for wild meat by a section of people within the communities is one other community use of the forests.

A recent socioeconomic study carried out Joseph Bahati and Associates (2016), for example indicated that 87%, 48%, 25%, 22% of the households living around the CFRs in the MPA, obtained firewood, water, herbal medicine and charcoal respectively either for domestic use or for sale. **Table 16** shows a list of the various forest resources harvested by the communities and their comparative importance.

Table 16: Forest products accessed by households around the CFRs in the MPA

Forest resource	% of HHs that accessed /used	% of HHs that never accessed /used	Unit	Average unit cost (UGX)	Rank[3]
Firewood	87	13	Bundle	2,000	1
Timber	10	90	Piece of length 10-12 feet	18,725	2
Poles	19	81	Pole	1,250	3
Rattan canes	5	95	Bundle	1,500	3
Grass/Thatch	6	94	Bundle	1,250	2
Charcoal	22	78	Sack	20,000	2
Clay (for pottery/brick making)	4	96	Wheelbarrow	7,550	3
Sand	1	99			
Game meat/fish	2	98	Kg	5,000-7,500	2
Water	48	52	Jerry cans	500	1
Climbers (for basket)	4	9	Bundle	500	3
Herbs/herbal medicine	25	75	sack	5000-7100	3
Fruits	11	88	Basket or piece	1858-9,000	4
Wild yams	3	97	Basket	n.a	n.a
Insects	2	98	n.a	n.a	n.a
Others e.g.	1	99	n.a	n.a	n.a

1. Government of Uganda (GoU), 2001: National Forest Policy

[2] Constitution of the Republic of Uganda 1995 (article 237 (2)(b)

[3] *(1=Most frequently obtained; 2=2nd most frequently obtained product etc. Rank only the forest products obtained by the household)*

Forest resource	% of HHs that accessed /used	% of HHs that never accessed /used	Unit	Average unit cost (UGX)	Rank[3]
mushrooms					

na: Data not available

Source: Socio-Economic Baseline Report for Communities around the CFRs in the Mabira Ecosystem, 2016

2.7 Infrastructure

2.7.1 Roads

The MPA is easily accessed from Kampala-Jinja highway, Mukono –Kayunga and Jinja – Kayunga roads. A network of roads maintained by NFA, Ministry of Works, Local Authorities or Tea Estates connects all the Central Forest Reserves. The then FD constructed and maintained Namavundu road through Buwoola, Ssese-Namaganda-Namatogonya to the nature reserve and Namusa-Namanyama road through compartments 206 and 207. The total length of the roads maintained by the then FD was 51 km. NFA formerly maintained 7km Buwoola-Kyabaana-Maligita and 3 km long Waswa – Kito roads but has recently abandoned their maintenance because of being used for transporting illegal forest produce. The 1km stretch of road from Kampala – Jinja highway to Najjembe eco-centre is being maintained by NFA. The forest roads were constructed under the forest canopy and become very difficult to use during rainy seasons that is exacerbated by the nature of forest soils. The roads passing through the reserves maintained by local authorities include Kayunga-Namataba, Najjembe-Buikwe, Nagojje-Nakifuma and Najjembe-Ssese/Namusa, Kiwala-Bubiro-Kyajja, Luwala-Mulange, Buwoola-Sanga, Naluvule-Zintengese and Bulanga-Kalagala that are all feeder roads.

2.7.2 Housing

There are eleven (11) forest stations in the MPA with houses for both office space and staff accommodation. The Sector Manager in charge of Mabira MPA resides at Lwankima station. A Forest Supervisor, Transport Assistant, Patrolmen and security guard, occupies the rest of the houses at this station. In Maligita station, a Forest Supervisor and two patrolmen occupy the houses. A Forest Supervisor and two patrolmen occupy the houses at Nagojje station. Wanende station houses are occupied by one Forest Supervisor and two Patrolmen. The house at Kyabaana is occupied by one patrolman and the others are vacant. At Naluvule, the two houses are occupied by a Forest Supervisor and two patrolmen. The house at Namawanyi is occupied by one patrolman. The two houses at Nandagi station are occupied by one Forest Supervisor and one patrolman. In Najjembe Eco-tourism site, one house is occupied by the in charge of the site and the remaining houses are occupied by tour guides and two night watchmen.

With the exception of houses at Lwankima and Najjembe Eco-tourism, all the houses are dilapidated and need renovation with reconstruction in some stations like Buwoola and Naluvule being inevitable. Staff are living in deplorable conditions and some houses are unfit for human habitation.

The current housing position in the MPA is summarized in **Table 17.**

Table 17: Housing and Accommodation position in the FMP

Station	Built by FD	Built under EU funding	Remarks

	Residence	Office	Store	Kitchen	Residential	Eco – centre	Bandas	Kitchen	
Lwankima	6	1	1	-	-	-	-	-	- 1 timber shed built by NFA - 7 buildings were renovated by NFA
Maligita	1	-	-	-	3	-	-	-	- All buildings need renovation
Nagojje	5	1	-	-	-	-	-	-	- All buildings need renovation
Wanende	-	-	-	-	5	-	-	-	- All buildings need renovation
Najjembe	1	-	-	-	3			-	Good condition
Buwoola	-	-	-	-	2	-	-	-	Need renovation
Kyabaana	-	-	-	-	3	-	-	-	Dilapidated
Naluvule	-	-	-	-	2	-	-	-	Dilapidated
Namawanyi	-	-	-	-	2	-	-	-	Dilapidated
Namulaba	-	-	-	-	5	-	-	-	Dilapidated
Nandagi					2			1	Dilapidated
Total	**13**	**2**	**1**	**-**	**27**	**-**	**-**	**1**	

2.8 Staff and Labour

2.8.1 Staff

Mabira Forest Management Plan Area has a total of 9 staff, (One Sector Manager and eight Forest Supervisors).Other employs are contracted to support the day to day running of the activities in the MPA on monthly basis as detailed in **Table 18**.

Table 18: Staff position in the MPA

S/N	Station	SM*	FS*	PM*	TG*	SG*	OA*	CC*	TA*	CT*
1	Lwankima	01	01	02	-	01	01	01	01	
2	Maligita	-	01	02	-	-	-	-	-	
3	Namawanyi	-	-	01	-	-	-	-	-	
4	Naluvule	-	01	02	-	-	-	-	-	
5	Kyabaana	-	-	01	-	-	-	-	-	
6	Buwoola	-	01	02	-	-	-	-	-	
7	Najjembe	-	-	-	02	02	-	04	-	01
8	Wanende	-	01	02	-	-	-	-	-	-
9	Nandagi	-	01	01	-	-	-	-	-	-
10	Nagojje	-	01	02	-	-	-	-	-	-
11	Namulaba	-	01	02	-	-	-	-	-	-
	Total	**01**	**08**	**17**	**02**	**03**	**01**	**05**	**01**	**01**

SM*Sector Manager; PM* Patrolman; CC* Compound Clearer; TG* Tour guide; CT* Caretaker; FS* Forest Supervisor; SG* Security Guar; TA* Transport Assistant; and OA* Office Attendant

2.8.2 Labour

Labour in the MPA is readily available though most of it is unskilled. Most of the forest fieldwork is executed using contracted groups (CBOs, CFM) or individuals from within the forest edge communities most of whom are unskilled, poor and illiterate. The numbers hired fluctuate depending on the magnitude and nature of work. Patrolmen assist the supervisors especially with forest protection and surveillance. However, there seems to be a problem of ineffective protection that stems from NFA's inadequate budget and inability to recruit skilled forest staff (forest guards & rangers) to protect the forest.

2.9 Revenue and Expenditure

The current expenditure is far more than the income due to the fact that Mabira ecosystem is not managed for timber production only but also as a public good of national, regional and global significance. This therefore calls for external financial support to facilitate the implementation of the FMP.

2.9.1 Revenue

Revenue is generated from various sources in the MPA. These include but not limited to the following: Timber licences for soft and hardwood logs, construction and utility poles, licences for land for tree planting and ecotourism, sale of seeds and seedlings, sand, charcoal, firewood and research fees. Tourism revenue is generated from licensing of private tourism operators as well NFA managed tourism site. Details of revenue collected during the period 2009/10-2015/16 are indicated in **Table 19.**

Table 19: Revenue collection for the period 2009 -2016(UGX)

Description	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	Total
Timber licenses - soft logs	14,215,000	-	-	50,633,701	-	240,000	-	**65,088,701**
Timber licenses - hardwood log	2,758,401	34,802,600	4,460,600	73,355,835	15,274,916	1,900,000	3,360,000	**135,912,352**
Construction poles	660,000	390,000	-	-	-	-	-	**1,050,000**
Utility poles	-	240,000	-	-	-	-	-	**240,000**
Land licenses (tree planting)	408,550	1,690,000	3,423,542	4,065,634	3,563,356	6,257,646	3,780,000	**23,188,728**
Land rent-Telecom masts	235,850	372,500			-			**608,350**
Sale of sand	180,000	487,500		4,550,000	60,000	6,100,000	11,895,000	**23,272,500**
Sale of charcoal	25,000				300,000	224,000		**549,000**
Sale of firewood/Slabs	5,403,000	674,000	440,000	1,680,000	-	1,950,000	2,700,000	**12,847,000**
Sale of milled timber	1,213,724	-	-	-	-	-	-	**1,213,724**
Legal compliance	-	-	-	-	-	-	-	**-**
Sale of seeds	-	-	-	-	-	-	-	**-**
Sale of seedlings	250,000	3,485,000	4,854,000	3,995,500	5,533,200	7,602,750	8,449,600	**34,170,050**
Private ecotourism(License fees)	2,447,500	2,449,000	14,227,154		-		5,848,010	**24,971,664**
Entrance fees (NFA eco-site)	11,485,353	14,752,687	10,731,301	10,355,001	9,319,541	13,190,257	8,374,000	**78,208,140**
Research fees	40,000	-	-	332,000	80,000		80,000	**532,000**
Camping fees(NFA eco-site)	115,000	1,105,000	152,000	38,000	687,000	143,000	165,000	**2,405,000**
Accommodation-bandas (NFA eco-site)	2,810,000	4,518,797	-	-	-	2,487,800	14,033,118	**23,849,715**
Nature walk & bird hike /Guiding(NFA eco-site)	766,619	14,000	3,624,000	10,536,034	2,782,000	675,538	11,676,600	**30,074,791**
TOTALS	**43,013,997**	64,981,084	41,912,597	159,541,705	37,600,013	40,770,991	70,361,328	**458,181,715**

2.9.2 Expenditure

Expenditure was incurred on various forest field activities, salaries and wages, vehicle running costs and other recurrent costs. The annual expenditure in the MPA for the period 2009/10 to 2015/16 is indicated in **Table 20.**

Table 20: Expenditure for period 2009/10 – 2015/16 (UGX)

Description	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	Total
Training	2,534,000	-	-	-	-	-	-	**2,534,000**
Staff subsistence	6,267,000	4,920,000	7,252,000	4,867,500	3,948,000	400,000	2,145,000	**29,799,500**
Salaries	73,200,000	73,200,000	73,200,000	130,956,000	130,956,000	130,956,000	130,956,000	**743,424,000**
Boundary maintenance	8,120,000	-	-	-	-	-	-	**8,120,000**
Forest Management Plans (FMP's	1,856,400	-	-	-	-	-	-	**1,856,400**
Plantation establishment	8,950,000	-	500,000	-	-	-	1,000,000	**10,450,000**
Tending expenses	13,868,140	1,330,000	3,397,500	-	1,400,000	-	6,830,000	**26,825,640**
Affirmative silviculture in natural forest	40,540,000	630,000	-	-	-	-	-	**41,170,000**
Permanent Sample Plots(PSP's)	3,800,000	-	-	-	-	-	-	**3,800,000**
Patrols	21,770,000	20,565,000	20,400,000	22,776,000	26,253,400	18,792,000	16,980,000	**147,536,400**
Forest road maintenance	1,270,000	-	-	-	-	-	-	**1,270,000**
Seedlings / Nursery Expenses	15,379,600	13,828,600	17,572,050	21,949,450	32,664,250	7,483,250	21,295,750	**130,172,950**
Timber Handling	2,025,100	1,328,000	4,550,000	50,000		-	250,000	**8,203,100**
Law enforcement	1,345,000	3,209,900	130,000	2,936,700	3,642,000	2,825,000	28,261,250	**42,349,850**
Intelligence Gathering	150,000	-	-	-	-	-	-	**150,000**
Casual Labour	6,934,300	8,000,000	11,393,900	8,768,000	7,200,000	4,710,000	320,000	**47,326,200**
Water	-	-			59,322	-	807,958	**867,280**
Electricity	669,916	283,458	648,945	212,929	245,332	296,747	708,041	**3,065,368**
Office & computer stationery	-	-	609,000	41,000	-	-	1,369,000	**2,019,000**
Telephone/fax	193,000	-	-	-	-	-	140,000	**333,000**
Vehicle/Motorcycle- fuel, oil & gr	2,215,972	2,611,060	3,086,000	1,380,500	2,492,000	8,217,206	5,219,500	**25,222,238**
Vehicle/Motorcycle- Repairs & main	3,108,500	4,677,540	600,000	-	-	2,360,000	535,000	**11,281,040**
Repairs- Buildings	-	-	1,552,600	4,230,600	-	-	2,575,000	**8,358,200**
Community Grants & Collaboration	-	200,000	-	1,655,000	-	800,000	-	**2,655,000**
Office rent	60,000	110,000	-		-	800,000	900,000	**1,870,000**
Compound maintenance	1,810,000	510,000	1,320,000	1,320,000	1,320,000	1,870,000	1,860,000	**10,010,000**
Office supplies	1,385,300	110,000	-	192,000	-	-	1,255,000	**2,942,300**
Workshop/meetings	5,542,000	200,000	-	-	-	351,000	4,955,000	**11,048,000**
Security services	2,405,000	850,000	1,560,000	1,560,000	1,560,000	2,460,000	6,920,000	**17,315,000**
Total	**225,399,228**	**136,563,558**	**147,771,995**	**202,895,679**	**211,740,304**	**182,321,203**	**235,282,499**	**1,341,974,466**

Pictures of some threats to the forests in Mabira MPA

Charcoal burning in Namananga CFR

Pure stand of Broussonetia papyrifera in Namawanyi CFR

CHAPTER 3: ENVIRONMENTAL CONSIDERATIONS

3.1 Biodiversity status

According to the biodiversity inventory report on the 65 CFRs in Uganda, Mabira CFR does not rank high it terms of overall biodiversity. The forest is ranked 24th (score=13.1), but ranks 19th in terms of the rarity value of species represented. The forest supports 9 species found in no other forest in Uganda (including 6 butterfly species, 1 moth species, 1 bird species, and 1 tree species) and one species endemic to Uganda. It presents the only block of medium altitude moist semi-deciduous forest type D1 (Langdale-Brown et al., 1964) in the protected area system, a vegetation type that does not occur in any of the country's National Parks or Wildlife Reserves. **Table 21** gives the details.

Table21: Biodiversity assessment report of Mabira CFR

Criteria	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No of species known	312	287	23	199	97	
No. of restricted range species (Y 5 forests)	9	37	-	27	7	
Species unique for forest (list)	*Caesalpinia volkensii*	Tit Hylia	None	*Epitolacatuna Pseudathymaplutonica Neptistrigonophora Sallya natalensis Acraearogersi Caenidesdacena*	*Orthogonioptilum* sp.	9 spp
Uganda endemics (list)	None	none	*Crociduraselina*			4 spp
Albertine Rift endemics (list)	*Grewia pubescens*	none	None	None	None	1 spp
Species diversity (score and rank)	6.5 (26=)	6.5 (24=)	5.4 (4.0)	6.9 (25=)	5.8 (30=)	6.4(22=)
Species rarity value (Score & rank)	7.2 (29=)	6.6 (14=)	5.4 (22=)	5.6 (15=)	6.8 (+5=)	6.7(19=)

Overall biodiversity score 13

However, the ecological study carried out during the update of this FMP (2016) indicates that overall, there has been an increase in the number of indicator taxa since the last biodiversity survey of 1996.

Plants

The total number of plant species now known from the Mabira Forest Reserve is 636. See **Table 22** for details. The trees, shrubs and climbers (woody plants) contribute 450 species (312 were recorded in the previous Forest Department Biodiversity inventory in the 1990s while 138 are new additions from this work). The herbs contribute 186 species. The rest of the reserves have fewer species: 87 (Namakupa), 92 (Namawanyi), 139 (Nandagi) and 68 (Kalagala), and 68 (Namananga). In the case of Mabira Forest Reserve, the climbers and herbaceous species were previously not included, and also data for the smaller forest reserves are here newly presented in this report. Inclusion of data from the five smaller reserves (Namakupa, Namawanyi, Nandagi, Kalagala and Namananga) gives a total of 732 species recorded from the Mabira ecosystem (this includes 252 species of herbs and 480 woody species). Data on Epiphytes, Mistletoes and Stranglers and other non-vascular taxa such as Bryophytes, Licherns and Fungi are required to enhance the knowledge.

Table 22: Number of plant species recorded in the CFRs in the MPA

Plant form	Mabira	Kalagala	Namakupa	Namananga	Namawanyi	Nandagi
Woody species	450	31	60	38	61	85
Herbaceous species	186	37	27	30	31	54
Totals	**636**	**68**	**87**	**68**	**92**	**139**

Two of the grasses are uncommon in Uganda; *Isachne mauritianum*, a species of forest clearings known only from four other forests namely, Kashyoha-Kitomi, Bwindi Impenetrable, Rwenzori and Mpanga. The wild species of rice, *Oryza eichingeri*, is also uncommon in Uganda and is known from four other forests namely, Zoka, Semuliki, Maramagambo and Budongo.

Table 22b. IUCN Redlisted woody plant species in the Mabira Forest Reserves

Species	National threat status	Global threat status	Mbr	Ndg	Kgl	Nmg	Nwy	Nkp
Entandrophragma angolense	EN	VU	1	1				
E. cylindrica	EN	VU	1					
E. utile	EN	VU	1					
Lovoa swynnertonii	EN	NT	1					
L. trichilioides	EN	VU	1					
Beilschmiedia ugandensis	VU	VU	1					
Calamus deeratus	VU	NE	1					
Cordia millenii	EN	LC	1					
Milicia excelsa	EN	NT	1		1	1		
Warburgia ugandensis	VU	NE	1					
Albizia ferruginea	EN	VU	1					
Chrysophyllum albidum	VU	NE	1					1
C. muerense	VU	NE	1					
C. perpulchrum	VU	NE	1					
Erythrophleum suaveolens	VU	NE	1					
Mondia whytei	VU	NE	1			1	1	
Prunus africana	VU	VU	1	1				
Citropsis articulata	VU	NE	1			1	1	
Fagaropsis angolensis	VU	NE	1			1		
Olea welwitschii	VU	NE	1				1	
Khaya anthotheca	EN	VU	1					

Mbr = Mabira, Ndg = Nandagi, Kgl = Kalagala, Nmg = Namananga, Nwy = Namawanyi, Nkp = Namakupa

EN = Endangered, VU = Vulnerable, NT = Near Threatened, NE = Not Evaluated

Two species of ground orchids were recorded; the fairly common *Corymborkis corymbis* and *Zeuxine elongata.* Orchids are a CITES protected group of plants. The invasive Mimosa pudica has also been recorded for Mabira. This species needs to be observed to monitor if it spreads further into the forest. Factors like forest clearing can hasten the spread of alien invasive species, as they are usually heavy seeders that will quickly colonize disturbed areas. Other potentially invasive species found in Mabira are *Ricinus communis* and *Nicotiana tabaccum*. The woody plants include some red listed species such as the Mahoganies (*Entandrophragma angolense*, *Entandrophragma cylindricum*, and *Entandrophragma utile*. Others include *Prunus africana*, *Warbugia ugandensis* and *Milicia excelsa*. In total, 21 of the woody species are of conservation concern and are distributed in the different forests in the ecosystem as shown in Table 3.2. None of the herbs is IUCN Redlisted.

The following introduced species are recorded in the study sites: *Brousonetia payrifera, Lantana camara*, *Senna hirsuta*, *Capiscum frutescens*, *Carica papaya*, *Coffea arabica*, *Musa sapientum*, *Passiflora edulis*, *Solanum mauritianum*, *Terminalia superba*, *Thevetia peruviana* and *Artocarpus heterophyllus*. The first two of these species are invasive in Uganda with *B. papyrifera* dominating the small reserves.

Birds

A total of 154 species was recorded across the whole survey, 97 in Mabira Central Forest Reserve and 100 in the five small reserves. The results show that there were more bird species in the main forest than the five small reserves combined. There was little overlap between the surveyed forest sites, with 54 species unique to the Mabira CFR, 58 species unique to the five small CFRs and 42 species occurring in both forests. Most of the bird species recorded during the surveys are classified as "Least Concern" according to the IUCN redlist criteria. Seven of the species recorded are classified as threatened either at global or regional level. These include the Nahan's Francolin, Grey Parrot, Cinnamon-chested Bee-eater, White headed saw-wing, Toro Olive-Greenbul, White-browed Crombec and Green tailed Bristlebill. There were more forest visitors and other non-forest bird species recorded in the small CFRs than in the main forest block. Forest related bird species (FF & F) were much more in the main forest than in the small CFRs. **Table 23** gives the number of bird species recorded in the different forest reserves of the Mabira ecosystem

Table 23: Number of bird species recorded in the different forest reserves of the Mabira Forest Ecosystem

Forest	Sampling site	Number of species
Mabira CFR	Eco-centre-Najjembe north	56
	Buwola Trail	30
	Nature Reserve	52
	Musamya Trail	38
	Najjembe south	43
Small CFRs	Kalagala	42
	Namukupa	63
	Namananga	56
	Namawanyi	41
	Nandagi	33

Source: Ecological Baseline Report for Mabira Ecosystem 2016

Mammals

The small mammals constitute 22 species (5 shrews and 17 rodents). An additional 9 species are added to these, from records, to make 31 known species. Three closed forest dependent species

Deomys ferrugineus, Malacomys longipes and *Scutisorex somereni* were recorded albeit in small numbers. A forest dependent species, *Deomys ferugineus* was captured in Namananga and Namakupa forests that have previously been encroached and opened up. In total 12 species of bats were captured with more species captured in Namananga, although historical records available show Mabira CFR to have a higher number of species. A total of 22 medium to large sized mammal species were also recorded for the 6 forests all together. Mabira CFR has the richest number of species compared to the rest.

Butterflies

All together 207 species of butterflies were recorded -114 species in Mabira, 64 in Namukupa, 63 in Namananga, 82 Nandagi, 45 in Namawanyi, and 54 in Kalagala (See **Table 24)**. A reasonably high proportion of forest dependent species was found in all the forests although Mabira CFR had the largest number of such species. Kalagala and Namananga had the highest proportion of more open environment species, which would symbolize the heavy level of impact by humans opening up these forests.

Table 24: Distribution of butterfly species in the six forest reserves

Forest	Mabira	Nandagi	Namananga	Namukupa	Namawanyi	Kalagala
No of species	114	82	63	64	45	54

Source: Ecological Baseline Report for Mabira Ecosystem, 2016

Amphibians and Reptiles

Up to 42 species of amphibiansi n 13 genera and 9 families were recorded. They belong to the Order Anura. The family Hyperoliidae had the highest number of genera (3) and species (11), See **Table 25**. The water-confined families of Dicroglossidae, Hemisotidae, Pyxicephalidae and Pipidae were represented by single species. A total of 32 reptile species belonging to 4 orders, 13 families and 23 genera was recorded.

Table 25: Amphibian species richness by families and genera for the Mabira ecosystem

Family	**Number of genera**	**Number of species**
Dicroglossidae	1	1
Hemisotidae	1	1
Pyxicephalidae	1	1
Pipidae	1	3
Phrynobatrachidea	1	3
Bufonidae	1	4
Arthroleptidae	2	7
Ranidae	2	7
Hyperoliidae	3	11
Total	**13**	**38**

Source: Ecological Baseline Report for Mabira Ecosystem 2016

3.2 Ecological functions

3.2.1 Watershed protection

Mabira CFRs are a major watershed forests. In the western block, River Sezibwa flows through Mabira CFR to Lake Kyoga with many tributaries including Wolekekata, Kasala, Luzibwe, Katogo, Nakasagazi, Namamiya, Kinyanyo, Kizibigi, Nyansa, Mayanja, Lulimba, Mulungu, Waluke, Wakisu, Namokomo, Wabuyimba, Nakalasa, Jugula, Kasininya, and Musamya. In the eastern block, rivers Waliga, Kasate, Nakwanga, Kitigoma, Nakyeyedo, Balunginjuku, Kyetinda, Buwoola, Nkuse and Mabugwe flow to River Nile. The forests play a very important role in maintaining the dry season flow that is attributed to the greater wetness of the soils in, and the higher water table under the forest.

Apart from the maintenance of even stream flow, the water is also made cleaner due to the forest soils being highly permeable, allowing the seepage of water through the sub soil and the underlying rock during which process particulate matters in the water is removed.

This group of forests is an important environmental asset to the neighboring communities, districts and nation as a whole in mitigating climatic conditions. The forest is vital in soil stabilization, and rivers flowing through form a network as part of the hydrological system in drainage and agricultural production.

3.2.2 Carbon Sequestration

Forests and other natural vegetation in Mabira Ecosystem absorb carbon dioxide and other gaseous emissions such as nitrogen oxide mainly generated from Kampala, Jinja, Mukono and Lugazi towns. It is estimated that Mabira Central Forest Reserve absorbs approximately 550 tones/ha of carbon. Therefore the biomass CFRs in the MPA have locked up an estimated 17,211,150 tons of carbon.

Emerton & Muramira (1999) and Bush *et al* (2004) give the following carbon storage values for different vegetation types: primary closed forest UGX 54,660/ha/year; degraded forest UGX 32,538/ha/year; and woodland, bush land and grassland UGX 2,603/ha/year. Therefore the value of carbon stored in the FMP is estimated to be UGX 940,761,459,000.

3.2.3 Other ecological services

The forests also provide other ecological services such as;

- Maintenance of soil quality and provision of organic materials through leaf and branch fall
- Nutrient cycling and soil formation
- Control of erosion and protection of soil from the direct impact of rainfall
- Modulating climate
- Provides habitat for many plants and animals

3.3 Wetlands, Rivers and Streams

3.3.1 Wetlands

There are numerous wetlands in the CFRs in the MPA, which perform wetland functions such as water cleaning and storage, habitat for wildlife and provision of wetland products and other services.

3.3.2 Rivers/ stream banks

The CFRs in the MPA protect the banks of River Sezibwa and its tributaries including Wolekekata, Kasala, Luzibwe, Katogo, Nakasagazi, Namamiya, Kinyanyo, Kizibigi, Nyansa, Mayanja, Lulimba, Mulungu, Waluke, Wakisu, Namokomo, Wabuyimba, Nakalasa, Jugula, Kasininya, and Musamya; rivers Waliga, Kasate, Nakwanga, Kitigoma, Nakyeyedo, Balunginjuku, Kyetinda, Buwoola, Nkuse and Mabugwe which flow to River Nile whose banks are protected by Kalagala falls CFR. These forests protect the rivers from erosion and silting while at the same time preventing floods by regulating water run-off.

3.4 Vulnerable/ecologically fragile areas.

The CFRs are important in protecting the steep sides of the hills located within the MPA such as Dangala, Namusa, Ntunda, Wankobe and many others all which rise to about 1340 meters above sea level (a.s.l), the highest being Najjembe Hill at 1356 meters a.s.l.by stabilising the soils. They also protect the wide shallow valleys occupied by swamps from erosion and siltation.

3.5 Socio- cultural sites

Many people have strong cultural and spiritual attachments to the forests within the MPA. The presence of rich indigenous knowledge among the local people is testimony of how local people understand and use the forest resources. Thus indigenous belief systems have a major protective role in a culture's relationships with the forests and in nature's relationship with a culture.

There are a number of cultural and spiritual sites within the MPA to which local people attach value for healing purposes and making sacrifices to their gods. These cultural assets are used in the various ways, including the following:

i. source of peace and stability in Buganda and the country at large
ii. cleansing purposes and source of blessings and wealth
iii. hosting spiritual ceremonies for crowning the Buganda kings (Kabakas)
iv. source of herbal and medicinal tree and plant
v. fore castings and foretelling including doom, famine, invasion, disasters, etc
vi. hosting a variety of monument trees for the past kings
vii. hosting the remains for the Mutesa II palace
viii. cultural heritage
ix. source of sustainable socio-economic benefits through development of cultural tourism
x. used by schools, universities, Ugandans for aesthetic, educational, ecological and environmental research and values. (MWE-Kalagala Offset Sustainable Management Plan 2010-2019*)*

Some of these sites include: Buwoola hills, Kirugu, Namaganda hills, Nakalanga caves, Maligita hills and Kiwaala which are located in Mabira CFR. The cultural assets found in Kalagala Falls CFR include the following as shown in **Figure 4**:

- ✓ Bwene worship rock dwelling the spirits that crown Buganda's Kabakas
- ✓ The boulders (large rocks) dwells the 3 spirits for Buganda, Busoga and Bunyoro.
- ✓ Kabaka Wabakabaka worship rock inhabiting the King of Buganda spirits
- ✓ Riverside worship cave inhabits Ssalongo the caretaker for all the Buganda spirits
- ✓ Mwariro worship rocks for the Kabakas, Buganda men, women and Balongo
- ✓ Abatonde worship rock

- ✓ Abazale worship rock
- ✓ Ababumbe worship rock
- ✓ Obukilo worship rock
- ✓ Embuga ya Benne Musaka worship rock
- ✓ Rwego worship rock specifically for cleansing and blessings
- ✓ Nnabuzana worship rock for safety of children
- ✓ Kiwanuka worship rock for men blessings
- ✓ Nabawanuka worship rock for women blessings
- ✓ Embuga worship rocks for Musisi, Ddungu, Omutonzi and Kitinda
- ✓ The Kwoto "worshiping shrine" erected by the Balangira clan.
- ✓ Kinabiro kya Mukasa worship rock
- ✓ Ekikono kya Mukasa worship rock
- ✓ Namulondo ya Mukasa inhabiting in worship rocks and ceremonial trees
- ✓ Embuga ya Nakibinga worship rock for initiation and blessings
- ✓ Mutabazi worship rock for defense and security
- ✓ Mukyala Namirembe worship rock for peace
- ✓ Lubowa and Nalubowa spirits dwelling in rocks, ceremonial trees and natural habitats
- ✓ Kinene and Nabinene spirits dwelling in rocks, ceremonial trees and natural habitats
- ✓ Musoke and Namusoke cultural spirits dwelling in worship rocks and caves
- ✓ Tree and plant species with herbal and medicinal values

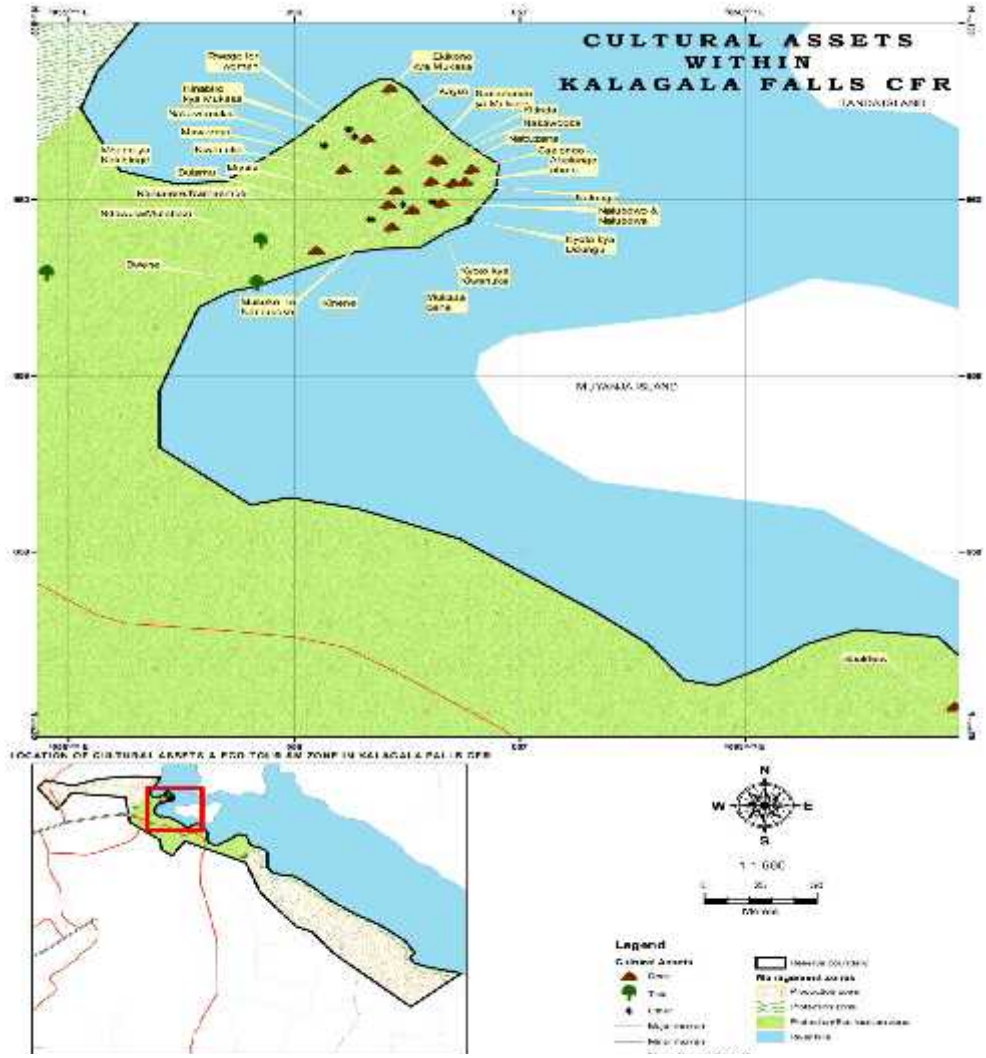


Figure 4: Map showing location of cultural resources within Kalagala falls CFR (Source; MWE-Kalagala offset sustainable management plan 2010-2019)

3.6 Emerging Issues

3.6.1 Climate Change

For most Ugandans, climate change is a matter of survival. Their livelihoods depend on agriculture, which in here is used to include cropping systems, livestock, fisheries and forestry. The agriculture sector is a major source of food, raw materials, employment, and income. It also provides a base for a variety of manufacturing and processing. Therefore climate change is likely to mean increased food insecurity; shifts in the spread of diseases like malaria; soil erosion and land degradation; flood damage to infrastructure and settlements and shifts in the productivity of agricultural and natural resources.

As the effects of climate change continue to bite, the forest edge and communities resort to the forest as a safety net thereby piling more pressure on the already stressed forest resources.

Other potential impacts of climate change on forests include;

- Extensive tree loss due to extreme events e.g wind storms and flooding
- Increasing occurrence, intensity and extent of fires affecting native forest species and possibly accelerating the spread of invasive species

- Changes in growth rates, species composition and regeneration
- Vulnerability of wildlife species with highly specialized habitats and food requirements and flora with narrow habitat ranges. While some species can migrate or spread to new habitats, for others, suitable habitats may be eliminated resulting in loss of these species in the wild.
- Shifts in the reproductive and behavioral traits of flora and fauna as a result of changes in temperature and seasonal patterns (USAID, 2012)

Forests and trees act as sinks for greenhouse gas emissions, and are the most visible frontline assets available for the MPA for mitigation of climate change effects. Therefore, tree growing and sustainable management of natural forests will not only enable the MPA to make its due contribution to the fight against climate change through CDM and REDD+ initiatives, but it will also bring in income to NFA and private tree growers who manage their forests according to SFM standards.

REDD+ is one of the tools that can be used to conserve Uganda's forests while promoting sustainable development. Through REDD+, the government can put in place a set of policies, strategies, positive incentives and practices to simultaneously reduce greenhouse gas emissions; reverse the trend of deforestation and forest degradation; and achieve sustainable development. Uganda's conditional pledges regarding the forestry sector are set out in its Intended Nationally Determined Contribution, 2015 (INDC) – reverse deforestation trend to increase forest cover to 21% in 2030, from approximately 14% in 2013, through forest protection, afforestation and sustainable biomass production measures (MWE, 2016).

NFA's efforts to promote forestry production and productivity has a comparative advantage of mitigating climate variability and climate change while at the same time improving on food security, reducing rural unemployment and rural poverty by modifying the climate which in turn positively affects agricultural production which is the main source of livelihood in the country. For climate change mitigation, Uganda's focus is on implementation of a series of policies and measures in the energy supply, forestry and wetland sectors. Despite the fact that forestry is being affected by climate variability/change impacts, its destruction also contributes to GHG emissions.

Because forests capture carbon through photosynthesis in terrestrial ecosystems, they have very high potential for reducing emissions and enhancing carbon sinks. It is estimated that the biophysical mitigation potential of forestry averages to 1.5 GtCeqv. /yr (5.4 Gt CO_2eqv./yr, IPCC 2001) without the realization of a substantial part of this mitigation. Therefore, finding an efficient mix of mitigation and adaptation solutions through forestry development should be a priority policy issue.

FAO submission to UNFCCC in 2009 noted that —Perhaps no sectors other than agriculture, forestry and fisheries have the potential to contribute so directly to the provisions of Article 2 of the United Nations Framework Convention on Climate Change (UNFCCC): the ultimate objective of the Convention is stabilization of GHG concentrations in the atmosphere at a level which ensures that food production is not threatened and enables economic development to proceed in a sustainable manner.

In Uganda, climate change and increased weather variability has recently been observed and is manifested in the increase in frequency and intensity of weather extremes including unusually high temperatures leading to prolonged droughts, erratic rainfall patterns and lowering of the water table. Consequently, this has led to an increase in disasters related to hydro-meteorological hazards including drought, floods, tropical storms, wildfires, siltation, soil erosion and frequent incidences of thunderstorms, lightening and hailstorms. WWF-World Wide Fund for Nature, 2006)

The Mabira forest ecosystem contributes to stabilizing climate, especially through absorption of carbon dioxide (CO_2) from the atmosphere. Although there is no statistical data as to what extent the Mabira

ecosystem has played in carbon sequestration, there is no doubt that forests absorb a lot of gas emissions (CO_2) from the atmosphere. According to the current management plan for Mabira Central Forest Reserves (Mabira, Nandagi, Namukupa, Namawanyi/Namananga & Kalagala falls -2009-2019), it is estimated that 1 ha of THF can absorb 550-tons/ha/of carbon. Mabira ecosystem with an area of natural forest of 31,293 ha, will absorb at least 17,211,150 tons of carbon in the whole MPA.

The high rate of deforestation and forest degradation in the country implies that if nothing is done, Uganda may lose her natural forests by the end of this century. This will be very expensive because the consequences of deforestation are many; and include: desertification, loss of biodiversity, erosion of gene pools, increase vulnerability of local communities to climate extremes, and reduction of livelihood assets for rural communities. Dry conditions and prolonged droughts frequently lead to outbreaks of fire that degrade forests resulting to serious environmental consequences. Similarly, increased electricity tariffs leads to increased demand for firewood and charcoal, which in turn leads to increased deforestation, soil erosion, damage to vital watersheds, flooding and silting of rivers and lakes.
Notwithstanding the unrepresentative statistics of the contribution of forests to the development of Uganda, the impacts of climate change and climate change-induced activities will directly and indirectly reduce the contribution of the sector to Uganda's development. Reduction in forest products such as timber, poles and fuel (direct) and services such as habitat, agricultural productivity and watershed protection, will lead to reduction of the contribution of forests to the development of Uganda.

Forests play a very important role in the social and economic development of Uganda because of their products (timber, poles, medicine and firewood) and services (habitat for other diversity, moderating of micro climate, shade and enhancing productivity). Forests could also provide a sustainable source of power. Dry conditions and prolonged droughts create conducive conditions for spread of wild fires thus destroying forests with serious consequences. Increased population growth has also led to increased deforestation because of increased demand for food and fuel. Firewood provides 95% of Uganda's energy needs. Increased electricity tariffs lead to increased demand for fuel wood and charcoal, leading to increased soil erosion, damage to vital watershed, flooding and silting of rivers and lakes.

Climate change induced changes are likely to affect forests and wildlife in various ways. The impacts manifest through a number of extrinsic and intrinsic reactions. In wildlife, extrinsic behaviour involves movement to hostile environment in search of food and water. Intrinsic manifestations involve imbalance in physiology leading to phenomena, such as reduced immunity and also hormonal imbalance giving rise to disruption in reproduction.

Extreme weather and climatic events such as windstorms and flooding can destroy and kill trees on a massive scale as observed in Bwindi Impenetrable National Park (BINP). However, trees and forests, on the other hand, are generally resilient and respond to the impacts of climate change very slowly and insidiously. To illustrate this, a genuine climate-induced shift in phenology of leafing, flowering and fruiting of forest trees may not be attributed to climate change since such a phenomenon can easily be fitted into natural cyclical patterns. Watson (2001) stated this dilemma succinctly: climate change may lead to conditions unsuitable for the establishment of key species but the slow and delayed response of long-lived plants hide the importance of the change until the already established individuals die or are killed in a disturbance.

Similarly, unlike the animals, migration of trees and plants to trek environmental shifts induced by climate changes, in general, is seriously curtailed. Watson (2001) noted that fossil records indicate that the maximum rate at which most plant species have migrated in the past is about 1 km per year. Known constraints imposed by the dispersal process (e.g. the mean period between germination and the production of seeds, and the mean distance that an individual seed can travel) suggest that, without

human intervention, many species would not be able to keep up with the rate of movement of their preferred climatic niche projected for the 21st century, even if there were no barriers to their movement. The heavy cutting and burning of the forest cover contributed to land and soil degradation. This practice over the years has created fertile grounds for susceptibility to climate change the fragile ecosystems (cattle corridor) and highlands. In such fragile ecosystems, deforesting and/or degrading forests predispose poor communities to climate change disasters (e.g. landslides), exacerbate the severity of some disasters (e.g. floods and windstorm) and trigger a downward spiral of food insecurity and its consequences.

The disappearance of medicinal plant species was consistently reported. This is serious because a large proportion of the rural population depends on direct herbal medicine to treat a wide range of ailments. The disappearance is mainly related to changes in the ecosystems, land degradation and unsustainable use. The loss of herbal plants was most prominent in highland ecosystems (Climate Change Uganda National Adaptation Programmes of Action, 2007).

In order to cope with some of the effects of climate change, communities living adjacent to the CFRs have developed strategies some of which include the following:

- Use of herbal medicines to treat common ailments such as malaria, diarrhea, wounds, worms, skin diseases, eye infections and coughs. The increasing costs of malaria drugs, coupled with resistance to malaria drugs has increased and spread the use of herbal medicine to cope with malaria epidemics.
- Engagement in alternative income generating options to crop cultivation and livestock rearing such as charcoal burning, brick making, craft making and boda boda cycling.
- Consumption of forest foods such as wild yams, *mulondo, matungulu*, honey, mushrooms and wild fruits
- Increased exploitation of forest and wildlife resources. The CFRs are sources of diverse products (e.g. wood, craft materials, medicine and foods) and services (microclimate moderation, sanitation, and water catchments). With increasing stress, exploitation of these resources is increasing.
- Bush burning is done by livestock farmers to improve pastures and by hunters to trap wildlife.
- Intensify forest patrols during periods of climatic stress when community dependence on the forests increases.

3.6.2 Gender and Equity

Use, Access and Control of Forests

Whereas forests in the MPA benefit both men and women (including the youth, vulnerable and disabled) in terms of food security, income, health, connection with nature, rituals, good health, courtship and recreation, minerals and water catchment, women and men often have different types of relationships with natural resources due to the gender division of labour and socio- cultural factors and are affected differently when these resources decline. There is gender differentiation in use, access and control of forest resources. Men and women obtain different resources from the forest and benefit differently from forest ecosystems. However, there are some resources such as wild fruits, white ants, vegetables and mushrooms that are used by both women and men while some benefits such as fuel, food, beauty, and health are more applicable to women than for men.

Governance constraints

Women face some constraints relating to forest governance such as limited access to forest resources and the fact that women only access the edges of the forest while men can access deeper ends of the forest for resource harvesting. Women have to be accompanied to get deeper into the forest even if they are professionals or academics working in the forest; the women harvest resources for meeting

basic household needs like; firewood, herbal medicine, and craft materials and on a small scale thatching materials (mainly non-cash items). Men on the other hand harvest cash items like; timber, charcoal and building poles. Participation for women is constrained by cultural expectations, stereotypes and time constraints due to heavy workload. The land tenure favours men while women are considered part of men's property and therefore with limited/ or no control over forest resources. Generally, in the MPA, men predominantly do forest use and management.
Limited participation in forestry management committees, control of productive resources such as land, income and sharing benefits from forest resources by men are the main key issues affecting women's access and control of forests. Women get more non-cash benefits that are enjoyed by the entire family although there may be differences among the educated and the rural uneducated women. Also, in a patriarchal society like Uganda where men inherit land and women only access land, the culture dictates the access to other resources that are found on the land such as forests.

Women's roles in the family as food providers, health care givers with the primary responsibilities of household maintenance makes them the primary forest users for supplementary foods, medicinal plants, craft materials, building materials with a critical stake. Forest loss then would have a gender-differentiated impact. Women will be affected mainly by the extinction of traditional medicinal plants, loss of herbs, extinction of some food varieties, change of diet as indigenous food disappear, increasing diseases like diarrhea which will increase their workload as they are the primary caretakers, loss of wind breakers running down houses, long distances travelled to collect firewood and generally, insecurity for women and girls. Loss of social ties in the community, reduced rains may result into longer distances travelled to collect water, health hazards as a result of carrying heavy containers, etc.
Women may be vulnerable to climate change but they are also critical agents of change. Therefore there is need to ensure that women, youth, disabled and the vulnerable are actively involved in the sustainable management of forests in the MPA, including taking up leadership positions in collaborative forest management groups among others. As key stakeholders, they should also be actively involved in all alternative livelihood projects that will be initiated and promoted in and around the CFRs to reduce human induced pressure on the forests.

CHAPTER4: HISTORY OF MANAGEMENT

4.0 General

Prior to gazettement, forests in the MPA were managed under the 1900 Buganda agreement and since the population was still small, there was no pressure on the reserves and as such, there was no management plan until after the Second World War when the first management plan was written.
Mabira, Namukupa and Nandagi were under the South Mengo forest management plans which covered a total of 85 reserves of varying sizes, the smallest being 2.4ha and the largest, Mabira FR, 29,985ha. Administratively, the forests were divided into two groups, the East Mengo and West Mengo groups. Mabira, Namukupa and Nandagi FRs were grouped under East Mengo in the 1948-57 and 1961-1971 management plans. (The 1948-1957 management plan-Sangster)

4.1 The 1948-1957 Management Plan (Sangster)

4.1.1 Management objectives

The objectives of management were to produce in perpetuity the maximum quantity of timber from the forest by the most efficient methods, provided that the satisfaction of the needs of the inhabitants of Uganda took precedence over export considerations.

4.1.2 Yield Control and Harvesting

In Mabira forest reserve, the Annual Allowable Cut (AAC) was first fixed at 4,323.6m^3 of *compulsory species*. However, as a result of enumeration and surveys carried out between 1947 and 1951, a change of the felling cycle from the first cycle of 67 years and a second one of 33 years to one of 30 years, the AAC was increased to 7,566.3m^3. Unlimited quantities of non-compulsory species could also be removed from the forest and this consisted mainly of *Celtis spp*.

In 1952 an exclusive licence was granted to Sikh Saw millers& Ginners Ltd to harvest timber from Mabira Forest Reserve. Felling started in 1953 and was systematic and well controlled. Between 1953 and 1958, a total of 46,758.8m^3 was removed from an area of 2,760.3ha giving an average yield of 16.9m^3 per ha. From 1959 to 1960, a total of 22,843.1m^3 was removed from an area of 681.5ha giving an average yield of 33.5m^3 per ha.

In 1959, the licensee commissioned a plywood factory as a result of which their round wood requirement increased. The AAC was therefore raised from 7566.3m^3 to 9,241.7m^3. In spite of the increase the licensee's requirements were not fulfilled.

4.1.3 Silviculture

Between 1948 and 1954, silvicultural treatment of the forest was based on artificial regeneration (compensatory planting). Species planted were *Khaya anthotheca, Entandrophragma spp, Milicia spp* and *Lovoa spp* using large striplings 1.5-2.1m height. Artificial regeneration was stopped in 1954 when the silvicultural research section of the FD indicated there was enough natural regeneration.

In order to promote the best conditions for the growth of natural regeneration, post exploitation treatments of the forest began in 1955. These consisted of refining the forest by spraying the bark of "weed trees" with hormonal arboricide Finopal DT mixed with diesel oil. At that time, it was prescribed that the forest

would be worked on a selection system with a felling cycle of 30 years. However, subsequent studies indicated that such a system would not give the required yield due to frequent felling damage and the inability of the species to achieve maximum growth rates under the shade conditions of the selection system. The selection system was, therefore, abandoned in 1957 in favour of uniform system.

4.1.4 Encroachment

There was no significant encroachment in Mabira CFR during the period of the management plan. Encroachment began surfacing in 1953 when the "Mbwa" fly (*Simulium*) disappeared due to treatment of River Nile with insecticides.

The working plan was not revised on schedule but was extended several times until the 1961-71 was prepared in 1960 and approved in 1961.

4.2 The 1961-1971 Working Plan (Webster G)

4.2.1 Management objectives

The management objective was the same as the one of the previous plan (1948-1957). The plan prescribed one working cycle, the production working cycle consisting of a nature reserve, research plots and a pure production area. The nature reserve of 259ha was to be established in the forest and there were already 16 research plots. The forest was divided into 65 compartments of 259-518ha numbered 171-235.

4.2.2 Yield Control and Harvesting

The rotation for straight conversion to the uniform system was 60years, but in order to remove senescent stock in the forests, a conversion system of 40 years was prescribed and remained in force up to 1982.

The AAC of compulsory species was fixed at 11,313.5m^3 per year plus unlimited quantities of “optional species”. The Asian owners of the sawmill were expelled in 1972 from Uganda and the sawmill was taken over by the defunct Wood Industries Corporation (WICO). Neither Sikh Sawmill and Ginners nor WICO ever removed the maximum AAC.

The Lukiko Forest Officer was to prepare an Annual programme of works, for controlling operations to be done. A copy was filed with each master copy of the working plan. No deviations from work plans were allowed without approval of the Chief Conservator of Forests.

4.2.3 Silviculture

Results of timber stand improvement (TSI) research carried out at Mpanga Forest showed that it was possible to promote growth and advancement of natural regeneration of most natural forest tree species provided that:-

(i) Harvesting of mature timber trees was carefully carried out causing minimum damage
(ii) All trees of the then un merchantable species down to 10cm dbh were “weeded” out to make the canopy of the remaining trees as open as possible to allow light to reach the forest floor so as to promote growth of seedlings and advance growth.

The objective of the silvicultural treatment carried out after harvesting was to promote the rapid growth of trees belonging to the merchantable species.

It was discovered from records that only eleven compartments in the southern part of Mabira FR were treated with arboricide chemicals mixed with heavy diesel oil. A large part of the treated area occurred in the west block while only two compartments were treated in the east block. The west block was better stocked than the east block. The difference in stocking could not be attributed entirely to the treatment.
Other considerations were:-

(i) Unplanned and unregulated tree exploitation was carried out more in the east block than in the west.
(ii) The east had been greatly degraded by encroachment and timber thefts that systematically removed most trees of high value (*Entandrophragma, Lovoa, Holoptelea grandis, Milicia excelsa* and *Olea).*

4.2.4 Gap Planting/Encroached areas

After evicting encroachers in 1961/62, a programme of rehabilitating encroachments started, planting *Maesopsis eminii* to restore the forest and creating ecological conditions for regeneration of other natural forest species. The programme was successful and had resulted in areas of the forest carrying uniform crops of *Maesopsis spp* some of which was mistaken as colonising young forest as was seen in compartment 210 around Namaganda hill.

4.2.5 Research

During the colonial and immediate post-independence era, the first priority research area in Uganda's natural forests including Mabira was the productivity and silviculture of these forests. Most of the silvicultural research involved tending and improvement of forests targeted at timber production.

The major projects that were undertaken within this priority area which are relevant to Mabira were:

- Performance of trees in treated natural forests;
- Natural regeneration in closed forests;
- Under planting/enrichment planting;
- Tending of trees in treated natural forests;
- Sampling of the natural forests through permanent sample plots.

Under each project, there were several research plots (RPs) for assessing particular problems. For the case of Mabira, research plots were established with their subject matter as indicated in T**able 26**.

Table 26: Research Plots in Mabira CFR

RP NO.	Subject	Objective
156	*Milicia* and *Maesopsis eminii*	Trial plot
157	Natural THF	Performance
158	Natural THF	Performance
159	*Khaya & Maesopsis*	Trial plot
498	Natural THF	Natural regeneration
499	*Maesopsis*	Gap filling
532	Under planting species	Enrichment
552	Various spp	Trials in 0.1 acre plots
688A	*Terminalia ivorensis*	Provenance trial
688B	*Cedrella ordorata*	Provenance trial
688C	*Terminalia superba*	Provenance trial

NB: Almost all these research plots are already closed after the objectives of research were achieved.

Kriek carried out a survey and critical assessment of these research plots during the period 1967-1969. The results of this exercise were compiled in 1970 and are contained in FD's Technical Notes.

The following species were most successful and are suitable for enrichment or rain forest conversion:-

- *Araucaria cunninghamii* – with growth rates of 1.4 -1.8m height in early years
- *Agathis robusta* – suitable for enrichment with early growth rates as above
- *Flindersia brayleyana* – gives good growth. Originates from Australia and gives high quality timber
- *Triplochiton scleroxylon* – vigorous growth, highly valued W. African species for peeling
- *Terminalia ivorensis/ T. superba* – the former more vigorous than the latter even under adverse light conditions. It is good as a light hardwood suitable for joinery, flooring, panelling and furniture.
- *T. superba* is mainly used for peeling.

Several other studies especially biodiversity surveys have been carried out in Mabira.

Thirty-six (36) permanent sample plots (PSPs) were located in the west block and they appeared on the management map No. KYA/113 of 12th December 1960. At the time of writing the 1961-1971 MP all the PSP files could not be found and were presumed lost. It was assumed the PSPs were located on the map but never actually demarcated in the field.

Enrichment or under planting was researched on a small scale in Mabira forest. One trial at Kasaala, north of Nagojje forest station was established to test various species for their suitability in large scale enrichment planting in harvested and refined THF. Performance of this trial was impressive.

Large scale use of under planting as a regeneration technique in THF was used in Buwoola (Compartment 187) using *Maesopsis eminii* and *Terminalia ivorensis*. Growth was very good and showed (in case of the exotic *Terminalia)* that depending on the degree of canopy opening, under planting is a successful method of regenerating the THF.

The plan expired at the end of 1971 but a revision could not be undertaken because of the political environment and its validity was therefore extended from year to year until an Interim management plan of 1994-1995 was developed.

4.3 The 1994-1995 Interim Management Plan (Mugumya-Nyindo X)

4.3.1 Management Objectives

The objectives of this two year management plan were to attain a multiple use management system including:-

- Maximum high-grade timber production in perpetuity using most efficient and appropriate methods for the satisfaction of the local needs and export.
- The forest cover in designated areas is protected in such a state as to preserve the existing population of flora and fauna.
- The forest is managed to optimise its ability to furnish on a sustainable basis forest benefits such as water catchment, protection of wild life habitat and climate amelioration.
- The aesthetic potential of the forest is developed with the aim of promoting it to the benefit of immediate and surrounding communities and
- Communities adjoining the forest reserve are involved in the promotion and implementation of sustainable development programmes.

In order to attain the foregoing objectives, the area was divided into two broad management zones namely the production and conservation zones.

The **Production Zone** consisted of all areas where intensive silviculture would be practised for increased yield of forest products. Activities were to include enrichment and encroachment planting, salvage operations, boundary maintenance, general protection and production of minor forest produce.

The **Conservation zone** consisted of strict nature reserve, buffer zone, enclave buffer zone and development of aesthetics (tourists) potential zone.

4.4 The 1997-2007 Management Plan (Karani, Kiwanuka, Sizomu-Kagolo)

4.4.1 Management Objectives

The objectives of the management plan were:-

- Conservation of the forest biodiversity and ecological conditions.
- Production of maximum sustainable yield of timber and non-timber products by the most efficient methods without compromising the capability of the forest to provide environmental services.
- To integrate the communities within the forest enclaves and parishes surrounding the forest reserve into forest management.
- Provision of recreational facilities for the people of Uganda and outsiders and,
- To carry out research aimed at obtaining information on various aspects of forest ecosystem dynamics for use to improve forest management.

4.4.2 Division of area

The forest was divided into five working circles:-

(i) Conservation WC – consisting of 13 compartments designated the SNR (Cpts 198-202, 207-210, 213-216).

(ii) Production WC – consisting of 45 compartments 171-188, 192-197, 217-237 and 71ha of Kalagala Falls central Forest Reserve.

(iii) Community participation WC –within selected enclaves and some surrounding parishes.

(iv) Recreational WC - consisting of 13 compartments 189-191, 203-206, 211-212 and 33ha of Kalagala Falls Central Forest Reserve.

(v) Research WC.

(i) Conservation of Biodiversity WC

This WC consisted of thirteen compartments with an area of 6,106ha equivalent to 19.8% of the total area of the reserve. These compartments were designated strict nature reserve (SNR). 8 compartments to the south, equivalent to 4097ha (13.3%) were retained as buffer zone (BZ) with low impact usage involving collection of medicinal materials, flowers, fruits, seeds, bark and dry wood materials for domestic fuel use. This area was managed for biodiversity conservation only but research involving no cutting of trees or any sort of damage to flora and fauna was allowed.

(ii) The Production WC

Because of past illegal timber harvesting which resulted in removal of almost all trees of fee group 1, the WC was divided into two:-

- Areas to be harvested for timber.
- Encroached areas in which no harvesting had to be done during the period of the plan.
- Rotation was fixed at 60 years

Yield control

Total volume in the whole of Mabira FR for trees 50cm dbh and above was calculated from the 1993 inventory data. This volume was reduced by the volume contained in the conservation, recreation WCs and from compartments that were encroached upon. This volume was further reduced due to the rampant illegal harvesting after 1993. The AAC was 10,423.4m^3. No trees from fee group 1 were to be harvested during the duration of the plan.

Silviculture

The silvicultural methods of regenerating the THF were geared towards maintaining the stage of mixed forest condition which is valuable both ecologically and economically. It was decided to continue with the uniform system of management for the whole of the production WC with a 60 year rotation, relying on natural regeneration to re-stock harvested areas of the forest.

- Where diagnostic sampling showed natural regeneration was not adequate, artificial regeneration using mahoganies, *Milicia* and *Olea* species had to be used
- Climber cutting had to be done on a regular basis as a silvicultural operation in the production area.
- The encroached compartments covered with *Broussonetia papyrifera* due to lack of financial resources, were to be left expecting shade tolerant species to come up and form the future growing stock.

Revenue

Table 27 Revenue from round wood.

Table 27: Expected annual revenue from round wood at current fee rates

Fee group	Volume m3	Rate/m3 (UGX.)	Value (UGX).'000
i.	-	-	-
ii.	8,088.6	9,496.0	79,809
iii.	2,334.8	5,860.5	13,683
Total			**93,492**

Source: Mabira FR Management Plan 1997-2007

Other sources of revenue included:- Ground rent for Cardamom growing, tree growing in Nandagi FR and rattan cane and other handicraft materials as shown in **Table 28**

Table 28: Other sources of revenue

Ground rent for Cardamom growing for 200ha at UGX. 2,500 per ha per year	500,000
Rattan cane and other handicraft materials (UGX)	250,000
Ground rent from the Peri-Urban Scheme at Nandagi FR at UGX. 1,000 per ha per annum	250,000

It was difficult to assess revenue from poles, fuel wood and charcoal production as there was no guiding data although legal harvesting was done.

(iii) Community participation WC

After realising that forest reserves and other protected areas are managed for the benefit of the people of Uganda and that the methods hitherto employed to protect the forests have largely been exclusive of the locally resident people, the FD decided to introduce CFM as a new approach that would ensure integrity of the forest reserve under its jurisdiction.

(iv) Recreational WC

At the time of writing the 1997-2007 management plan, ecotourism was based in compartment 190 Najjembe which had basic facilities. Other compartments 189,191,203-206,211 and 212 were also included in the recreational WC. In addition to its recreational activities, this area was designated as a conservation area, a buffer zone to the strict nature reserve. No timber harvesting was therefore allowed in this area.

The recreational WC was developed within the FD as a tourism development project (TDP) financed under the EC Natural Forest Management and Conservation Project. Every effort was made to provide the necessary facilities and services in order to maintain a good standard acceptable to both local and foreign visitors. It was named Mabira Forest Ecotourism Project.

During the months of March to September 1996 a total of 1053 people both Ugandans and foreigners visited the ecotourism area. Fees in 1997 were fixed as shown in **Table 29.**

Table 29: Category of tourists visiting Mabira in UGX

Category	Forest entry	Camping permits	Bandas
Uganda citizens	1,000	1,000	8,000
Non-citizens	5,000	2,500	12,000
Children under 14 years were charged at half price			
Estimated annual income		8,039,000	
Estimated expenditure		4,944,000	

(v) Research WC

This introduction to the Research WC was very important and "it should be emphasized that natural forest research in Uganda has not received the attention it deserves. It is not enough to assume that the forest will continue to exist and provide products and services when very little is known about its performance. As with all renewable resources, THF must be thoroughly studied if it is to continue meeting the present and future demands for products and services. It means that without research there is no future for the THF in Uganda. It is therefore necessary to give research top priority in allocation of funds and staff time. It is through research that foresters get information that is necessary to devise appropriate silvicultural and management methods to meet the demands of multiple usages of Mabira and similar forests.

There is no record that any of the 16 research plots were inspected and assessed throughout neither the period of the 1997-2007 Mabira Management Plan nor initiation of research prescribed.

Financial forecast

The estimated annual revenue from the production and recreation WCs was estimated at UGX 101,531,000 as detailed in **Table 30**.

Table 30: Estimated Revenue for the Production WC

Revenue source	**Amount (UGX)**
Round wood	93,492,000
Tourism	7,039,000
Other sources	1,000,000
Total	**101,531,000**

PART II:

PLANNED MANAGEMENT

CHAPTER 5: OBJECTIVES OF MANAGEMENT

5.1 Basis of Plan

This management plan is based on the need to ensure maximum and sustainable supply of forest products and services from the CFRs in the MPA. The forests have the following values;

- Water catchment for river Nile and Ssezibwa which have a hydro power potential for sustainable industrial development
- Source of many streams that provide millions of local communities with domestic water
- Modulation of micro- and macro-climate on which agricultural production in the area depends.
- Habitat for wildlife including globally-threatened species such as Nahans Francolin; (*Francolinus nahani)*and other 9 species found nowhere else in Uganda including the newly discovered species of Mangabey monkey (*Lophocebusalbigena johnstoni*) and the Short-tailed Fruit Bat
- Source of livelihood to especially the forest adjacent communities including employment.
- Forest products such timber, firewood, herbal medicine, charcoal, wild meat, sand, stones and services whose demand is ever increasing given their proximity to rapid growing urban centres.
- Beautiful scenery and aesthetic values for ecotourism

The location, unique species richness and productivity of Mabira group of CFRs, gives them special status requiring a strategic direction for their management so as to provide the aforementioned benefits on a sustainable basis.

5.2 Vision

The vision for the Mabira MPA is: *A well-managed, economically viable, ecologically and environmentally stable forest estate that provides sustainable products and services to the local and global community.*

5.3 Mission

To improve management of Mabira CFRs by harnessing their multiple uses and partnerships to produce high quality products and services for the improved livelihoods of the people of Uganda

5.4 Objectives of Management

The management plan objectives shall be:

Short – Term Objectives

- To supply high quality consumptive and non-consumptive forest products and services.
- To strengthen and expand tourism investment and partnerships.

Medium term objective

- To integrate local communities into forest management and improve their livelihoods.

Long-Term Objectives

- To conserve environmental and ecological functions of the Mabira ecosystem.
- To promote applied research for forestry development.

5.5 Period of the Plan

The management plan shall operate for a period of 10 years starting on 1st July 2010 to 30th June 2020. **(Prescription 1)**

The FMP shall be reviewed in year 5 (2014) of its implementation in a participatory process with key stakeholders including local communities so as to incorporate emerging issues and policies. **(Prescription 2)** Revision of this FMP shall commence at least six (6) months before expiry, i.e. not later than January 2019.

CHAPTER 6: PLANNED MANAGEMENT ACTIVITIES

6.1 Division of the Area

Forests are important natural resources that are renewable and capable of producing multiple products and services to support economic growth, create jobs and contribute to the livelihoods of the majority of the people of Uganda.

Consequently, the activities that will be undertaken in this FMP are designed to contribute to and support economic growth in line with the national development goal for the forestry development ***"an integrated forest sector that achieves sustainable increases in economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and vulnerable"***, and under the relevant Sustainable Development Goals. Section 524 (iii) of NDP2 emphasizes increasing national forest cover and economic productivity of forests.

In order to achieve set management objectives in this FMP the CFRs shall be zoned into two (2) broad management zones; the production and conservation zones. (**Prescription 3)** The Production zone shall consist of all the areas where intensive silviculture is done for increased yield of forest products and services. The activities include timber harvesting, enrichment and encroachment planting, tending operations, as well as general protection and production of other forest products. The Conservation Zone shall consist of the strict nature reserve for scientific research and the buffer zone where ecotourism is being developed. **(Prescription 4) Table 31** shows the proportion of each zone in the respective CFRs.

All ecologically fragile areas including wetlands in the production zone shall receive special management status as if they were in the conservation zone. **(Prescription 5)**

Table 31: Management zones in Mabira Forest Management Plan Area

Forest Reserve	Total Area (ha)	Area under Production Management Zone (ha)	Area under Conservation Zone (ha)
Mabira	29,974	26,785	3,189
Nandagi	479	479	0
Namukupa	280	280	0
Namawanyi	325	325	0
Namananga	131	131	0
Kalagala falls	104	50	54
Total	**31,293**	**28,050**	**3,243**

Working Circles

The six (6) CFRs shall be managed as one MPA and there shall be five (5) working circles. **(Prescription 6)**These shall include:-

i. Production working Circle
ii. Partnership and Community livelihood working circle
iii. Conservation working circle
iv. Tourism working circle
v. Research and Education working circle

Table 32 indicates the respective compartments for the various working circles

Table 32: Compartments under each Working Circle

S/N	Working circles	Compartments	Remarks
1	Production working Circle (45 compartments)	171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187,188, 192, 193, 194, 195, 196, 197, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234,235,236, 237 and 71 ha of Kalagala falls CFR	
2	Partnership and Community livelihood working circle	171, 173, 176, 183, 211 ,219, 229, 233	
3	Conservation working circle (SNR) 13 compartments)	198, 199, 200, 2001, 202, 207, 208, 209, 210 , 213, 214, 215,216	
4	Tourism working circle	189, 190,191, 203, 204, 205, 206, 211, 212 and 33 ha of Kalagala Falls CFR	
5	Research and Education working circle	In Compartments where there are research plots, PSPs, picnic sites and the rest of the forest	

6.2 Management of the Production Working Circle

Objectives of managing the production working circle;

The objectives of managing the production-working circle include;

- enhance regeneration of formerly encroached areas,
- monitor changes in tree species composition and growth,
- maintain the integrity of the forest reserve boundaries,
- increase the forest cover within the management plan area and
- supply both timber and non- timber forest products among others.

Protection of the growing stock shall be given top priority in terms of financial resources and staff-time. Planned harvesting shall be authorised as and when the stock is identified after EI and ISSMI in accordance with the objectives of management. All possible avenues shall be sought to ensure that the growing stock is safeguarded against all forms of illegal activities.**(Prescription 7)**

The production working circle shall be managed to provide both consumptive and non-consumptive forest products on a sustainable basis. **(Prescription 8)**

a) Natural high forest silvicultural practices

Encroachment planting shall be done in formerly encroached areas of Kalagala Falls CFR as part of conservation planting of river Nile bank on the western side and along forest boundaries. **(Prescription 9)**

In the expired FMP (1997-2007), it was recommended to observe growth characteristics of the paper mulberry (*Broussonetia papyrifera)* with regard to its effect on natural regeneration of indigenous wood species. After ten (10) years, field observations show that natural regeneration of indigenous tree species is still poor as only shade tolerant species tried to come up.

Some enrichment planting has been done in the MPA but it requires intensive tending to minimize hindrances from climbers and other weeds for proper growth. The following silvicultural operations shall be carried out;

- The 35ha crop of Maesopsis eminii and *Terminalia superba* in Bugule (Cpt 175) and other areas planted in 2004/05, now at sapling/pole size (above 6m in height and dbh 10-15m) requires no further slashing but all stunted poles shall be thinned out.(**Prescription 10**)

- Enrichment and restoration planting together with subsequent tending activities shall be carried out covering 3,600ha of the 9 compartments(No. 236, 171, 172, 173, 174, 175, 180, 181 & 237) in the eastern block of Mabira that were previously encroached under the double agriculture production program in the 1970s**.(Prescription 11**)

- Ten (10) enrichment trial plots each of one (1) hectare shall be established in eastern block of Mabira CFR that has been colonized by paper mulberry. They shall be planted with high value species such as *Khaya anthotheca*, *Cordia millenii* and Entandrophragma spp at spacing 10m by 10m.Two (2) trial plots shall be established per year in the first five (5) years of the FMP. Maintenance shall be carried out in the first five (5) years of the crop. (**Prescription12**)

In compartments where there is licensed harvesting of timber, logging waste including the lops and tops shall be disposed off immediately by authorised charcoal production. (**Prescription 13)**
Harvested areas with big gaps where charcoal production has been carried out shall be prepared and planted with appropriate species. (**Prescription 14)**

Routine maintenance activities such as climber cutting, liberation tending, and other operations shall be carried out at appropriate times. **(Prescription 15)**

b) Plantation Development

A total of 350ha and 50ha in Nandagi and part of Kalagala Falls CFRs respectively, has been allocated for plantation development by private farmers.

Land demarcation shall be done for private tree farmers in the above CFRs by end of year one (1) of this FMP. All private tree growers shall adhere to the NFA Guidelines on plantation establishment and management. Tree farmers in Kalagala Falls CFR shall be encouraged to plant mainly indigenous timber tree species to stabilise the river banks. **(Prescription 16)**
Licences for tree farmers who have planted exotic species in Kalagala falls CFR shall be terminated after the second harvest and the area planted with appropriate indigenous tree species for protection of the riverbanks**.**

c) Sustainable Harvesting Regime

Harvesting of timber (round wood), fuel wood (firewood and charcoal), and non-wood forest products shall be authorised. Timber harvesting shall commence after carrying out exploratory inventory (EI) and ISSMI

and this shall exclude the eastern block of Mabira CFR**.** Reduced impact logging shall be exercised through the use of light machinery. **(Prescription 17)**

Following the Inventories, volumes to be harvested will be determined and the respective trees marked for harvesting. The volume to be harvested will not exceed 2000m³/year **(Prescription 18)**

Adequate financial resources and logistics shall be allocated to carry out EI and ISSMI in the production zone of Mabira CFR. Until EI and ISSMI are carried out and completed (2010/11) to determine annual allowable cut (AAC), harvesting will be limited to planted trees of *Cedrella odorata* (Cpt 234), *Terminalia spp* (Cpt 187) and *Maesopsis eminii* (Cpt. 196). Harvestable volume shall not exceed 2,000m³/year. **(Prescription 18)** ISSMI blocks shall be regularly maintained. **(Prescription 19)**

Cases of abandoned logs and wind thrown trees shall be salvaged by NFA or disposed off under the harvesting guidelines for disposal to the public. **(Prescription 20)**

Harvesting of NTFPs on a commercial scale shall be allowed in accordance with the license terms and conditions. **(Prescription 21)**

Regulated extraction of non-wood forest products by private enterprises shall be allowed in accordance with license terms and conditions. As for community-based organisations, M.O.Us shall be developed to guide the mode of extraction. (**Prescription 22)**

Extraction of other forest products such as stones, clay, sand and forest soil shall not be allowed except sand from Nandagi CFR where it occurs in reasonable quantities. **(Prescription 23)**

d) Permanent Sample Plots

Seven (7) new PSPs shall be established in the Eastern block of Mabira in the first two years of this FMP implementation. Subsequently, together with the fourteen (14) existing ones, all the 21 PSPs shall be maintained annually by cleaning of the trenches, slashing of the plot lines and re-painting of the trees. The fourteen (14) existing PSPs shall be assessed within the first three years of this FMP implementation and thereafter every five years from the last assessment. **(Prescription 24)**

However, by time of updating this plan, no new PSPs had been established and only 12 of the existing ones are being maintained. Staff have failed to locate the remaining two (2) on the ground.

6.3 Management of the Partnership and Community Livelihood Working Circle

One major difference from the traditional forest management which is reflected in the current forest policy and legislation is the implementation of policies and practices that promote community participation in the management of forests and for such communities to share the benefits of improved forest management. This approach is generally considered to be more effective in ensuring compliance.

The objectives of the partnership and community livelihood-working circle include to;

- promote collaborative forest management with forest adjacent communities
- create environment and conservation awareness among the stakeholders
- promote forest based enterprises among forest adjacent communities and
- improve the livelihoods of forest adjacent communities.

In accordance with the National Forestry and Tree Planting Act, 2003, Collaborative Forest Management (CFM) guidelines and plans and CBO constitutions, CFM shall be promoted as a management approach in the sub-counties of Nagojje, Najjembe, Wakisi, Ntunda, and Kangulumira where it is already being implemented.

Public participation shall be promoted by empowering the stakeholders through education, public awareness, gender balance, information exchange, research and networking and observation of international and bilateral agreements, to which Uganda is a signatory. **(Prescription 25)**

This approach shall be scaled up to areas where it is deemed necessary to enhance community participation in the management of forests in this FMP. **(Prescription 26)**

The performance of CFM implementation shall be monitored and evaluated to ensure compliance to the CFM guidelines and plans. **(Prescription 27)**

With support from NFA and other relevant partners such as CSOs and local governments, CFM groups shall be assisted to improve their livelihoods by engaging in alternative income generating projects like raising of tree seedlings, energy saving technologies, tree growing on farm and apiary to mention but a few. **(Prescription 28)**

In order to consolidate and perhaps increase the area and contribute to improving the management of Mabira CFR, efforts shall be explored to buy off remote and sparsely populated enclaves in the CFR. The current and anticipated infrastructural developments (roads, railway hydropower and oil pipe lines) are encroaching on the size of the permanent forest estate (PFE) therefore forest land lost to these developments shall be appropriately compensated and the funds generated there from shall be used for this purpose. **(Prescription 29)**

Community support initiatives through grants and benefit sharing with adjacent local communities shall be done through institutions like schools, NGOs (e.g. MAFICO), CBOs, churches, mosques and any other organised groups. **(Prescription 30)**

Local communities, especially those in the ten totally enclosed enclaves, women and youths, shall be given first priority whenever there are employment opportunities, awarding local contracts, establishing community nurseries and supporting management of private forests (in liaison with DFS) in addition to issuing licences for harvesting forest products and services.**(Prescription 31)**

Whenever there will be competitive bidding for timber harvesting, a percentage of harvestable volume shall be given to interested and capable local communities and/or community based organizations registered at the sub-county and district at a reserve price. **(Prescription 32)**

6.4 Management of the Conservation Working Circle

Conservation involves the protection of nature from exploitation to prolong its use (preservation); the correction of past willful and inadvertent abuses that have impaired the productivity of the resource base (restoration); the upgrading of the usefulness of the quality of the resource(beneficiation); avoiding waste and increasing the quality and quantity of resource(maximization); the reuse of waste material (recycling); the use of most common resource instead of rare ones and the use of renewable rather than non-renewable resources (substitution); making the best and most appropriate use of the resource (allocation); the combined use of all the resources available in a certain area at the same or appropriate time.

These definitions highlight a very important rationale that forest conservation must focus on the forest as an ecosystem and a living organism; on man as part and parcel of this organism; on the goods and services accruing from the forest community; and hence the interactional bonds between the ecology, the economy and the sociology of a forest.

The Objectives of this working circle include:

i. Protect and rehabilitate all the biodiversity and fragile ecosystems within the MPA
ii. Promote conservation of existing bio-diversity and enhance its contribution to socio-economic development
iii. Strengthen linkages and partnerships with various conservation institutions and other stakeholders to improve biodiversity management and ecosystem restoration.
iv. Raise awareness of forest edge communities through conservation education in order to safe guard the forest values.

Biodiversity inventory shall be carried out within the first5 years of the FMP to update the 1996 report and assess the level of species increase/decrease. (**Prescription 33)** *Biodiversity inventory was however done in the 8th year of the FMP*

The Forest and Nature Conservation Master Plan (2000) is the guide in the management of natural forests in CFRs at the national level. It provides for the zoning of major forest reserves into Strict Nature Reserves (20%), Production Forests (50%) and Buffer Zones (30%). Due to some emerging issues such as population pressure, high demand for forest products, shortage of land and the proximity of some of the compartments under the strict nature reserve to the settlements, it is proposed that the forest be re-zoned in the ratios of 20 % Strict Nature Reserve zone, 10% of Buffer zone and 70% of Production zone. However this shall be done after a careful scientific study to justify the change. **(Prescription 34)**

Fragile ecosystems like swamps, hills, and riverbanks shall be protected and restoration shall be carried out in degraded areas. **(Prescription 35)**

Water catchment areas shall be preserved while degraded areas shall be rehabilitated with indigenous tree species. **(Prescription 36)**

Palms and associated trees along the riverbanks of R. Ssezibwa and R. Musamya shall be conserved for riverine and wetland protection and licensing for harvesting shall not be done without prior assessment of impacts. **(Prescription 37)**

In collaboration with NEMA, as the responsible body, the Sugar Corporation of Uganda Ltd (SCOUL) shall be made to manage its industrial effluents before releasing them into R. Musamya. **(Prescription 38)**

Processing of local gin (waragi) along watercourses and use of non-biodegradable materials shall be prohibited in the forest. Disposal of non-biodegradable materials shall be controlled by setting up disposal pits and warning/information sign posts along the Jinja-Kampala highway and any other public roads through the reserves. **(Prescription 39)**

Stakeholders within Mabira MPA such as Nile Ply, SCOUL, National Water and Sewage Corporation, UMEME, UBL among others shall exercise their obligations as stated in their EIA reports especially in regard to compensation for absorption of effluents**. (Prescription 40)**

Formal partnership arrangements with interested conservation institutions such as UWA; CSOs/CBOs such as MAFICO, Nature Uganda; DLGs such as Mukono, Buikwe and Kayunga and private companies such as Nile Ply, SCOUL shall be established. **(Prescription 41)**

In conformity with sustainable forest management practices, Mabira ecosystem shall be managed responsibly to meet ITTO and FSC standards for forest certification. **(Prescription 42)**

Appropriate activities shall be undertaken to raise conservation awareness among the forest edge communities; **(Prescription 43)**

These shall include but not limited to the following;

i. mobilize communities to participate in conservation activities
ii. conduct community conservation sensitization meetings on conservation
iii. form conservation groups(such as music, dance and drama) in the community and clubs (e.g. wildlife) in schools
iv. organize regular music, dance and drama activities among the communities
v. conduct radio talk shows on conservation
vi. produce and disseminate information, education and communication (IEC) materials on conservation to the communities and schools

6.5 Management of the Tourism Working Circle

There is high potential for recreational activities in Mabira due to its proximity to major urban centers of Jinja and Kampala, people usually run away from these towns just to rest.

The objectives of this working circle include:

- Improve and expand the available recreation and leisure facilities.
- Identify and promote all the potential tourism attractions within the MPA.
- Increase eco-tourism awareness at a national and international level.
- Encourage private- public partnership arrangements to fully exploit eco-tourism potential in the MPA

The development of eco-tourism in Mabira will greatly depend on how the private sector responds to the incentive structure offered to them. Guidelines for eco-tourism investment shall be developed and properly implemented taking into consideration tourism investment with appropriate rates and licenses. **(Prescription 44)**

EIA shall be done for all potential tourism sites within the boundaries of the CFRs and proper assessment done to determine the likely technical and social-economic impact to the environment. (**Prescription 45)**

Eco-tourism site facilities at Najjembe are highly limited in quality and quantity .The three (3) existing bandas are not sufficient for the anticipated increase in the number of tourists. In order to improve on the current tourism infrastructure, four (4) more bandas shall be constructed in addition to renovating the old ones. The trail network and tree name tags shall be regularly maintained while the information room at the recreation centre shall be expanded. **(Prescription 46**

The current tariffs for the services at the eco site shall be revised from time to time as need arises. **(Prescription 47)**

A competent service provider shall be identified and licensed to construct and manage a catering unit near the entrance of the Najjembe eco-tourism site to provide catering services to the visitors. **(Prescription 48)**

Marketing and promotion of the eco-site shall be done using bill boards, sign posts, brochures, flyers, partnerships with tour companies and Mabira eco-tourism website and resource centre.**(Prescription 49)**

The private sector shall be encouraged to participate in tourism development by providing appropriate and attractive conditions. (**Prescription 50)**

Community ecotourism involves communities participating in tourism activities like performing cultural dances, making crafts products for sale, offering guide services to visitors, putting up accommodation facilities such rain forest lodges . Community tourism in compartment 211 shall be supported through training and capacity building in; visitor handling, crafts making, marketing of handicrafts, food items and other related services. **(Prescription 51)**

Cultural tourism which involves tourists visiting cultural sites within the MPA shall be promoted in sites where Buganda Kingdom subjects go to perform traditional rituals such as worship and praise, searching for wealth, health, children, luck and prosperity. **(Prescription 52)**

While the license agreement with the high-end Geo Lodge has been largely successful, the NFA ecotourism center facilities have become very dilapidated. A new license to manage these facilities has been awarded. The current accommodation facilities are perhaps beyond the point of salvaging. Therefore, the contract shall allow for the building of 10-15 new budget to mid-end units that can help diversify the forest's accommodations offer. The license shall also cover recreational areas including shaded rest areas, picnic spots, and environmentally friendly dry toilets. **(Prescription 53)**

Tour guides shall be provided with additional training; both in technical areas such as birding as well as in making tours more dynamic and groups of tourists shall be limited to a maximum of 10 tourists per guide. **(Prescription 54)** New trails shall be required to support the Mangabey tracking activity that will be developed shortly. New trails and a boardwalk shall also be required to allow bird watchers to access a wetland area rich in birdlife. **(Prescription 55)** Along all trails, signage and interpretative infrastructure shall be created to orient tourists and enrich their experiences. Trail maps shall also be developed and either distributed or sold to tourists. **(Prescription 56)**

Community relations play an important role in conservation. The MAFICO group running ecotourism operations in Griffin Falls shall be supported when possible. Their guides and any others involved in their operations shall be incorporated into training courses, perhaps even by licensees. (**Prescription 57)**

Mabira Forest shall be better promoted. There is a huge potential market for day visits and weekend stays just among Ugandans and expatriates based in Kampala. Yet most do not know of opportunities in Mabira or are perhaps influenced by negative images related to the area's deforestation. NFA, along with the licensees, shall work to creatively promote the area through social media and other cost-effective means including staging of open-air cultural performances and other events in the forest. (**Prescription 58)**

6.6 Management of the Research and Education Circle

Research in here is used to refer to a careful study or investigation in order to discover new facts or information while development is the action of growing or cause something to growth, to become larger, more advanced or more organized. In research for development the aim is to develop new or improve products and the manufacturing process.

Research and development to enhance scientific innovation, skills, information and policy advice for increased productivity and sustainable management of forests and tree resources shall be promoted. **(Prescription 59)**

The objectives of the Research and Education circle include:

- Develop and promote technologies and practices for sustainable forest management
- Support research on improving socio-economic conditions of local communities.

Research shall be carried out in partnership with research and training institutions, projects and NGOs. The M.O.U between NFA and NaFORRI shall be reviewed to include more wood utilisation research. **(Prescription 60)**

Appliedresearch using diagnostic sampling shall be carried out periodically to monitor restoration progress in areas under enrichment planting and colonizing forest. **(Prescription 61)**

Threat reduction assessment research is urgently required. It shall be conducted in 2009/2010 in order to identify threat indicators. **(Prescription 62)**

Research guidelines based on research categories shall form the basis for issuance of research permits/licences. **(Prescription 63)**

Except for students carrying out non-destructive research, all researchers shall pay research licence fees to conduct research in the FMPA. Copies of all research conducted within the MPA shall be submitted to the Executive Director NFA. (**Prescription 64)**

Diagnostic sampling shall be done two years after biodiversity inventory has been carried out within the two blocks (Eastern and Western) of Mabira to determine the natural regeneration of the forest. **(Prescription 65)**

Indigenous tree species shall be extended to the community/private land for domestication in partnership with NaFORRI and Makerere University and the tree species performance shall be closely monitored to offer technical advice where needed **(Prescription 66).**

6.7 General Prescriptions

6.7.1 Boundaries

The external boundaries of Mabira, Namakupa and Namawanyi/Namananga CFRs with a total cutline length of 346.6km shall be resurveyed, verified re-opened and marked with concrete pillars (about 2m high) within this plan period. (**Prescription 67)**

Boundary planting using live markers along the whole 367km cut line length for all the five CFRs (Mabira, Nandagi, Namakupa, Namawanyi/Namananga, and Kalagala Falls) in this management plan shall be done with appropriate commercial tree species. **(Prescription 68)**

During the first five years of the plan, the external boundaries shall be maintained by slashing annually until the live markers are fully established. **(Prescription 69)**

Where applicable, the external boundary shall be made into forest management roads that will reduce the cost of annual maintenance and encroachment. **(Prescription 70)**

In Nandagi CFR, internal boundaries shall be opened to serve as access roads or fire lines. All private tree growers shall be required to maintain the fire lines in their plots. **(Prescription 71)**

Forest roads shall be maintained every financial year of the FMP implementation **(Prescription 72).**

6.7.2 Encroachment

Forest encroachment in Mabira MPA is associated with areas of high population pressures and commercial farming. Whereas there are no major incidences of encroachment, there are some isolated cases such as in Namawanyi and Namananga CFRs where a few farmers cultivate seasonal crops especially due to unclear boundaries. In the same reserves, sugarcane out growers have also taken advantage of the unclear boundaries to encroach on the forest though marginally.

During the stakeholder consultations, it was reported that majority of encroachment cases result from workers that lose employment in the nearby sugar estates.

Boundary re-surveys and re-opening is anticipated to be carried out within this plan period. Once the boundaries have been re-surveyed and opened, a census of encroachers shall be carried out to ascertain the extent of encroachment and numbers of encroachers. (**Prescription 73)**

All people confirmed to be encroachers shall be evicted. Periodic monitoring of encroachment shall be carried out and any future encroachers shall be evicted as soon as discovered. (**Prescription 74**)

6.7.3 Fire protection

Fire protection is an important part of forest management operations though it does not pose a serious threat in Mabira MPA. However, in consideration of seasonal bush burning, especially by the neighbouring communities, the Forest Supervisor with private tree growers particularly in Nandagi and Kalagala falls shall take appropriate steps for fire protection in accordance with the law and the guidelines issued by NFA. **(Prescription 75)**

The steps shall include:

i. Organising and educating communities about the dangers of fire and the risks involved in uncontrolled bush burning in general.
ii. At the beginning of every dry season, warning communities not to engage in uncontrolled bush burning especially near the plantations.
iii. Ensuring that internal firebreaks and lines are maintained.

iv. Where necessary, early burning will be done at the beginning of the dry season

6.7.4 Vermin Control

The natural forests harbour animals that may raid crops on neighboring lands. NFA staff shall work with Mukono, Kayunga and Buikwe DLGs and UWA to control vermin **(Prescription 76)**

6.7.5 Pests and diseases

It is common for pests and diseases to attack crops including trees. Both NFA staff and private tree farmers shall be on the lookout for such outbreaks and immediately after discovery, report to relevant authorities most appropriately, NaFORRI. **(Prescription 77)**

6.7.6 Carbon sequestration

Although there is no precise statistical data regarding the extent to which Mabira ecosystem has played in carbon sequestration, there is no doubt that these forests absorb a lot of gas emissions (CO^2) from the atmosphere. Emerton & Muramira (1999) and Bush *et al* (2004) give the following carbon storage values for different vegetation types: primary closed forest UGX 54,660/ha/year; degraded forest UGX 32,538/ha/year; and woodland, bush land and grassland UGX 2,603/ha/year.

Therefore Mabira MPA with an area of 31,293 ha of closed forest has an estimated carbon value of UGX1, 710,475,380/year.

Much as forests act as carbon sinks, they are also a source of carbon. Deforestation and poor management of forests and swamps has led to the increase of greenhouse emissions into the atmosphere. It should also be born in mind that CFRs in Mabira MPA are close to fast growing urban and industrial areas which emit a lot carbon and other industrial waste. Therefore the forests shall be managed responsibly to ensure that their carbon sequestration potential is enhanced while the emissions are reduced. **(Prescription 78)**

During this plan period, innovative funding mechanisms such REDD+, PES, CDM, shall be explored. **(Prescription 79)**

6.7.7 Climate Change

Climate change mitigation involves reducing the impact of climate change and global warming by reducing emissions of greenhouse gases (GHGs) to the atmosphere and by increasing carbon sinks.
In order to effectively contribute to mitigating the effects of and adapt to climate change, emphasis shall be put to activities such as afforestation, reforestation, and sustainable management of forests in the MPA. (***Prescription 80***)
Such activities shall include but not limited to the following:

- Domestication of forest medicinal and edible plants
- Promote sustainable use of forest resources
- Explore alternative and sustainable technologies for charcoal production, brick and craft making
- Promote tree growing on farm
- Strengthen community sensitization and advocacy on climate change related issues.
- Promote use of indigenous knowledge as coping mechanisms

- Intensify law enforcement through regular patrols and other related activities

6.7.8 Management of Paper Mulberry (Broussonetia papyrifera)

Paper mulberry *(Broussonetia papyrifera)* is an invasive tree species which regenerates profusely and covers the ground without allowing any undergrowth. The species has covered large parts of the CFRs and is causing concern to the managers.

Further research shall be undertaken on the paper mulberry *(Broussonetia papyrifera*) to determine alternative uses, silviculture and ways to control its invasive nature. **(Prescription 81)**

6.7.9 Partnerships

The role and importance of natural forests and plantations has become more recognized locally and internationally in terms of, *inter alia*, biodiversity conservation, climate stability, carbon sequestration, water catchment and production of various forest products for livelihood improvement. In order to optimize the above benefits, it is essential to develop and promote partnership arrangements with the various beneficiaries of the mentioned products and services. Partnerships lead to higher levels of compliance and lower monitoring and enforcement costs. This understanding therefore provides a basis for and influencing partnership between various institutions in the implementation of this FMP. NFA shall endeavour to promote public-private partnership arrangements to enhance sustainable management of these forests. (**Prescription 82)**

A strong, transparent and fair partnership among the stakeholders especially NFA and local communities is paramount if management of Mabira is to succeed. Local communities are major stakeholders whose actions and activities directly or indirectly affect forest resources. The women form the biggest number of the rural population in Uganda and often interact with the environment especially forests as they are the main collectors of firewood, forest food, water and craft materials. On the other hand, over 50% of the population in Uganda is composed of the youth. Unfortunately most of the youth are unemployed and as result turn to the common pool resources such as forests for survival. A deliberate effort shall be made to ensure that women and the youth are actively involved in the management of the forests and shall be given responsibilities in forest management including employment. (**Prescription 83)**

The Interests of other stakeholders including resource users, DLGs, UWA, NGOs, CBOs, researchers, development partners (donors) and herbalists shall be taken into account as potential partners, individually or as groups, who can cause impact on the forest resource and influence its management. (**Prescription 84***)*

NFA staff shall regularly continue meeting and coordinating with other stakeholders on all forestry issues and for those beyond their control like reported unfavorable policies including high ground rates for tree farming on CFRs; matters are reported to relevant higher authorities. (**Prescription 85***)*

Communities still believe that they have *de facto* rights to the cultural sites in the CFRs as a natural heritage that they need to continue enjoying. NFA staff shall in a participatory manner design the best method for the cultural sites to be used without damage being caused to the forests. (**Prescription 86)**

All NFA staff shall always engage political leaders and sensitize them on importance of CFRs for sustainable community livelihood improvement and development. *(***Prescription 87)**

6.7.10 Conflict/Grievance Redress Mechanism

While conducting consultative meetings for the update of this FMP, it was noted that different forest stakeholders have varying forms of conflicts and grievances. During the implementation of this FMP, other conflicts and grievances in addition to the existing ones are likely to emerge. These include; perceived marginalization, lack of commitment by on the implementation of CFM protocols, the conduct of law enforcement personnel (especially the EPPF) and ethical issues affecting the use and management of the forest resources.

NFA shall therefore develop an effective mechanism for receiving, evaluating and addressing grievances and conflicts arising from the implementation of activities in this FMP. (**Prescription 88)**

The objectives of the Conflict and Grievance Redress Mechanism will be to:

- detect and prevent the conflicts before they occur, and mitigate their consequences when they occur, as well as preventing them from escalating;
- contribute to the resolution of grievances and conflicts from the activities of this FMP in a timely and efficient manner;
- contribute to the improvement and restoration of the relationships among stakeholders affected by conflicts as a result of this FMP activities;
- Enable the vulnerable (such as the poor, PWDs, the elderly, the landless, the women, and marginalized forest-dependent and forest adjacent communities) to have a voice by submitting complaints and receive timely feedback on their submissions;
- improve stakeholder participation and decision making through dialogues and registration of grievances and conflicts

CHAPTER 7: MITIGATION OF ENVIRONMENTAL AND SOCIAL IMPACTS

The implementation of this FMP will lead to positive and negative to environmental and the social impacts to the forest and especially the adjacent communities. Therefore appropriate mitigation measures shall be taken to minimize the negative effects while enhancing the positive effects. (**Prescription 89**)

7.1 Environmental impacts

7.1.1 Positive Impacts

The MPA is a provider of wood and non-wood forest products and services in addition to being a store of biomass. The forests act as ***carbon sinks absorbing excess atmospheric carbon dioxide emissions*** the bulk of which are produced by neighboring industries such as sugar and tea processing, brick baking, bakeries and from auto mobiles. Already there has been some effort to ***protect the existing natural forests, restore degraded ones and increase the forest estate through plantation establishment in Nandagi and Kalagala Falls CFRs by private investors. Eco-tourism is being promoted as one of the conservation activities in the MPA.***

7.1.2 Actions to be taken to enhance positive impacts

- During this plan measures shall be taken to make sure that the positive impacts are maintained and even improved.

- There will be selection of right species to be planted and staff shall adhere to set standards for natural forest management, plantation establishment, management and harvesting. **(Prescription 90)**

- Areas put aside for ecological and biodiversity purposes shall be managed as such. **(Prescription 91)**

- In areas where there are streams and rivers, the recommended distance of 30-100meters from the stream or river respectively shall not be put under monoculture crop as per NEMA regulations but shall be enriched with suitable indigenous species.**(Prescription 92)**

- In eco-tourism areas, tourist numbers shall be controlled to match with the carrying capacity of the ecosystem. **(Prescription 93)**

7.1.3 Negative Impacts

(a) Clearing of vegetation for plantation establishment and restoration planting

Impacts

Most of the Central Forest Reserves in the MPA have been degraded in one way or another while in Nandagi and Kalagala falls plantations have been established. Forest degradation and conversion of the woodlands to plantation forest estates has led to reduction and loss of biodiversity. There has also been use of fire in bush clearing.

The slash and burn method of land preparation for tree planting is common and is detrimental to forest resources resulting into destruction of tree and grass species, which in turn makes the soils susceptible to erosion.

Mitigation

- Areas to be converted into plantations shall be clearly defined and marked so that peculiar species of flora and fauna are well conserved**. (Prescription 94)**
- Slash and burn method of land preparation shall be limited. In circumstances where it must be used, strict control measures shall be put in place under close supervision. **(Prescription 95)**
- The planting process shall be monitored to ensure that the limits specified in the guidelines and licenses are not violated (**Prescription 96)**
- Collaborative management involving local leaders and communities neighbouring the central forest reserves in forest management activities such as planting and protection shall be promoted to reduce on the illegal activities. **(Prescription 97)**

(b) Soil erosion and degradation

Impact
Clearance (including cultivation, road construction, etc.) and burning of the bushes exposes soils. Such exposed areas are susceptible to soil erosion during the rainy seasons. Soil degradation and pollution may occur due to herbicide and pesticides application. Effluents from SCOUL and other small-scale industrial activities may add to the degradation and pollution of both soil and water.

Mitigation
- Clearing on unstable slopes or highly erosive/fragile soils shall be avoided. **(Prescription 98)**
- The use of heavy machinery and equipment on shall be limited and manual clearing shall be promoted. (**Prescription 99)**
- In addition to using fast growing species, intermediate tree crops and/or growing of grass will be done on exposed soils. (**Prescription 100)**
- Use of hazardous chemicals including herbicides and pesticides will be avoided. NFA will provide a list of recommended chemicals in accordance with WHO and/or FSC standards. (**Prescription101)**
- Poly tubes and plastic materials will equally be disposed by digging pits where they will be buried or burnt depending on whichever will be deemed fit on a case by case basis. **(Prescription 102)**

(c) Wildlife displacement

Impact
The number of plant and animal species (biodiversity) has reduced due to loss of habitat through land use changes especially encroachment, deforestation and degradation of natural high forest and woodlands. Replacing these with uniform monoculture tree plantations drastically limits the biodiversity that can be supported per unit area. This is evidenced by the disappearance or decline in the number of animals seen in the forest in the recent past such as elephants, buffaloes, leopards, lions, bush pigs, duikers and hyenas owing to the clearing of the forests and selective illegal harvesting of certain tree species especially for timber. Even to date hunting is one of the activities that some adjacent

communities still practice and this continues to deplete the remaining population of wild life. Whereas part of the hunting is wild meat, some animals are hunted because they are vermin.

Mitigation

- Efforts shall be put in place to ensure that activities that lead to deforestation and degradation such as encroachment are minimized **(Prescription 103*).***
- Plantation establishment shall be limited to degraded sites or sites of low biodiversity.**(Prescription 104)**
- Hunting in the forest shall not be allowed except for vermin control. However, in consultation with UWA controlled hunting may be permitted ***(*Prescription 105)**

(d) Road Construction and maintenance

Impact
The impacts of road construction include acceleration of soil erosion and loss of flora & fauna and habitats. In addition, road construction breaks the connectivity of ecosystems which is critical to species reproduction and survival. Road excavation loosens soils that end up being washed into wetlands and streams thereby causing siltation and affecting the water quality. Other impacts are modification of the natural drainage pattern and formation of uncontrolled gullies along the roads.

Mitigation
- Road cuts and banks shall be stabilized with grass vegetation on top of ensuring proper drainage and regular road maintenance. **(Prescription 106)**
- Tree lines shall be planted at the outer edge of the road reserve. Immediate replanting shall be done after clear felling of these trees is done.**(Prescription 107)**
- The use of the same forest roads, tracks and loading areas in plantation operations shall be encouraged to avoid creation of new ones which contribute to further soil degradation and erosion.**(Prescription 108)**

(e) Wetlands and stream banks

Impact

The conversion of wetlands into plantation forests may impede the flow of water through them and negatively impact the forest trees.

Clearing up to the bank of a river or a stream causes erosion and may cause exposure of the underlying rocks which don't support vegetation growth or enhance the speed of the water flow leading to floods in lower areas.

Mitigation

- All the wetlands within the CFRs shall be mapped and demarcated in the forest plantation development areas. The process will follow the laws and regulations on the management of wetlands in Uganda. This will help to maintain and sustainably manage the wetlands. **(Prescription 109)**
- A prescribed buffer zone of undisturbed area as per NEMA guidelines shall be observed along streams and rivers. **(Prescription 110)**

(f) Eco-tourism development

Impact

The development of ecotourism infrastructure such as houses for accommodation, road networks, roads, water treatment plants can cause damage to the environment if not properly handled. In addition, if the tourist numbers are not matched commensurately with the carrying capacity of the site can negatively impact on the ecosystem. Poor waste disposal can also affect the environment

Mitigation

Civil works (construction of roads, houses, trails, water treatment plants) shall be treated as in section b above.

Tourist visitor numbers shall be regulated and shall be encouraged to adhere to the eco-site regulations. (**Prescription 111)**

Both solid and liquid waste in the eco-sites shall be handled appropriately. **(Prescription 112)**

7.2 Social impacts

7.2.1 Positive Impacts

The development of forest-based industries will provide products and services in addition to creating employment. Wages paid to local people and commodities bought by employees usually bring income to CFR neighbouring communities. Products will be accessed easily and from near. Local governments also will get revenues in form of taxes from the employees and the forest produce. The CFRs now remain as the main areas with trees that provide firewood cheaply to locals as other areas have been cleared for farming. There are many water sources in the CFRs that are accessed by locals. These CFRs are still sources of herbal medicines and people get the medicine free thus saving the medical costs.

7.2.2 Actions to be taken to enhance positive impacts

- Local people including women and youth living around the CFRs shall be given priority of employment in all activities undertaken in the forests such as plantation development, restoration planting, leisure and tourism and there shall be harmonized working relationship through constant consultations and meetings. **(Prescription 113).**

- The plan shall be accommodative and compatible with Government policies that aim at improving the livelihoods of the poor people**. (Prescription 114).**

- Locals shall continue collecting and enjoying non timber forest products and services including dry wood, fibre, water and medicinal plants from CFRs for domestic consumption.**(Prescription 115)**

- NFA shall work with DLGs to make sure that water sources used by communities are protected and where there are possible gravitational sources, they are developed in an environmentally friendly way.**(Prescription116)**

7.2.3 Negative Impacts

The local people perceive the reserved forest area to be bigcompared to the agricultural land, and view this as deprivation. Eviction of encroachers from CFRs will deprive them of a source of food though they know it is illegal. Restoring the integrity of the CFR management will take away land from encroaching communities back to legal use as people who have been grazing or cultivating as encroachers will be chased away. Regulations by NFA don't allow free and automatic access by locals to major forest products in CFRs and thus causes resentment.

7.2.4 Mitigation Measures

- When licenses are given for harvesting, consideration shall be given to the locals, including women and youth, to compete with outsiders and for fair participation, the local communities shall be protected e.g. by allocating them a percentage using a quota system. **(Prescription 117)**
- CFM programmes shall be rolled out to all communities living adjacent to all the CFRs to create a deep sense of ownership by sharing responsibilities and benefits from the CFRs. **(Prescription 118)**
- NFA frontline staff shall undertake in-service courses on how to manage forest adjacent communities and other stakeholders. **(Prescription 119)**
- Local people shall be encouraged and supported to grow their own trees on their land for both environmental and domestic uses.**(Prescription 120)**
- There shall be constant sensitization of leaders and communities about why some areas in the CFRs have to be protected as strict nature reserves. **(Prescription 121)**
- Land already allocated to private tree growers shall remain with them unless they breach the rules and conditions of the licenses. **(Prescription 122)**
- Allocation of CFR land for private tree growing shall be done in a fair and transparent manner. **(Prescription 123)**

CHAPTER 8: MANAGEMENT AND LOGISTICS

8.1 Staff

The present staffing level is inadequate taking into consideration the following large areas to be managed and the corresponding pressure from illegal activities such as harvesting and encroachment.

Consequently two (2) forest supervisors shall be recruited to take charge of Cadam and Namawanyi stations. In addition, one patrolman shall be recruited to support the forest supervisor at Cadam. **(Prescription 124)**

The proposed staff position is shown in T**able 33.**

Table 33: Proposed staff position

SN	Station	SM*	FS*	PM*	TG*	SG*	OA*	CC*	TA*	CT*
1	Lwankima	01	01	02	-	01	01	02	01	
2	Maligita	-	01	02	-	-	-	-	-	
3	Namawanyi	-	01	02	-	-	-	-	-	
4	Naluvule	-	01	02	-	-	-	-	-	
5	Kyabaana	-	-	02	-	-	-	-	-	
6	Buwoola	-	01	02	-	-	-	-	-	
7	Najjembe	-	01	-	02	02	-	04	-	01
8	Wanende	-	01	02	-	-	-	-	-	-
9	Nandagi	-	01	02	-	-	-	-	-	-
10	Nagojje	-	01	02	-	-	-	-	-	-
11	Namulaba	-	01	02	-	-	-	-	-	-
12	Cadam	-	01	02	-	-	-	-	-	-
13										
	Total	**01**	**11**	**22**	**02**	**03**	**01**	**06**	**01**	**01**

SM* Sector Manager
PM* Patrolman
CC* Compound Cleaner
TG* Tour guide
CT* Caretaker
FS* Forest Supervisor
SG* Security Guard
TA* Transport Assistant
OA* Office Attendant

Note; *There are four (4) environmental protection police officers in the MPA posted to support the staff in their routine patrols against illegal activities***.**

Table 34 below indicates the charge areas for the supervisors

Table 34: Charge areas for the supervisors in the MPA

Position	Station	Charge/Area (Cpts)
Sector Manager	Lwankima	Mabira MPA
Forest Supervisor	Lwankima	176,188,189,190,204,205,206
Forest Supervisor	Kyabaana	180,181,179,175,173 &172
Forest Supervisor	Maligita	183,182,171,184,194
Forest Supervisor	Wanende	211, 212, 209, 201, 213, 210, 214, 215
Forest Supervisor	Naluvule	195,196,197,198,199, & 200
Forest Supervisor	Nagojje	229,230,228,231,227,226& 233
Forest Supervisor	Namulaba	218,217,222,221,217 to 220
Forest Supervisor	Bulanga	232,225,224,215,216
Forest Supervisor	Buwoola	191,192,193,177,178
Forest Supervisor	Cadam	186,185,187,174
Forest Supervisor	Namawanyi	237,236,219, Kalagala falls, 218
Forest Supervisor	Nandagi	235,234 plus areas outside Mabira MPA
Forest Supervisor	Najjembe	Eco-tourism area

8.2 Labour

Forest fieldwork is carried out on contractual basis. Forest Protection and Extension Network (FOPENA) a community-based organization is contracted on a monthly basis to do protection and extension within in the network for threat reduction within the six reserves in the MPA. Casual labour is hired locally and seasonally depending on the demand for labour. Currently, Mabira sector hires 17 patrolmen who are inadequate. In comparison to the large area to be patrolled and the intensity of the illegal activities, the number of patrolmen shall be increased to 22 i.e. 2 patrol men per station. **(Prescription 125)** Generally labour for most of the activities is readily available.

The UGX 80,000 (eighty thousand only) paid to each patrolman monthly is ridiculously low compared with the resource they protect .This is further exacerbated by the fact that there is unnecessary delay in paying this little money sometimes extending beyond one year. Some of the patrolmen can be tempted to connive with illegal people. Resources permitting patrolmen shall be paid UGX 200,000 timely on contract in order to cushion them from the temptation to connive with illegal dealers ensure constant patrol of the Forest Reserves. **(Prescription 126)**

8.3 Health and safety

In order to improve working conditions of staff and contract workers, health and safety programs shall be initiated and promoted. (**Prescription 127**)

8.4 Vehicles

Currently the entire MPA has got one (1) pick up vehicle and one (1) motorcycle to run all the activities in all the six CFRs. The pickup vehicle is managed by the sector managed based at Lwankima forest station while the motorcycle is with the forest supervisor at Namulaba in Ntunda sub county. Given the sensitivity of the MPA, each supervisor shall be provided with a sound motorcycle with sufficient fuel and maintenance funds. Both are in poor mechanical conditions. All forest supervisors shall have

motorcycles with sufficient fuel allocation and a vehicle should be posted full time to the sector to supplement transport and to increase effectiveness of forest management. **(Prescription 128)**

8.5 Records

Records of all forest fieldwork shall be kept at the Sector and Beat Offices. **(Prescription 129)**

Detailed records shall be kept as shown in **Appendix 7** but specifically the Range Manager, the Sector Manager and Forest Supervisor shall keep the following:

i. All CFR reports
ii. Monthly and quarterly revenue and expenditure returns
iii. Annual and quarterly Operation Plans
iv. Amendments to the FMP
v. Monthly, quarterly and annual reports
vi. Copies of permits (in printed books)
vii. Central Forest Reserve Profiles

Forty (40) copies of this FMP shall be distributed and properly maintained as shown below. **(Prescription 130)**

Office/Officer	**Copies**
Forest Supervisor	1
Sector Manager	1 Master copy
Range Manager	1
Director Natural Forests	1
Corporate Affairs office/NFA	1
Executive Director/NFA	1+ 1 Master copy
The Commissioner, FSSD	1
The Permanent Secretary, MWE	1
Hon. Minister Water and Environment	2
Mukono District Local Government	1
Buikwe District Local Government	1
Kayunga District Local Government	1
Sub-counties neighbouring MPA	9
NFA library	1
NEMA	1
Makerere University	1
Key NGOs/Partners	10
Municipal & Town Councils of Mukono, Njeru and Lugazi	4

In October each year, the Sector Manager and the Range Manager shall update their master copies and send copies of the updated information to the Executive Director/NFA for approval and other FMP owners for updating their copies. All copies shall be updated not later than 31st December of each year. **(Prescription 131)**

8.6 Equipment and Tools

All field operations need tools and equipment such as hoes, pangas, axes, slashers, GPS, Cameras, linear tapes, boots, diameter tapes etc. which are part of normal stores. These items shall be purchased centrally and distributed to stations according to operational needs. **(Prescription 132)**

Table 35 indicates the list of equipment and tools to be purchased at the beginning of FMP whose cost and subsequent purchases are included in the estimated expenditure.

Annual consumables and other items for the nursery e.g. seeds, polythene tubing, fertilizers, soil/sand etc. have been appropriately estimated and included in the expenditure.

Table 35: Quantities of equipment and tools to purchased during the FMP period

Item	No
Pangas	50
Axes	10
Liner tapes (5m, 10m, 15m)	20
Diameter Tapes (0.50m, 1.0m, 1.5m)	10
Bow saw (frame + blades, 0.50m-1.0m)	10
Hoes	50
GPS	10
Binocular (varying optical power)	5
Camera	5
Projector	2
Uniforms	20
Gum boots	20
Rain coats	20
Slashers	20

8.7 Housing

Apart from Lwankima Offices and Najjembe where renovations were done recently, the remaining stations are dilapidated and urgently need renovation; water tanks need to be installed. Proper assessment of building repairs/maintenance shall be done to determine nature of work and costs involved. Kyabaana and Maligita are among stations to be given first priority. Two new houses/stations shall be built at Bulanga and Cadam. **(Prescription 133)**

CHAPTER 9: FINANCIAL FORECAST

This chapter is composed of revenue forecasts and expenditure schedules for the Forest management plan period. Details of the financial forecasts are contained in the tables below.

9.1 Revenue

During the implementation of this management plan, costs shall be incurred and some shall lead to generation of revenue while others shall be in the interest of public good.

The revenue projection for the ten year period is **UGX 9,667,831,000** as indicated in **Tables 36 and 37**.

Table 36: Production projection for the FMP Period 2009/10 – 2018/19

Activity/Item	Unit	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Ecotourism • Najjembe NFA Site	Year	1	1	1	1	1	1	1	1	1	1	10
• Rainforest Lodge	Year	1	1	1	1	1	1	1	1	1	1	10
• Adrift	Year	1	1	1	1	1	1	1	1	1	1	10
• MAFICO	Year	1	1	1	1	1	1	1	1	1	1	10
Tree planting License – Kalagala Falls	Ha	25	25									50
Nandagi	Ha	50	50	50	50	50	50	50				350
Sales of seeds	Kg	50	50	50	50	50	50	50	50	50	50	500
Sales of seedlings	No.											
Fencing posts	No.	300	300	300	300	300	300	300	300	300	300	3,000
Timber harvesting	M^3	2,000	2,000									4,000
	M^3	-	-	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	20,000
Research license	No		1			1		1		2		5
Carbon credit	MT											
Resource centre use/hiring	Year						1	1	1	1	1	5

NB: 1). Source: Lwankima Sector records; *Terminalia* spp – 500m^3 from Cpt 187; *Maesopsis eminii* – 700m^3 from Cpt 196; *Cedrella odorata* – 3000m^3 from Cpt 234

βAssumed after construction of the resource centre within first 5 years. The above species are planted trees to be felled in the first 2 years during EI & ISSMI Work 2009/10 – 2010/11. Harvesting elsewhere to begin 2010/11 or as early as possible

Table 37: Estimated Revenue (UGX; 000) during the FMP Period 2009-2019

Source/Item	Unit	Quantity	Rate	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	Total
Ecotourism • Najjembe NFA Site	Year	10	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	**300,000**
Rainforest Lodge	Year	10	8,540	8,540	8,540	8,540	8,540	8,540	8,540	8,540	8,540	8,540	8,540	**85,400**
• Adrift	Year	10	7,336	7,336	7,336	7,336	7,336	7,336	7,336	7,336	7,336	7,336	7,336	**73,360**
• MAFICO	Year	10	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	**10,000**
Tree planting License – Kalagala Falls	Ha	50	14.9	745	745									**1,490**
– Nandagi	Ha	350	22.3	1,115	1,115	1,115	1,115	1,115	1,115	1,115				**7,805**
Sales of seeds	Kg	500	50	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	**25,000**
Fencing posts	No	3,000	2	600	600	600	600	600	600	600	600	600	600	**6,000**
Timber harvesting	M^3	4,000	70	140,000	140,000									**280,000**
	M^3	20,000	65			162,500	162,500	162,500	162,500	162,500	162,500	162,500	162,500	**1,300,000**
Research license	No	5	250		250			250		250		500		**1,250**
Bujagali Compensation				5,000,000										**5,000,000**
Carbon credit	Ha	31293	41									1,283,013	1,283,013	**2,566,026**
Miscellaneous (Fines etc.)	Year	10	2,000									2,000	2,000	**4,000**
Resource centre use/hiring	Year								1,500	1,500	1,500	1,500	1,500	**7,500**
Total				**5,191,836**	**192,086**	**213,591**	**213,591**	**213,841**	**215,091**	**215,341**	**213,976**	**1,497,489**	**1,496,989**	**9,667,831**

Note :) Carbon sink value is estimated at UGX 41,000/ha (Mabira MPA = 31,293ha).
NB: Other revenues from Rain Forest Lodge and Adrift will be annual tax based on performance according to respective 25 years

9.2 Expenditure

In view of the increased activities under this FMP, expenditure is expected to go up from the previous levels.

The estimated total expenditure for this plan period is **UGX. 8,375,125,000** as summarized in **Table 38** below.

Table 38: Summary of Expenditure 2009/10 – 2018/19in UGX. '000

Year	Production W.C	Partnership W.C	Conservation W.C	Ecotourism W.C	Research & Education W.C	General Management costs	Total
2009/10	154,500	28,000	15,000	58,864	5,000	134,380	**395,744**
2010/11	5,180,850	33,000		40,864	3,000	136,430	**5,394,144**
2011/12	150,200	28,000		38,864		130,430	**347,494**
2012/13	137,150	38,000		48,864		103,830	**327,844**
2013/14	111,900	28,000		38,864	2,500	115,930	**297,194**
2014/15	113,200	36,000		104,097		102,754	**356,051**
2015/16	118,050	28,000		39,097		131,754	**316,901**
2016/17	114,400	28,000		39,097	2,500	105,154	**289,151**
2017/18	116,500	26,000		39,097		143,754	**325,351**
2018/19	112,400	26,000		39,097		143,754	**325,251**
Total	**6,309,150**	**299,000**	**15,000**	**486,805**	**13,000**	**1,248,170**	**8,375,125**

For the day to day implementation of this FMP, an activity schedule and annual operational plan shall be developed. The activity schedule shall be strictly adhered to in accordance with budgeted annual expenditure. The Sector Managers shall not spend beyond the annual estimates without approval of the Range Manager or NFA Headquarters. All expenditures shall be made according to budget lines and ceilings. **(Prescription 134)**

9.3 Costs and profitability

A comparison of projected revenues and expenditure (T**ables 37 & 38**) indicates that management of Mabira MPA is a viable undertaking when income from carbon is factored in. However, the following important factors should also be taken into consideration:-

i) Mabira CFR suffered from serious illegal pitsawying and encroachment. The former, removed almost all high value species and harvestable volume. Encroachment decimated the productive area into a very degraded and unproductive forest.
ii) Mabira CFR is the largest water catchment for Lakes Victoria and Kyoga.
iii) Other non-monetary benefits such as climate mitigation and absorption of carbon mean a lot to the whole country and particularly the agricultural sector.

The Range Manager shall make sure that only prioritized activities shall be implemented to avoid unplanned expenditures. **(Prescription 135)**

Given the management and conservation challenges Mabira MPA is facing, it is evident that the revenue, which is generated internally from the forests, is far too low to optimally finance all planned activities. Top management of NFA shall endeavor to mobilize additional resources to supplement internally generated revenue so that the prescriptions, which have not been translated into activities within the plan and budget, can as well be implemented. Innovative funding mechanisms such as PES, CDM and REDD+ shall be explored (**Prescription 136)**

CHAPTER 10: MONITORING AND EVALUATION

A plan for monitoring the ecosystem of the Mabira ecosystem has been developed and is presented independently of the Monitoring and Evaluation Prescription.
Monitoring and routine evaluation shall represent an on-going activity to track the progress of this FMP against planned tasks and targets. **(Prescription 137).**

Monitoring and evaluation are important because of their benefits in:

- establishing whether planned results are achieved or not, and the reasons;
- improving and supporting management through lessons learnt;
- generating shared understanding amongst the stakeholders or partners
- generating new knowledge and support learning
- building the capacity of the implementing partners;
- motivating stakeholders; and
- ensuring accountability

Activities in the FMP shall be benchmarked and performance regularly monitored. **(Prescription138)**

10.1 Operational plans

The schedule of activities for this FMP shall be the basis for preparation of annual operations plans (AOP). Every year, the NFA Sector Manager shall prepare an AOP in which key stakeholders should have an input. **(Prescription 139**)

Licensed operators (excluding casual licensees) shall prepare AOPs in accordance with guidelines issued by the NFA. (**Prescription 140)**

AOPs shall be prepared and shall conform to the criteria and indicators described in Section 10.2 of this FMP.

10.2 Criteria and indicators

Scientific criteria and indicators (C&I) shall be used in monitoring and evaluating activities. C&I from the International Timber Trade Organization (ITTO) and the National standard for Forest Stewardship Council (FSC) – (**Appendix 8a & b**) shall be adopted for this FMP. **(Prescription 141***)*

A tentative M& E framework is shown in **Table 39.**

10.3 Inspection of forest field work

Regular field visits by superiors shall be made to assist in assessing the progress of work compared to planned targets and take timely appropriate actions for improvements. **(Prescription 142)**

- Forest Supervisors shall visit each reserve at least once every month compiling a comprehensive field report after each visit.

- The Sector Manager shall inspect activities in the MPA at least twice a month compiling a comprehensive field report after each visit.

- The Range Manager on his part shall inspect activities in this MPA at least once every 2 months compiling a comprehensive field report after each visit.

- Senior Officers from NFA HQs shall inspect activities in this MPA at least twice a year compiling a comprehensive field report after each visit.

- Meetings shall be held as part of field visits. These meetings shall include key partners and stakeholders, including Local Government Authorities, and local communities. *(***Prescription 143)**

10.4 Evaluation of the FMP activities

Evaluation shall represent a systematic and objective assessment of on-going or completed FMP components or activities in terms of their design, implementation and results. **(Prescription 144)**

During preparation of the AOP, the activities planned for the previous year shall be evaluated in a participatory manner in order to inform the AOP being prepared. ***(*Prescription 145)**

Activities shall be evaluated and the FMP reviewed every five (5) years in accordance with Section 28(6) of the National Forestry and Tree Planting Act, 2003 though it may be done earlier should there be any emerging management issues that warrant it. **(Prescription 146)**

10.5 Reporting procedure

Regular reporting shall be done to help in the implementation of this FMP. ***(*Prescription 147)**

- The Forest Supervisor shall prepare bi-weekly reports to the Sector Manager who in turn shall prepare monthly reports to the Range Manager.

- The Range Manager shall summarize all reports from Sector Managers and submit his/her monthly report to the Director, Natural Forests at the NFA Headquarters.

- Copies of these reports shall be distributed to relevant stakeholders at each reporting level.

- All monthly reports shall be structured in a way that conforms to the NFA Performance Agreement with Government and as prescribed in the management standards. (**Prescription 148***)*

- Situational reports dealing with emergency situations like serious encroachment and illegal harvesting shall be prepared and submitted immediately to the appropriate person responsible for dealing with the situation. *(***Prescription 149***)*

10.6 Mapping

Mapping is an important tool in the management of natural resources and other phenomena affecting them and therefore must be an integral part of the Monitoring, Reporting and Verification (MRV) processes. Mapping adds a spatial dimension to data collected from the field that greatly enhances analysis yielding concise information that can be used to guide decision making. Copies of

management maps at various scales ranging from 1:10,000 to 1:50,000 shall be maintained up to date, clearly showing the areas of operation and conservation patches. **(Prescription 150)**

- Supervisors shall collect detailed spatial data on all key field activities using GPS. Activities to be mapped include but not limited to;
  - Area to be allocated for planting (private and NFA) as well as subdivision that may be applicable
  - Natural belts which include wetlands, patches of natural forests
  - Areas with concentration NWFPs such as rattan, clay, sand, medicinal plants, crafts material etc.
  - Spots of both positive and negative impact such as illegal harvesting, extraction, cultivation, settlements, sites with tourism potential, etc.
  - Management activities like area planted, weeded, thinned, burnt, etc.
- The GPS data collected along with the sketches and appropriate metadata shall be compiled and sent to the GIS Unit at the NFA headquarters for further analysis and integration and reporting.
- All field reports should have a map (s) and or GPS data attached whenever a key parameter is being monitored such as planted, burnt and encroached areas among others.

Regular training in data collection, processing and management should be conducted periodically (**Prescription 151**)

Table 39: M&E Framework of outputs and outcome indicators

Planned Activity (Objective)	Baseline information	Output Indicators (Target)	Means of Verification	Partnership Strategy Used	Impediments to Output	Factors towards Output	Factors contributing to Output	Responsible
Boundary resurvey and demarcation	• Unclear boundaries	• No of Km. surveyed and demarcated	• Field visits • Length covered • Survey reports	• Surveyors contracted	• Delays by contracted surveyors	• Timely release of funds	• Reliable contractors	• NFA
Planting live boundary markers	• Unplanted boundaries	• No of km planted	• Field visits • Length planted • Survey reports	• Contracting communities	• Unreliable rains	• Timely release of funds	• Reliable contractors	• NFA, Local community
Handling encroachment	• No. of registered encroachers • Area Encroached	• No of registered encroachers evicted • Area (ha) recovered	• Field visit • Copies of Eviction Notices • Court action	• Local leaders • Security gents	• Political interference	• Timely release of funds • Political support	• Encroacher leaving voluntarily	• NFA staff • LCs
Restoration Planting	• Area currently planted (ha)	• Area planted (ha)	• Field visits • Reports • maps	• NFA • Private sector	• Unreliable rains • Lack of funds	• Timely release of funds • Political support	• Reliable contractors	• MWE • NFA
Inventories and surveys	• Un-demarcated area • No. of blocks	• No of (ha) of EI and ISSMI • Assessed	• Field visits • Ha assessed • Reports	• TSD contracted	• Lack of adequate baseline data • Immature trees	• Timely release of funds	• Reliable contractors • Mature trees	• NFA
Review of the FMP	• • Planned activities	• Achieved targets in FMP implementation • No of achieved planned activities	• Annual report • W/circle prescription implemented • Field visits	• Joint planning	• Delay in release of funds • Poor annual planning	• Timely release of funds and active participation of partners	• Good planning	• NFA and other stakeholders
Collaborative Forest Management	• Community Action Plan • CFM agreements	• No of CFM agreements signed • No of community action plans developed& implemented •	• Minutes of Community meetings • Records	• Joint planning with community	• Inadequate funds • Poor community mobilization	• Poor participation of community • Lack of commitment from NFA	• Good community mobilization	• NFA • Communities
Tending THF	• Untended forest	• No of (ha) Tended	• Field reports • Work done	• Capable contractors	• Unreliable contractors	• Timely release of funds	• Reliable contractors	• NFA

Planned Activity (Objective)	Baseline information	Output Indicators (Target)	Means of Verification	Partnership Strategy Used	Impediments to Output	Factors towards Output	Factors contributing to Output	Responsible
			(ha)		• Unprofessional work			
Buildings	• Buildings to be built or renovated	• No. of buildings built, renovated	• Field visits • Certificates for work payment	• Capable contractors	• Unreliable contractors	• Timely release of funds	• Reliable contractors	• NFA
Revenue generation	• Licenses to be issued • Revenue sources	• No. of licenses issued • No. of revenue sources identified	• Revenue reports • Receipts • Revenue registers	• Encourage purchases	• Lack of communication • Lack of interested people	• Availability of NFA facilities	• Availability of interested people	• NFA
Improve local community income	• Local people employed or licensed • Level of household incomes in target communities	• Higher household income • No. of licenses issued • No of people employed by NFA	• Field observations • Reports • licenses	• Contracting community • Local leaders • District leaders	• Community unwillingness to cooperate	• Adequate and timely payment • Willingness of community to cooperate	• Technical and political support	• NFA staff • Communities • LCs • NGOs and CBOs
Land cover Mapping	• Area to be mapped	• Change in area of forest type	• Maps, reports	• NFA	• Inadequate funds	• Timely release of funds	• Good planning	• NFA
Management of invasive species	• Impacted area	• Number and coverage of invasive species	• Report	• NFA • NaFORRI	• Inadequate funds	• Timely release of funds	• Good planning	• NFA • NaFORRI
Research	• Research Area	• Number of new findings	• Reports, • Research licenses	• NFA • NaFORRI • Students	• Inadequate funds	• Timely release of funds	• Good planning	• NFA
Forest patrols	• Level of illegal activities	• Area (ha) protected • Cases prosecuted • Quantity of	• Report • Court records	• Community • Local leaders • District leaders	• Community unwillingness to cooperate	• Timely release of funds	• Good planning	• NFA staff • Communities • LCs • LGs

Planned Activity (Objective)	Baseline information	Output Indicators (Target)	Means of Verification	Partnership Strategy Used	Impediments to Output	Factors towards Output	Factors contributing to Output	Responsible
		• illegal produce confiscated						
Streamline climate change(CC) issues in forest management	• CC coping strategies in place • CC interventions in place	• Level of CC awareness among FACs • Area and no. of medicinal and edible plant species domesticated • Area of trees planted on farm • No. of alternative & sustainable technologies for charcoal production and brick & handcraft making • Level of sustainable use of forest resources • Level of illegal activities	• Reports • Field Visits • Minutes of meetings • Attendance lists • Court & police records	• LGs • NGOs • Local communities • CFM Groups • CBOs • Private Investors	• Inadequate funds • Lack of cooperation from partners including local communities and leaders	• Adequate and timely release of funds • Willingness of community to cooperate to plant trees and adopt technologies	• Technical and political support • Good community mobilization • Good planning	• NFA staff • Communities • LCs • NGOs • CBOs • LGs • EPPF
Streamline gender and equity issues in forest management	• Women, youth and vulnerable people involved	• No. of women & youth benefiting from the forests • No. of women &	• Reports • Field Visits	• CFM groups • CBOs • CDOs • NGOs	• Inadequate funds • Lack of cooperation from partners including	• Adequate and timely release of funds • Willingness of community to cooperate to plant trees and	• Technical and political support • Good community mobilizatio	• NFA • CBOs • NGOs • LCs • LGs • Local communities

Planned Activity (Objective)	Baseline information	Output Indicators (Target)	Means of Verification	Partnership Strategy Used	Impediments to Output	Factors towards Output	Factors contributing to Output	Responsible
		youth trained in forest management • No. of women & youth groups formed & supported • Standard of living of the women, youth and the vulnerable			local communities and leaders	adopt technologies	n	

Source: ***Based on UNDP Evaluation Office, 2002, Part III Monitoring and Evaluation Performance, Part IV Use of Monitoring and Evaluation Information.***

REFERENCES

1. Atlas of Uganda, 1967. Department of Lands and Surveys: Entebbe.
2. Banana A.Y., Mukasa C., Tibazalika A. & Mwangi E.2013. Gender, tenure and community forests in Uganda: Policy and practice for women's participation
3. Bush, G. Nampindo, S., Aguti, C. & Plumptre, A. 2004. The Value of Uganda's Forests: A livelihoods and ecosystems approach. Wildlife Conservation Society, Albertine Rift Programme/EU Forest Resources Management and Conservation Programme/National Forestry Authority. Kampala, Uganda
4. Cheney .E. M. 1960. An Introduction to the Soils of the Uganda Protectorate. Kawanda Research station,
5. Davenport, T., Howard, P.C. and Baltzer, M. 1996. Biodiversity Report for Mabira. Forest Department, Kampala, Uganda.
6. Earl, D. E. 1968. The Latest Techniques in the Treatment of Natural High Forest in South Mengo District. Forest Department, Kampala, Uganda.
7. Eggeling, W.J. & Dale .I.R. 1951. The Indigenous Trees of Uganda. Government Printer Entebbe, Uganda
8. Emerton, L. & Muramira, E.T. 1999. Uganda Biodiversity: An Economic Assessment Report for IUCN World Conservation Union, Biodiversity Economics for Eastern Africa. Nairobi, Kenya.
9. Environmental Alert, GEF & UNEP.2007. Climate change Uganda National Adaptation Programmes of Action
10. Forest Department. 1993. Forest Inventory report for Mabira Forest Reserve
11. Forest Department. 2002. Forestry and Nature Conservation Master Plan. Kampala, Uganda.
12. Forest Department (FD), 2003. National Biomass Study Technical Report ISBN 9970 863 002 (1st Edition). Ministry of Water, Lands and Environment Forest Department Kampala Uganda pp. 152
13. Howard, P. 1995. The Economics of Protected Areas in Uganda: Costs Benefits and Issues. Unpublished M.Sc. Thesis, University of Edinburgh.
14. Kabi. 2002. A community Level Economic Value Assessment of Natural Resources. The case of Sango Bay Swamp Forest Ecosystem, Rakai District, Uganda. MSc. Thesis, Makerere University.

15. Kefi M and Yoshino K. 2010. Evaluation of the economic effects of soil erosion risk on Agricultural productivity using remote sensing: Case of watershed in Tunisia. International Archives of the Photogrammetry, Remote Sensing and Spatial Information Science, Volume XXXVIII, Part 8, Kyoto Japan

16. Kramer, R.A., Mercer, E. & Sharma, N. 1993. *Valuing Tropical Rainforests Protection as a Global Environmental Good*. Durham, NC: Centre for Resource and Environmental Policy Research, Duke University, USA.

17. Lette, H & de Boo, H. 2002. *Economic Valuation of Forests and Nature – A Support Tool for Decision-making*. Theme Studies Series 6: Forests, Forestry and Biodiversity Support Group

18. Lock wood Consultants Ltd (1973). Forest Resource Development Study, Republic of Uganda Part 1. The Forest Resource and its Management. Toronto Canada.

19. Maille Peter and Mandelsohn Robert (1993). Valuing ecotourism in Madagascar. Journal of Environmental Management. (38) 213-218

20. Mendelsohn, R. & Balik, M.J. 1995. The value of undiscovered pharmaceuticals in tropical forests. *Economic Botany* 49(2) pp. 223-228

21. Ministry of Water, Lands and Environment (2002). Uganda Forestry Nature Conservation Master Plan.

22. Ministry of Water, Lands and Environment. 2010. Kalagala Offset Sustainable Management Plan (2010-2019)

23. Ministry of Water, Lands and Environment. 2012. National Forest Plan (Revised)

24. Ministry of Water, Lands and Environment .2016.Strengthening National Feedback And Grievance Redress Mechanism For Uganda's Redd+ Programme

25. Munasinghe, M. 1992. *Environmental Economics and Valuation in Development Decision making*. Environment Working Paper No. 51. Environment Department. Sector Policy and Research Staff, The World Bank, Washington, D.C., USA.

26. National Environment Management Authority (NEMA). 2001. *State of the Environment Report for Uganda 2000*. Kampala, Uganda

27. National Forestry Authority.2015. Business Plan.

28. National Forestry Authority. 2010. Forest Management Plan for Kalagala Falls Central Forest Reserve (July 2010-June 2020)

29. National Forestry Authority. 2005. Guidelines for development of Forest Management Plans

30. National Forestry Authority. 2005. NFA Ecotourism Development Plan(2014-2018

31. Nature Uganda. 2011. The Economic Valuation of the Proposed Degazettement of Mabira Central Forest Reserve.

32. Pearce D W & Pearce C, 2001, The value of ecosystem conservation. Conservation of Biological Diversity. Montreal Canada.

33. Pearce, D. & Moran, D. 1994. *The Economic Value of Biodiversity*. IUCN, Gland, Switzerland in association with Earthscan Publications, London

34. Report on the inter-ministerial committee on assessing the request by Mehta Group to grow sugarcane on part of Mabira forest reserve land, 2006.

35. Republic of Uganda. 1995. CONSTITUTION OF THE REPUBLIC OF UGANDA.

36. Republic of Uganda. 2001. Uganda Forestry Policy.

37. Republic of Uganda. 2012. National Forest Plan

38. Republic of Uganda. Land Act. CAP 227.

39. Republic of Uganda. THE NATIONAL ENVIRONMENT ACT. CAP 153

40. Republic of Uganda. 2013. National Land Policy.

41. Republic of Uganda. 2010. National Development Plan for 2010/11-2014/15.

42. Republic of Uganda. 2015. SECOND NATIONAL DEVELOPMENT PLAN (NDPII) 2015/16 – 2019/20

43. Republic of Uganda. Statutory Instruments 1998 No. 63.

44. Republic of Uganda. 1998. The Environmental Impact Assessment Regulation, S.I. No. 13/1998.

45. Republic of Uganda. 2003. The National Forestry and Tree Planting Act.

46. Republic of Uganda. Uganda Vision 2040.

47. Ruitenbeck, J. 1989. *Social Cost Analysis of the Korup Project, Cameroon*. A Report prepared for the World Wildlife Fund for Nature and the Republic of Cameroon, London

48. Slade, G., and Weitz, K. 1991. "Uganda Environmental Issues and Options. A Masters Dissertation. Unpublished, Duke University, North Carolina

49. Society of American Foresters.1971. Terminology of forest science. Technology practices and products

50. Twinomuhangi Leo. 2011. Recruitment and Volume Increment of selected indigenous tree species in Mabira CFR. A dissertation submitted to the Directorate of Research and Graduate Training in partial fulfillment of requirements for the award of Master of Science in Forestry of Makerere University.

51. Uganda Bureau of Statistics (UBOS) 2014. Uganda Population and Housing Census. *Preliminary Report* March 2014.

52. USAID. 2012. Uganda Climate Adaptation Fact sheet

53. WWF-World Wide Fund for Nature (formerly World Wildlife Fund). 2006. Gland, Switzerland.

54. Yaron, G. 2001. Forest Plantation Crops or Small-scale Agriculture: An economic analysis of alternative land use options in Mt. Cameroun area. Journal of Environmental Planning and Management. 44(1), 85-108

APPENDICES

Appendix 1: Summary of Prescriptions

No.	Prescription	Section
1.	The management plan shall operate for a period of 10 years starting on 1st July 2009 to 30th June 2019	5.5
2.	The FMP shall be reviewed in year 5 (2014) of its implementation in a participatory process with key stakeholders including local communities so as to incorporate emerging issues and policies.	5.5
3.	In order to achieve set management objectives in this FMP the CFRs shall be zoned into two (2) broad management zones; the production and conservation zones.	6.1
4.	The Conservation Zone shall consist of the strict nature reserve for scientific research and the buffer zone where ecotourism is being developed.	6.1
5.	All ecologically fragile areas including wetlands in the production zone shall receive special management status as if they were in the conservation zone.	6.1
6.	The six (6) CFRs shall be managed as one MPA and there shall be five (5) working circles.	6.1.1
7.	All possible avenues shall be sought to ensure that the growing stock is safeguarded against all forms of illegal activities.	6.2.1
8.	The production working circle shall be managed to provide both consumptive and non-consumptive forest products on a sustainable basis.	6.2.1
9.	Encroachment planting shall be done in formerly encroached areas of Kalagala Falls CFR as part of conservation planting of river Nile bank on the western side and along forest boundaries.	6.2.1
10.	The 35ha crop of *Maesopsis eminii* and *Terminalia superba* in Bugule (Cpt 175) and other areas planted in 2004/05, now at sapling/pole size (above 6m in height and dbh 10-15m) requires no further slashing but all stunted poles shall be thinned out.	6.2.1
11.	Enrichment and restoration planting together with subsequent tending activities shall be carried out covering 3,600 ha of the 9 compartments(No. 236, 171, 172, 173, 174, 175, 180, 181 & 237) in the eastern block of Mabira that were previously encroached under the double agriculture production program in the 1970s.	6.2.1
12.	Ten (10) enrichment trial plots each of one (1) hectare shall be established in eastern block of Mabira CFR which has been colonised by paper mulberry. They shall be planted with high value species such as *Khaya anthotheca*, *Cordia millenii* and *Entandrophragma spp* at spacing 10m by 10m. Two (2) trial plots shall be established per year in the first five (5) years of the FMP. Maintenance shall be carried out in the first five (5) years of the crop	6.2.1
13.	In compartments where there is licensed harvesting of timber, logging waste including the lops and tops shall be disposed off immediately by authorised charcoal production.	6.2.1
14.	Harvested areas with big gaps where charcoal production has been carried out shall be prepared and planted with appropriate species.	6.2.1
15.	Routine maintenance activities such as climber cutting, liberation tending, and other operations shall be carried out at appropriate times.	6.2.1
16.	All private tree growers shall adhere to the NFA Guidelines on plantation establishment and management. Tree farmers in Kalagala Falls CFR shall be encouraged to plant mainly indigenous timber tree species to stabilize the river banks.	6.2.1
17.	Reduced impact logging shall be exercised through the use of light machinery.	6.2.1
18.	Harvestable volume shall not exceed 2,000m³/year	6.2.1
19.	ISSMI blocks shall be regularly maintained.	6.2.1
20.	Cases of abandoned logs and wind thrown trees shall be salvaged by NFA or disposed off under the harvesting guidelines for disposal to the public.	6.2.1
21.	Harvesting of NTFPs on a commercial scale shall be allowed in accordance with the license terms and conditions.	6.2.1

No.	Prescription	Section
22.	As for community based organizations, MoUs shall be developed to guide the mode of extraction.	6.2.1
23.	Extraction of other forest products such as stones, clay, sand and forest soil shall not be allowed except sand from Nandagi CFR where it occurs in reasonable quantities.	6.2.1
24.	The fourteen (14) existing PSPs shall be assessed within the first three years of this FMP implementation and thereafter every five years from the last assessment.	6.2.1
25.	Public participation shall be promoted through empowerment of concerned stakeholders through education, public awareness, gender balance, information exchange, research and net-working and observation of international and bilateral agreements, to which Uganda is a signatory.	6.3
26.	This approach shall be scaled up to areas where it is deemed necessary to enhance community participation in the management of forests in this FMP.	6.3
27.	The performance of CFM implementation shall be monitored and evaluated to ensure compliance to CFM guidelines and plans.	6.3
28.	With support from NFA and other relevant partners such as CSOs and local governments, CFM groups shall be assisted to improve their livelihoods by engaging in alternative income generating projects like raising of tree seedlings, energy saving technologies, tree growing on farm, and apiary to mention but a few.	6.3
29.	The current and anticipated infrastructural developments (roads, railway hydropower and oil pipe lines) are encroaching on the size of the permanent forest estate (PFE) therefore forest land lost to these developments shall be appropriately compensated and the funds generated there from shall be used for this purpose.	6.3
30.	Community support initiatives through grants and benefit sharing with adjacent local communities shall be done through institutions like schools, NGOs (e.g. MAFICO), CBOs, churches, mosques and any other organised groups.	6.3
31.	Local communities, especially those in the ten totally enclosed enclaves, women and youths, shall be given first priority whenever there are employment opportunities, awarding local contracts, establishing community nurseries and supporting management of private forests (in liaison with DFS) in addition to issuing licences for harvesting forest products and services.	6.3
32.	Whenever there will be competitive bidding for timber harvesting, a percentage of harvestable volume shall be given to interested and capable local communities and/or community based organizations registered at the sub-county and district at a reserve price.	6.3
33.	Biodiversity Inventory shall be carried out within the first 5 years of the FMP to update the 1996 report and assess the level of species increase/decrease	6.4
34.	Due to some emerging issues such as population pressure, high demand for forest products, shortage of land and the proximity of some of the compartments under the strict nature reserve to the settlements, it is proposed that the forest be re-zoned in the ratios of 20 % Strict Nature Reserve zone, 10% of Buffer zone and 70% of Production zone. However this shall be done after a careful scientific study to justify the change.	6.4
35.	Fragile ecosystems like swamps, hills, and riverbanks shall be protected and restoration shall be carried out in degraded areas.	6.4
36.	Water catchment areas shall be preserved while degraded areas shall be rehabilitated with indigenous tree species.	6.4
37.	Palms and associated trees along the banks of R. Ssezibwa and R. Musamya shall be conserved for riverine and wetland protection and licensing for harvesting shall not be done without prior assessment of impacts.	6.4
38.	In collaboration with NEMA, as the responsible body, the Sugar Corporation of Uganda Ltd (SCOUL) shall be made to manage its industrial effluents before releasing them into R. Musamya.	6.4
39.	Processing of local gin (waragi) along water courses and use of non-biodegradable materials shall be prohibited in the forest. Disposal of non-biodegradable materials shall be controlled by setting up disposal pits and warning/information sign posts along the Jinja-Kampala highway and any other public roads through the reserves.	6.4
40.	Stakeholders within Mabira MPA such as Nile Ply, SCOUL, National Water and Sewage	6.4

No.	Prescription	Section
	Corporation, UMEME, UBL among others shall exercise their obligations as stated in their EIA reports especially in regard to compensation for absorption of effluents.	
41.	Formal partnership arrangements with interested conservation institutions such as UWA; CSOs/CBOs such as MAFICO, Nature Uganda; DLGs such as Mukono, Buikwe and Kayunga and private companies such as Nile Ply, SCOUL shall be established.	6.4
42.	In conformity with sustainable forest management practices, Mabira ecosystem shall be managed responsibly to meet ITTO and FSC standards for forest certification.	6.4
43.	Appropriate activities shall be undertaken to raise conservation awareness among the forest edge communities.	6.4
44.	Guidelines for eco-tourism investment shall be developed and properly implemented taking into consideration tourism investment with appropriate rates and licenses.	6.5
45.	EIA shall be done for all potential tourism sites within the boundaries of the CFRs and proper assessment done to determine the likely technical and social-economic impact to the environment.	6.5
46.	In order to improve on the current tourism infrastructure, four (4) more bandas shall be constructed in addition to renovating the old ones. The trail network and tree name tags shall be regularly maintained while the information room at the recreation centre shall be expanded.	6.5
47.	The current tariffs for the services at the eco site shall be revised from time to time as need arises	6.5
48.	A competent service provider shall be identified and licensed to construct and manage a catering unit near the entrance of the Najjembe eco-tourism site to provide catering services to the visitors.	6.5
49.	Marketing and promotion of the eco-site shall be done using the bill boards, sign posts, brochures, flyers, partnerships with tour companies and Mabira eco-tourism website and resource centre.	6.5
50.	The private sector shall be encouraged to participate in tourism development by providing appropriate and attractive conditions for investment	6.5
51.	Community tourism in compartment 211 shall be supported through training and capacity building in; visitor handling, crafts making, marketing of handicrafts, food items and other related services.	6.5
52.	Cultural tourism which involves tourists visiting cultural sites within the MPA shall be promoted in sites where Buganda Kingdom subjects go to perform traditional rituals such as worship and praise, searching for wealth, health, children, luck and prosperity.	6.5
53.	The license shall also cover recreational areas including shaded rest areas, picnic spots, and environmentally-friendly dry toilets.	6.5
54.	Tour guides shall be provided with additional training; both in technical areas such as birding as well as in making tours more dynamic and groups of tourists shall be limited to a maximum of 10 tourists per guide.	6.5
55.	New trails and even a boardwalk shall also be required to allow bird watchers to access a wetland area rich in birdlife.	6.5
56.	Along all trails, signage and interpretative infrastructure shall be created to orient tourists and enrich their experiences. Trail maps shall also be developed and either distributed or sold to tourists	6.5
57.	The MAFICO group running ecotourism operations in Griffon Falls shall be supported when possible. Their guides and any others involved in their operations shall be incorporated into training courses, perhaps even by licensees.	6.5
58.	NFA, along with the licensees, shall work to creatively promote the area through social media and other cost-effective means including staging of open-air cultural performances and other events in the forest.	6.5
59.	Research and development to enhance scientific innovation, skills, information and policy advice for increased productivity and sustainable management of forests and tree resources shall be promoted.	6.6

No.	Prescription	Section
60.	Research shall be carried out in partnership with research and training institutions, projects and NGOs. The M.O.U between NFA and NaFORRI shall be reviewed to include more wood utilisation research.	6.6
61.	Applied research using diagnostic sampling shall be carried out periodically to monitor restoration progress in areas under enrichment planting and colonizing forest.	6.6
62.	Threat reduction assessment research is urgently required. It shall be conducted in 2009/2010 in order to identify threat indicators.	6.6
63.	Research guidelines based on research categories shall form the basis for issuance of research permits/licences.	6.6
64.	Except for students carrying out non-destructive research, all researchers shall pay research licence fees to conduct research in the FMPA. Copies of all research conducted within the MPA shall be submitted to the Executive Director NFA.	6.6
65.	Diagnostic sampling shall be done two years after biodiversity inventory has been carried out within the two blocks (Eastern and Western) of Mabira to determine the natural regeneration of the forest.	6.6
66.	Indigenous tree species shall be extended to the community/private land for domestication in partnership with NaFORRI and Makerere University and the tree species performance shall be closely monitored to offer technical advice where needed	6.6
67.	The external boundaries of Mabira, Namakupa and Namawanyi/Namananga CFRs with a total cutline length of 346.6km shall be resurveyed, verified re-opened and marked with concrete pillars (about 2m high) within this plan period.	6.7.1
68.	Boundary planting using live markers along the whole 367km cut line length for all the five CFRs (Mabira, Nandagi, Namakupa, Namawanyi/Namananga, and Kalagala Falls) in this management plan shall be done with appropriate commercial tree species.	6.7.1
69.	During the first five years of the plan, the external boundaries shall be maintained by slashing annually until the live markers are fully established.	6.7.1
70.	Where applicable, the external boundary shall be made into forest management roads that will reduce the cost of annual maintenance and encroachment.	6.7.1
71.	In Nandagi CFR, internal boundaries shall be opened to serve as access roads or fire lines. All private tree growers shall be required to maintain the fire lines in their plots.	6.7.1
72.	Forest roads shall be maintained every financial year of the FMP implementation	6.7.1
73.	Once the boundaries have been re-surveyed and opened, a census of encroachers shall be carried out to ascertain the extent of encroachment and numbers of encroachers	6.7.2
74.	All people confirmed to be encroachers shall be evicted. Periodic monitoring of encroachment shall be carried out and any future encroachers shall be evicted as soon as discovered.	6.7.2
75.	The Forest Supervisor with private tree growers particularly in Nandagi and Kalagala falls shall take appropriate steps for fire protection in accordance with the law and the guidelines issued by NFA.	6.7.3
76.	NFA staff shall work with Mukono, Kayunga and Buikwe DLGs and UWA to control vermin	6.7.4
77.	Both NFA staff and private tree farmers shall be on the lookout for pest and disease outbreaks and immediately after discovery, report to relevant authorities most appropriately, NaFORRI.	6.7.5
78.	The forests shall be managed responsibly to ensure that their carbon sequestration potential is enhanced while the emissions are reduced.	6.7.6
79.	During this plan period, innovative funding mechanisms such REDD+, PES, CDM, shall be explored	6.7.6
80.	In order to effectively contribute to mitigating the effects of climate change emphasis shall be put to activities such as afforestation, reforestation, and sustainable management of forests the MPA.	6.7.7
81.	Further research shall be undertaken on the paper mulberry *(Broussonetia papyrifera*) to determine alternative uses, silviculture and ways to control its invasive nature	6.7.8
82.	NFA shall endeavour to promote public-private partnership arrangements to enhance	6.7.9

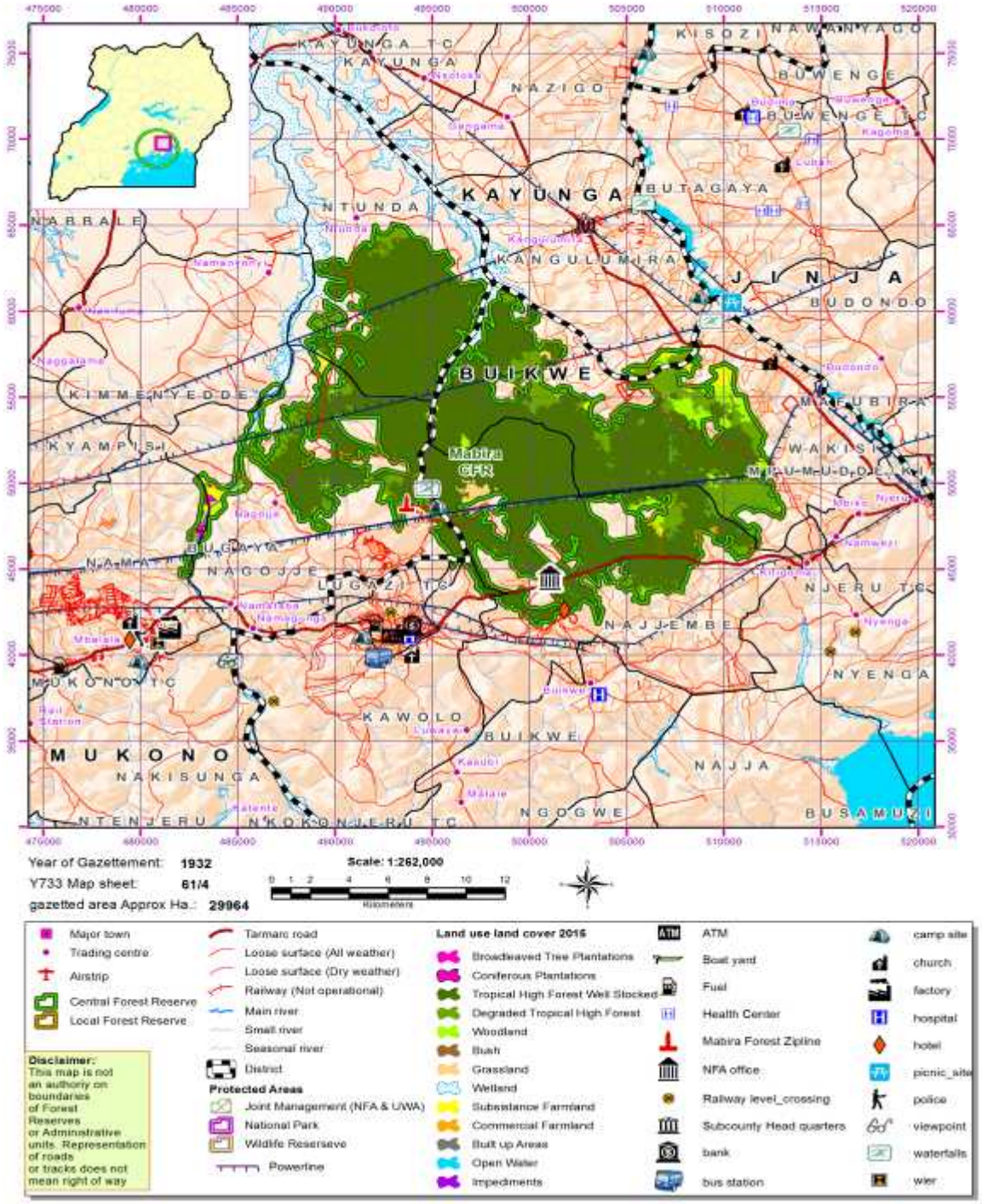
No.	Prescription	Section
	sustainable management of these forests.	
83.	A deliberate effort shall be made to ensure that women and the youth are actively involved in the management of the forests and shall be given responsibilities in forest management including employment.	6.7.9
84.	The interests of other stakeholders including resource users, DLGs, UWA, NGOs, CBOs, researchers, development partners (donors) and herbalists shall be taken into account as potential partners, individually or as groups, who can cause impact on the forest resource and influence its management.	6.7.9
85.	NFA staff shall regularly continue meeting and coordinating with other stakeholders on all forestry issues and for those beyond their control like reported unfavourable policies including high ground rates for tree farming on CFRs; matters are reported to relevant higher authorities.	6.7.9
86.	NFA staff shall in a participatory manner design the best method for them to be used without damage being caused to the forests.	6.7.9
87.	All NFA staff shall always engage political leaders and sensitize them on importance of CFRs for sustainable community livelihood improvement and development.	6.7.9
88.	NFA shall therefore develop an effective mechanism for receiving, evaluating and addressing grievances and conflicts arising from the implementation of activities in this FMP.	6.7.10
89.	Appropriate mitigation measures shall be taken to minimize the negative environmental effects while enhancing the positive effects.	7.0
90.	There will be selection of right species to be planted and staff shall adhere to set standards for natural forest management, plantation establishment, management and harvesting.	7.1.2
91.	Areas put aside for ecological and biodiversity purposes shall be managed as such.	7.1.2
92.	In areas where there are streams and rivers, the recommended distance of 30-100 meters from the stream or river respectively shall not be put under monoculture crop as per NEMA regulations but shall be enriched with suitable indigenous species	7.1.2
93.	In eco-tourism areas, tourist numbers shall be controlled to match with the carrying capacity of the ecosystem.	7.1.2
94.	Areas to be converted into plantations shall be clearly defined and marked so that peculiar species of flora and fauna are well conserved.	7.1.3
95	In circumstances where slash and burn method for land preparation must be used, strict control measures shall be put in place under close supervision.	7.1.3
96	The planting process shall be monitored to ensure that the limits specified in the guidelines and licenses are not violated	7.1.3
97	Collaborative management involving local leaders and communities neighbouring the central forest reserves in forest management activities such as planting and protection shall be promoted to reduce on the illegal activities	7.1.3
98	Clearing on unstable slopes or highly erosive/fragile soils shall be avoided.	7.1.3
99	The use of heavy machinery and equipment on shall be limited and manual clearing shall be promoted	7.1.3
100	In addition to using fast growing species, intermediate tree crops and/or growing of grass will be done on exposed soils.	7.1.3
101	Use of hazardous chemicals including herbicides and pesticides will be avoided. NFA will provide a list of recommended chemicals in accordance with WHO and/or FSC standards.	7.1.3
102	Poly tubes and plastic materials will equally be disposed by digging pits where they will be buried or burnt depending on whichever will be deemed fit on a case by case basis.	7.1.3
103	Efforts shall be put in place to ensure that activities which lead to deforestation and degradation such as encroachment are minimized	7.1.3
104	Plantation establishment shall be limited to degraded sites or sites of low biodiversity	7.1.3
105	Hunting in the forest shall not be allowed except for vermin control. However, in consultation with UWA controlled hunting may be permitted	7.1.3

No.	Prescription	Section
106	Road cuts and banks shall be stabilized with grass vegetation on top of ensuring proper drainage and regular road maintenance.	7.1.3
107	Tree lines shall be planted at the outer edge of the road reserve. Immediate replanting shall be done after clear felling of these trees is done	7.1.3
108	The use of the same forest roads, tracks and loading areas in plantation operations shall be encouraged to avoid creation of new ones which contribute to further soil degradation and erosion.	7.1.3
109	All the wetlands within the CFRs shall be mapped and demarcated in the forest plantation development areas. The process will follow the laws and regulations on the management of wetlands in Uganda. This will help to maintain and sustainably manage the wetlands.	7.1.3
110	A prescribed buffer zone of undisturbed area as per NEMA guidelines shall be observed along streams and rivers.	7.1.3
111	Tourist visitor numbers shall be regulated and shall be encouraged to adhere to the eco-site regulations.	7.1.3
112	Both solid and liquid waste in the eco-sites shall be handled appropriately.	7.1.3
113	Local people including women and youth living around the CFRs shall be given priority of employment in all activities undertaken in the forests such as plantation development, restoration planting, leisure and tourism and there shall be harmonized working relationship through constant consultations and meetings.	7.2.2
114	The plan shall be accommodative and compatible with Government policies that aim at improving the livelihoods of the poor people.	7.2.2
115	Locals shall continue collecting and enjoying non-timber forest products and services including dry wood, fibre, water and medicinal plants from CFRs for domestic consumption	7.2.2
116	NFA shall work with DLGs to make sure that water sources used by communities are protected and where there are possible gravitational sources, they are developed in an environmentally friendly way	7.2.2
117	When licenses are given for harvesting, consideration shall be given to the locals, including women and youth, to compete with outsiders and for fair participation, the local communities shall be protected e.g. by allocating them a percentage using a quota system.	7.2.4
118	CFM programmes shall be rolled out to all communities living adjacent to all the CFRs to create a deep sense of ownership by sharing responsibilities and benefits from the CFRs.	7.2.4
119	NFA frontline staff shall undertake in-service courses on how to manage forest adjacent communities and other stakeholders.	7.2.4
120	Local people shall be encouraged and supported to grow their own trees on their land for both environmental and domestic uses.	7.2.4
121	There shall be constant sensitization of leaders and communities about why some areas in the CFRs have to be protected as strict nature reserves.	7.2.4
122	Land already allocated to private tree growers shall remain with them unless they breach the rules and conditions of the licenses.	7.2.4
123	Allocation of CFR land for private tree growing shall be done in a fair and transparent manner.	7.2.4
124	Two (2) forest supervisors shall be recruited to take charge of Cadam and Namawanyi stations. In addition, one patrol man shall be recruited to support the forest supervisor at Cadam	8.1
125	In comparison to the large area to be patrolled and the intensity of the illegal activities, the number of patrolmen shall be increased to 22 i.e. 2 patrol men per station	8.2
126	Resources permitting patrolmen shall be paid UGX 200,000 timely on contract in order to cushion them from the temptation to connive with illegal dealers ensure constant patrol of the Forest Reserves	8.2
127	In order to improve working conditions of staff and contract workers, health and safety programs shall be initiated and promoted.	8.3
128	All forest supervisors shall have motorcycles with sufficient fuel allocation and a vehicle should be posted full time to the sector to supplement transport and to increase	8.4

No.	Prescription	Section
	effectiveness of forest management.	
129	Records of all forest fieldwork shall be kept at the Sector and Beat Offices.	8.5
130	Thirty two (32) copies of this FMP shall be distributed and properly maintained	8.5
131	In October each year, the Sector Manager and the Range Manager shall update their master copies and send copies of the updated information to the Executive Director/NFA for approval and other FMP owners for updating their copies. All copies shall be updated not later than 31st December of each year.	8.5
132	All field operations need tools and equipment such as hoes, pangas, axes, slashers, GPS, Cameras, linear tapes, boots, diameter tapes etc. which are part of normal stores. These items shall be purchased centrally and distributed to stations according to operational needs.	8.6
133	Two new houses/stations shall be built at Bulanga and Cadam.	8.7
134	All expenditures shall be according to budget line and ceilings.	9.2
135	The Range Manager shall make sure that only prioritized activities shall be implemented to avoid unplanned expenditures.	9.3
136	Innovative funding mechanisms such as PES, CDM and REDD+ shall be explored	9.3
137	Monitoring and routine evaluation shall represent an on-going activity to track the progress of this FMP against planned tasks and targets	10
138	Activities in the FMP shall be benchmarked and performance regularly monitored.	10
139	The schedule of activities for this FMP shall be the basis for preparation of annual operations plans (AOP). Every year, the NFA Sector Manager shall prepare an AOP in which key stakeholders should have an input.	10.1
140	Licensed operators (excluding casual licensees) shall prepare AOPs in accordance with guidelines issued by the NFA.	10.1
141	Scientific criteria and indicators (C&I) shall be used in monitoring and evaluating activities. C&I from the International Timber Trade Organization (ITTO) and the National standard for Forest Stewardship Council (FSC) – Appendix 7 (a & b) shall be adopted for this FMP	10.2
142	Regular field visits by superiors shall be made to assist in assessing the progress of work compared to planned targets and take timely appropriate actions for improvements	10.3
143	Meetings shall be held as part of field visits. These meetings shall include key partners and stakeholders, including Local Government Authorities, and local communities.	10.3
144	Evaluation shall represent a systematic and objective assessment of on-going or completed FMP components or activities in terms of their design, implementation and results	10.4
145	During preparation of the AOP, the activities planned for the previous year shall be evaluated in a participatory manner in order to inform the AOP being prepared.	10.4
146	Activities shall be evaluated and the FMP reviewed every five (5) years in accordance with Section 28(6) of the National Forestry and Tree Planting Act, 2003 though it may be done earlier should there be any emerging management issues that warrant it.	10.4
147	Regular reporting shall be done to help in the implementation of this FMP.	10.5
148	All monthly reports shall be structured in a way that conforms to the NFA Performance Agreement with Government and as prescribed in the management standards.	10.5
149	Situational reports dealing with emergency situations like serious encroachment and illegal harvesting shall be prepared and submitted immediately to the appropriate person responsible for dealing with the situation.	10.5
150	Copies of management maps at various scales ranging from 1:10,000 to 1:50,000 shall be maintained up to date, clearly showing the areas of operation and conservation patches.	10.6
151	Regular training in data collection, processing and management should be conducted periodically	10.6

Appendix 2: Central Forest Reserve Profiles

1. Mabira CFR



1 Mabira central forest reserve

1.1 Size, location and brief description of the forest

Mabira CFR covers 29,974 ha and is located in Wakisi, Nagojje, Najjembe, Kimenyedde and, Nama sub counties of Buikwe, Nakifuma, Mukono and Ntenjeru counties of Buikwe and Mukono Districts, 45 km from Kampala and 20 km from Jinja on the Kampala-Jinja Road.

The Uganda Department of Lands and Surveys covers the Forest Reserve in its Map Series Y732 on map sheets of 61/1V, 62/111, 71/11 and 72/1 at 1: 50,000.

The largest area of Mabira CFR is occupied by Tropical High Forest communities, classified as type D1 (*Celtis-Chrysophyllum* medium altitude moist semi-deciduous forest) and the remainder by *Piptadeniastrum-Albizia-Celtis* medium altitude moist evergreen forest (Langdale - Brown et al., 1964). Human activities have greatly influenced the forest condition, making some areas characteristic sub-climaxes. Sub-types of vegetation present are young or colonising mixed forest, dominated by *Maesopsis eminii* young mixed *Celtis Holoptelea* and mixed forest of wet valley bottoms dominated by *Baikiaea insignis*.

The formerly encroached parts of the forest have been colonized by paper mulberry (*Broussonetia papyrifera)* as clearly seen along the Jinja-Kampala highway.

1.2 Legal category

Legal ownership

Mabira was declared to be one of the forests falling under the Buganda Agreement in 1900 A.D. It was gazetted in 1932 under Legal Notice N0. 8. The forest was managed as part of the South Mengo Forests.

Legal "Constraints"/Disputes/claims related to CFR

Mabira CFR is still managed under the provisions of the National Forestry and tree planting Act 2003 and the 2001 Forestry Policy though Buganda Kingdom feels that they have de facto rights to some parts of the forest

1.3 Original Management Objectives

At gazettement

The objectives of management were to produce in perpetuity the maximum quantity of timber from the forest by the most efficient methods, provided that the satisfaction of the needs of the inhabitants of Uganda took precedence over export considerations.

In subsequent working plans

The management objectives in the subsequent plans were;

- Conservation of the forest biodiversity and ecological conditions.
- Production of maximum sustainable yield of timber and non-timber products by the most efficient methods without compromising the capability of the forest to provide environmental services.
- Integration of the communities within the forest enclaves and parishes surrounding the forest reserve into forest management.
- Provision of recreational facilities for the people of Uganda and outsiders and,
- Carrying out research aimed at obtaining information on various aspects of forest ecosystem dynamics for use to improve forest management

1.4 Vegetation type – Total forest area - 325 ha

Vegetation Type	Brief description of vegetation type	Area (ha) or percentage of FR	Estimated canopy cover	Level of degradation from natural state
Tropical High Forest	Dominated by *Celtis-Chrysophyllum*	95%		
Tropical High Forest	Medium moist ever-green forest dominated by *Piptadeniastrum, Albizia & Celtis*	5%		

The majority of the reserve is covered by the invasive" *Broussonetia papyrifera*

1.5 Land Use and Forest Condition

Land Use Patterns

Within the Forest Reserve are:

- Cultivation.
- Grazing.
- Timber harvesting
- Charcoal burning
- Sand mining
- Stone quarrying
- Hunting
- Collection of herbal medicine
- Firewood collection
- Water harvesting
- Cultural worship
- Tourism
- Infrastructural development.

Outside

- Tree plantations.
- Subsistence agriculture.
- Sugar cane plantations
- Tea estates
- Grazing.
- Infrastructural development.
- Industrial development.
- Human settlements
- Urbanization.

1.6 Zonation

Existing zonation

The forest is zoned into strict nature reserve, protection, recreation and production zones.

Proposed Zonation for Future Management

Zone	Criteria (why/reason for)	Proposed management
Strict nature reserve	Covers the central portion of the forest reserve, which is relatively intact. This has been selected to protect a viable area of semi-deciduous forest type D1 (Langdale Brown et. al., 1964), which is important because this is the only protected area in the country in which this forest type is represented.	• Preserve habitats, ecosystems and species in as undisturbed state as possible • Maintain genetic resources in a dynamic and evolutionary state • Maintain established ecological processes • Secure examples of the natural environment for scientific studies, environmental monitoring and deduction, including baseline areas from which all avoidable access is excluded • Minimise disturbance by careful planning and execution of research and other approved activities • Limit public access
Production	Provision of forest products and services but largely timber on a sustainable basis.	Harvesting to be authorized after carrying out EI and ISSMI. Carry out regeneration/ enrichment planting together with other related silvicultural activities Monitoring changes in tree species composition and growth through PSP maintenance and assessment Protection of the growing stock against all forms of illegal activities
Protection	Protection to improve biological diversity Protection of indigenous tree species, habitant for biodiversity Protection of rivers and streams such as Musamya and Sezibwa	Protection of such areas to continue Restoration of degraded areas especially along streams and steep slopes

Community use	Tree plantation development to provide fuel wood, poles and timbers to communities for livelihood improvement through CFM arrangement.	Low impact community use for crafts and boundary planting in 5% of the forest estate. Sensitization meetings and review of their management plans to continue.
Recreation/Ecotourism	Covers the area adjacent to the Nature Reserve with the aim of enhancing the long-term viability of the SNR. The zone encompasses the R. Musamya and the surrounding areas which are a valuable habitat for a number of species of plants and animals, and are some of the most scenic areas of the forest for eco-tourism	• Improve and expand the available recreation and leisure facilities. • Identify and promote all the potential tourism attractions in the CFR • Increase eco-tourism awareness at a national and international level. • Encourage private- public partnership arrangements to fully exploit eco-tourism potential in the CFR

1.7 Key Resources used/extracted

Timber Resources

Species	**Uses**	**Users – who?**	**Estimated abundance**	**Annual allowable cut (if known)**
Maesopsis eminii	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Terminalia spp	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Celtis spp	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Antiaris toxicaria	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Aningeria altissima	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Albizia spp	Furniture, construction	Construction companies, Local	Scattered	

		Community, Furniture workshops		
Chrysophyllum spp	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Blighia unijugata	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Trichilia spp	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Funtumia spp	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	
Pycnanthus angolense	Furniture, construction	Construction companies, Local Community, Furniture workshops	Scattered	

Non-timber Forest Products

Species	**Uses**	**Users – who?**	**Estimated abundance**	**Annual Allowable cut (if known)**
Phoenix reclinata	Making craft/fencing posts	Local Community	Low	-
Broussonetia papyrifera	Firewood, Charcoal	Local Community	Abundant	
Wild meat	Food	Local Community	Seasonal	-
Spathodea campanulata	Medicinal	Local Community	Low	-
Erythrina excelsa	Medicinal	Local Community	Low	-
Alstonia boonei	Timber/Medicinal	Local Community	Low	-
Prunus africana	Timber/Medicinal	Local Community	Low	-
Warbugia ugandensis	Medicinal	Local Community	Low	-
Assorted	Charcoal	Local Community	Low	-
Assorted	Firewood	Local Community, institutions, cottage industries	Low	-
Sand	Construction	Local Community, institutions	Low	-
Stones	Construction	Local Community,	Low	-

		institutions		

1.8 Historical Trends related to Forestry

Period	Events	Significance/Impact to forestry management
Pre 1900	All land belonged to Kabaka	▪ There was no formal management of forests ▪ There was no much interest on forests ▪ People were very few/land was idle, forests were well stocked ▪ Forests were mainly used for worship and hunting by Buganda Royals including Kabaka
1900	Buganda land agreement was signed	Land divided into crown land (queen), Mailo land (Kabaka) ▪ Formal management of Mabira Forests
1924	Uganda sugar factory started	▪ Sugar cane was planted on lease (99 years)
1932	Boundaries of Mabira forest surveyed and gazzetted	Proper management of forests by Forest department
1945	Flying(dogs) insects	People fell sick and others died and others left
1950-1960	Construction of the road through Mabira ▪ Construction of road from Kayunga to Bulumagi ▪ Colonial government introduced plantations of rubber, Bananas, coffee, sugarcane, tea (cash crops), Flowers ▪ Reduction of forests (cover) on private and public land	▪ Open access to the forest ▪ Destruction of the forest ▪ Settlements started around Najjembe
1961-1970	▪ Uganda independence ▪ Lubiri invasion	▪ Management of forests was taken over by Ugandans ▪ Most of the forests under Buganda kingdom were given to Central Government ▪ Government started managing the reserves ▪ More land under forest management increased ▪ Buganda lost some of their forest reserves to government (9, 000 square miles) ▪ Thick and intact forests ▪ FD maintained forest boundaries ▪ Tree species such as Mugavu, Musasa, Mukebu, Emikoge, Kirundu, Kamenyambazzi were in plenty ▪ Plenty of food
1971-1980	▪ Land decree by president Amin (Double agricultural production)	▪ Some parts of Mabira were given away for double agricultural production ▪ Coffee production on farm was booming ▪ Sufficient firewood on farm ▪ Adequate rain ▪ Increased food production ▪ Population was low ▪ People settled in the forest ▪ Forest was massively destroyed ▪ Total breakdown in rule of law and therefore,

		there was no control of forest use. Forests totally encroached ▪ Charcoal burning increased as a way of decreasing debris from cleared trees
1981-1990	▪ There was massive eviction from the forest	▪ Forest rehabilitated and restored with EEC funding ▪ Prior to forest eviction, Forest governance had ceased ▪ Forest Extension services were no more ▪ People lost lives and their property destroyed ▪ The post eviction situation was so scary to those who witnessed the old good days of forestry ▪ Forest land was freed ▪ Population increased due to migration- pressure increased on forests ▪ Introduction of private tree growing on government land in Nandagi ▪ Foreign investors started getting interested in the forests and wetlands and government gave them land.
1991-2000	▪ Boundary Opening in Mabira ▪ Restructuring of the forest department ▪ Change in land policy/land reforms by the government	▪ Paper mulberry started colonizing formerly encroached areas ▪ Monkeys, duikers and wild pigs were visible. ▪ Tree species like Mugavu, Kirundu, Enkoba, Nongo, Mvule, Enzo, Mikore, Miruru, Kamenyambazzi started gradually disappearing ▪ Boundaries were opened ▪ The NFTP Act 2003 was enacted. Separation of the management of forests- CFRs managed by NFA, Local forests managed by DFS ▪
2001-2010	▪ Establishment of the NFA ▪ Proposal to give away Mabira CFR to Mehta ▪ Construction of Bujagali Dam	▪ Rehabilitation and management the CFRs ▪ Continue restoration planting of trees in forest reserve ▪ Development of Kalagala project sustainable management plan ▪ Resurgence of illegal activities
2011-todate	▪ Introduction of Environmental Protection Police Force ▪ Restoration Planting under Kalagala offset project ▪ Updating Forest Management Plan ▪ Opening of the forest boundaries ▪ Installation of boundary pillars	▪ Facilitation for forest management poor leading to increased illegal activities ▪ Restoration of the integrity of the CFR ▪ Improvement in the management of the CFR

1.9 Issues/Concerns/Problems

	Direct Threats	Area ranking	Intensity ranking	Urgency ranking	Total ranking
	Forest Interior				
A1	Firewood cutting	2	2	2	6
A2	Charcoal burning	3	3	4	10
A3	Agricultural encroachment	6	6	3	15
A4	Timber harvesting	5	5	5	15
A5	Hunting	4	4	6	14
A6	Illegal acquisition of land titles in the forest/land grabbing	7	7	1	15
A7	Infrastructural development e.g. Roads, power lines, dams, industries, etc.	8	8	7	23
A8	Invasive species - *Broussonetia papyrifera*	1	1	8	10
	Sub total				108
	Forest edge	**Area ranking**	**Intensity ranking**	**Urgency ranking**	**Total ranking**
B1	Unclear forest boundaries	2	2	2	6
B2	Grazing	9	9	6	24
B3	Urbanization	4	4	8	16
B4	Industrialization	5	5	7	17
B5	Population pressure	3	3	9	15
B6	Settlement	7	7	4	18
B7	Political interference	6	6	3	15
B8	Inadequate funding	1	1	1	3
B9	Hostilities of some communities	8	8	5	21
	Sub total				135
	Grand total				**243**

1.10 Stakeholders Involved

Issues/Threat	Stakeholder(s)	Mandate/ Right	Interest	Influence
Charcoal burning	Community	Illegal	High	Low
Commercial firewood harvesting	Community	Illegal	High	Low
Grazing	Community	Illegal	High	Low
Agricultural cultivation	Community	Illegal	High	Low
Timber harvesting	Community/ Timber dealers	Illegal	High	Low
Hunting	Community	Illegal	High	Low
Illegal acquisition of land titles in the forest/land grabbing	Land grabbers, investors, politicians,	Illegal	High	High
Infrastructural development e.g. Roads, power lines, dams, industries, etc.	Government	Planned development	High	High
Invasive species - *Broussonetia papyrifera*	Researchers, tourists	Legal	High	Low

1.11 Opportunities

- Sites for research and education
- Potential source of herbal medicine for industrial purposes
- Abundant source of source of water for industrial and domestic use
- High tourism potential
- Carbon trade
- Potential for absorption of emissions from industries and urban areas
- Existence of endemic species of flora and fauna
- Potential quantities of commercial timber
- Employment creation
- Favorable climate
- Committed responsible agencies like NFA

1.12 Proposed strategies

- Scale up Collaborative forest management.
- Increase funding for implementation of activities
- Boundary re-opening and fixing of boundary pillars.
- Sensitization of the neighboring communities on sustainable forest management.
- Eviction of encroachers and cancellation of illegal titles.
- Increase surveillance and patrols
- Promote tourism
- Enforce ethical conduct of staff to stem corrupt tendencies
- Collaboration/coordination and joint planning with other relevant agencies
- Licensing of sustainable harvesting of timber and other forest products

1.13 Visions

Local Representative's Vision

A forest well managed and easily accessible by the local communities
A well-stocked forest
A forest visited by many tourists
A forest providing products and services on a sustainable basis

NFA Vision

A well-managed, economically viable, ecologically and environmentally stable forest estate that provides sustainable products and services to the local and global community

Potential for conflict of interests

- Free access and unregulated off take of forest products by the communities
- Political interference in the management and conservation of the forest
- Access to cultural sites i.e. between NFA and Buganda kingdom
- The desire by NFA to acquire land in the enclave to annex to the forest reserve

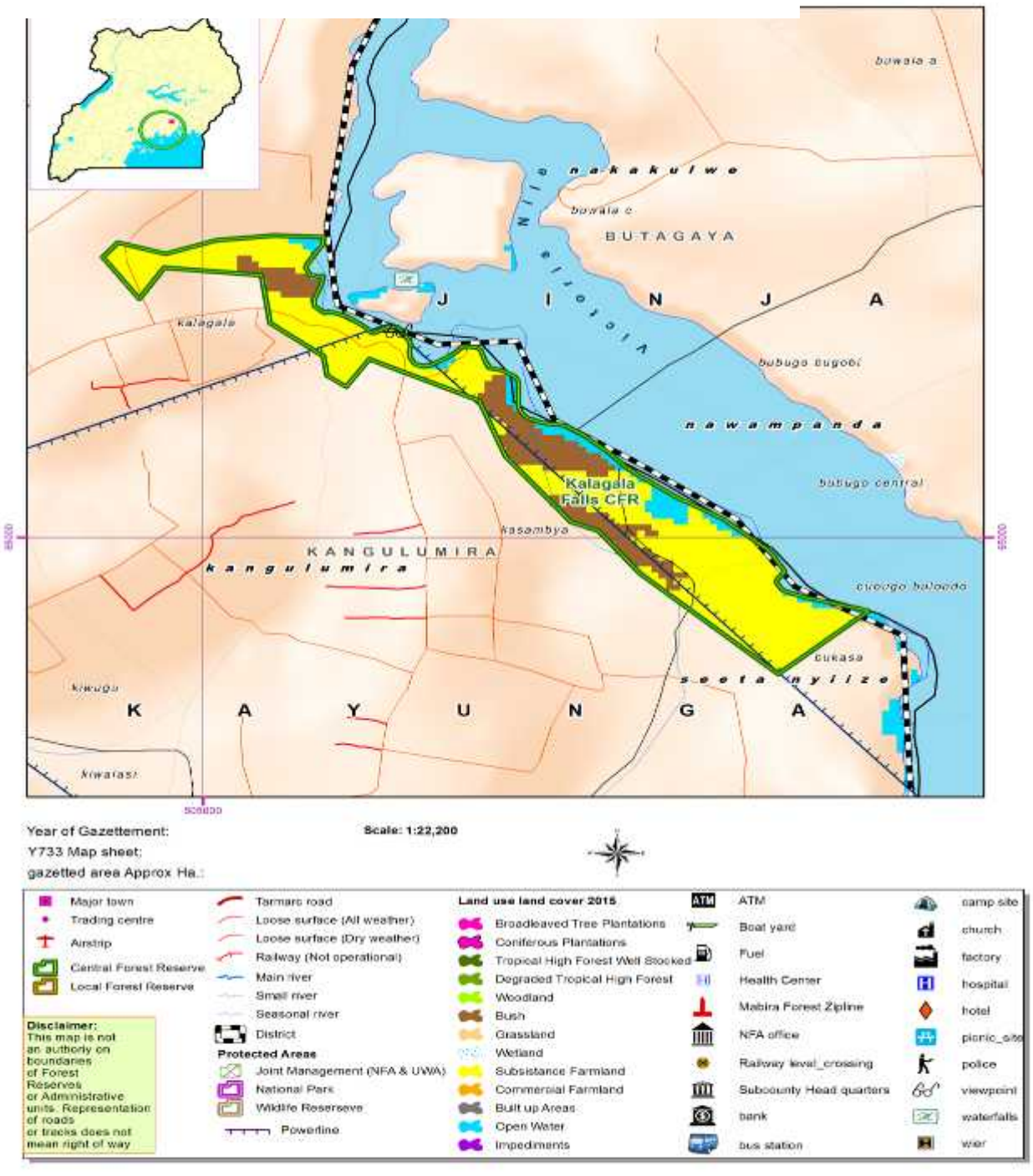
1.14 Obstacles/roadblocks to achieving vision

- Political interference
- Corruption
- Population pressure
- Limited funding

1.15 Priority actions to address the above obstacles

- Institutional strengthening
- Increased funding
- Boundary opening
- Wealth creation programmes targeting local communities
- Community Sensitization
- Lobbying and advocacy
- Collaborative forest management

2. Kalagala falls CFR



2 Kalagala Falls Central Forest Reserve

2.1 Size, location and brief description of the forest

Kalagala Central FR covers 104 ha and is located about 3 km from Kangulumira trading centre a town situated along Bukoloto-Njeru road. The FR is partly is mainly plantation by private planters and a small part (Island) is covered with indigenous tree species.

2.2 Legal category

Legal ownership
Kalagala CFR was first gazetted in 1932 as a local forest managed by Buganda Kingdom and then regazetted as CFR in 1968 under SI No, 176

Legal "Constraints"/Disputes/claims related to CFR

There was a conflict resolving between NFA and Buganda Kingdom in 2016 about the ownership of the reserve but it was later resolved in the favour of NFA

2.3 Original Management Objectives

At gazettement

Kalagala CFR was established for protection of the River Nile bank and water catchment.

In subsequent working plans

There is a need to restore Kalagala CFR with indigenous tree species to be able to serve the purpose it was gazetted for.

2.4 Vegetation type – Total forest area 104 ha

Vegetation Type	Brief description of vegetation type	Area (ha) or percentage of FR	Estimated canopy cover	Level of degradation from natural state
Plantation	Eucalyptus spp, Terminalia Spp, Grevillea robusta, Cypress Spp and Araucaria Spp	90%		
Tropical High forest	Inside the gate of Adrift and in island still stocked with indigenous tree spp	10%		

The biggest part of the forest reserve was given to private planters due to its high levels of degradation and the private planters have mainly planted exotic tree species

2.5 Land Use and Forest Condition

Land Use Patterns
Within the FR are:

- Cultivation
- Ecotourism
- Private tree planting
- Grazing
- Cultural rituals

Outside the reserve

- Grazing and cultivation
- Timber cutting
- Firewood harvesting

2.6 Zonation

Existing zonation

- Production mainly private tree planters
- Recreation mainly Adrift and Buganda Kingdom

Proposed Zonation for Future Management

Zone	Criteria (why/reason for)	Proposed Management
Protection (80%)	Protect the River Nile Bank	Restore the forest with indigenous tree species
Recreation (20%)	Tourism	Develop the cultural sites in addition to Adrift

2.7 Key Resources used/extracted

Timber Resources

Species	Uses	Users – who?	Estimated abundance	Annual allowable cut (if known)
Eucalyptus Spp, Grevillea Spp	Construction	Private tree farmers	Scattered	-

There are timber tree species on the island but they are for conservation e.g. *Chrysophyllum* spp and Albizia spp

Non-timber Forest Products

Species	Uses	Users – who?	Estimated abundance	Annual Allowable cut (if known)
Clay	Pottery	Community	Just along the river (Nile)	-
-	-	-	-	-
Spathodea companulata	Medicinal herb	Community	Scattered	-

2.8 Historical Trends related to Forestry

Date	Key Event	Significance to forest management
1900	Buganda Agreement	All forests were managed by Buganda Kingdom
1967- 1971	Immigrants from Samia and Bagisu settled around the CFR	Created threat to CFR
1968	Kalagala was regazetted under SI 176	Protection strengthened
1972	Double production by government	CFR cleared for cotton and coffee production.
1989	Eviction	Forest land regenerated
2001	Forest policy	Improved forest management
2003/2004	National forestry and tree planting Act	NFA contrasted to manage CFR
2006 – 2008	Visit by Kabaka Mutebi to CFR	Claimed ownership of Kalagala falls
2006 – 2008	Restoration planting	Part of the forest was stocked with Terminalia spp
2014	Demarcation of the boundary by MWE	Boundary became clear

2.9 Issues/Concerns/Problems

	Direct Threats	Area ranking	Intensity ranking	Urgency ranking	Total ranking
	Forest Interior				
A1	Cultivation	2	2	4	8
	Sub total				8
	Forest edge	**Area ranking**	**Intensity ranking**	**Urgency ranking**	**Total ranking**
B1	Cultivation	2	2	4	8
B2	Grazing	2	1	1	3
	Sub total				11
	Grand total				**19**

2.10 Stakeholders Involved

Issues/Threat	Stakeholder(s)	Mandate/Right	Interest	Influence
Cultivation	Local community	Illegal	High	Low
Grazing	Local community	Illegal	High	Low

2.11 Opportunities

- Tourism
- Cultural heritage
- Water

2.12 Proposed strategies

- An ecotourism site should be developed outside the waters to cater for those who fear moving in water.
- Also the cultural sites should be developed

2.13 Visions

Improved protection of the forest reserve and benefit sharing with the neighboring communities

NFA Vision

A forest well restored with indigenous species to be able to serve its purpose ecological purposes of water catchment and river bank protection

Potential for conflict of interest

- Private planters (Exotic tree species) and conservationists (Indigenous tree species)
- Benefit sharing for example Adrift and the lead community.

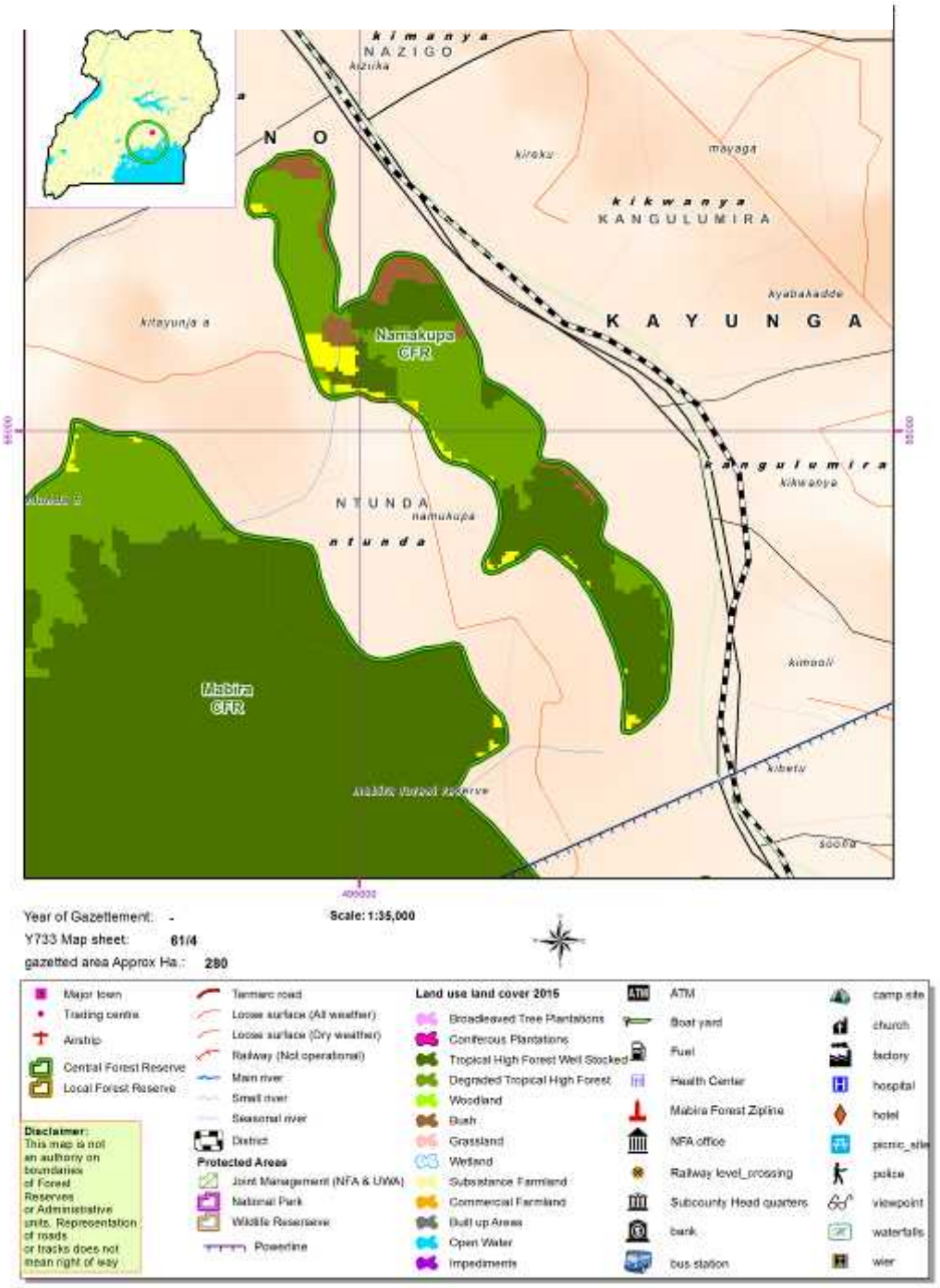
2.14 Obstacles/roadblocks to achieving vision

- Inconsistent government policies
- Population pressure
- Limited funding
- Corruption
- Poverty
- Political interference

2.15 Priority actions to address the above obstacles

- Institutional strengthening
- Increased funding
- Wealth Creation programs should be extended to the communities adjacent to CFR to provide alternative sources of income.

3. Namakupa CFR



3 Namakupa Central Forest Reserve

3.1 Size, location and brief description of the forest

Namakupa Central FR covers 280ha and is located about 30KM from Kayunga town. The FR is mainly tropical high forest with low stock and dominated by *Broussonetia papyrifera.*

3.2 Legal category

Legal ownership
Namakupa Central FR was gazetted in 1932 under the legal notice No. 87 and in 1962 under the legal notice No. 78 it was declared a separate CFR separated from main Mabira CFR

Legal "Constraints"/Disputes/claims related to CFR
Namakupa CFR is still being managed subject to the provisions of the National Forestry and Tree Planting Act 2003 and 2001 Forestry Policy.

3.3 Original Management Objectives

At gazettement
To ensure that major water catchment areas were protected and provide forest products and services on a sustainable manner

In subsequent working plans
There is a need to enrich Namakupa Central FR with indigenous tree species and strengthen protection to ensure sustainable use for better community livelihoods.

3.4 Vegetation type – Total forest area 280 ha

Vegetation Type	Brief description of vegetation type	Area (ha) or percentage of FR	Estimated canopy cover	Level of degradation from natural state
Tropical high low stock		70		
Wetland		10%		
Swamp		20%		

Majority of the vegetation is characterized by natural regeneration with species like *Funtumia elastica*, *Chrysophyllum* spp, *Albizia* spp, and *Celtis* Spp succeeding the invasive dominant *Broussonetia papyrifera* with a few scattered mature Celtis spp.

3.5 Land Use and Forest Condition

Land Use Patterns

Within the FR are:

- Timber cutting
- Charcoal burning
- Grazing
- Firewood collection

Outside

- Firewood harvesting
- Cultivation
- Grazing
- Timber cutting
- Settlement
- Sand mining
- Brick making

3.6 Zonation

Existing zonation

Namakupa CFR is zoned as a production zone

Proposed Zonation for Future Management

Zone	Criteria (why/reason for)	Proposed Management
1. Swamp	Protection of river Musamya and the general wetland	Low impact community use for crafts

3.7 Key Resources used/extracted

Timber Resources

Species	Uses	Users – who?	Estimated abundance	Annual allowable cut (if known)
Celtis spp	Construction	Community and timber dealers	Scattered	
Funtumia elastic a	Furniture	Community and timber dealers	Scattered	
Chrysophyllum albidum	Furniture	Community and timber dealers	Scattered and along the swamp	
Albizia spp	Construction and furniture	Community and timber dealers	Scattered	
Cordia	Furniture and books	Community and timber dealers	Scattered and along the swamp	

Non-timber Forest Products

Species	Uses	Users – who?	Estimated abundance	Annual Allowable cut (if known)
Broussonetia papyrifera	Firewood	Community	Abundant	-
Water sources	Water	Community	Fulltime	
Wild meat	Food	Community hunters	Seasonal	-
Spathodea companulata	Medicinal herb	Local Community	Scattered	-

3.8 Historical Trends related to Forestry

Date	Key Event	Significance to forest management
1900	Buganda Land Agreement	Forests managed by Buganda Kingdom and population was small hence little impact on forests
1932	Gazetted by the protectorate government	Improved forest management
1962	Regazetted under legal notice 75	Namakupa separated from Mabira for proper management.
1962	Independence	Management of forest handed over to Uganda government
1972	Double protection by the ruling regime	Namakupa was not affected heavily though there was increased illegalities
1989	Eviction of encroachers	Forest management strengthened
2001	Policy statement	Improved forest management
2003/2004	National forestry and tree planting Act	NFA put in place with a mandate to manage all CFR of which Namakupa is among
2007	Proposal for Mabira give away to investors for sugar cane growing	Increased Level of illegalities in the reserve

3.9 Issues/Concerns/Problems

	Direct Threats	Area ranking	Intensity ranking	Urgency ranking	Total ranking
	Forest Interior				
A1	Charcoal burning	3	5	4	12
A2	Timber cutting	1	2	3	6
A3	Firewood cutting	4	4	3	11
A4	Grazing	1	1	1	3
A5					
	Sub total				32
	Forest edge	**Area ranking**	**Intensity ranking**	**Urgency ranking**	**Total ranking**
B1	Boundary encroachment	4	5	5	14
B2	Grazing	1	1	2	4
B3	Cultivation	1	1	1	3
B4					
	Sub total				21
	Grand total				**53**

3.10 Stakeholders Involved

Issues/Threat	Stakeholder(s)	Mandate/Right	Interest	Influence
Charcoal burning	Surrounding community	Illegal	High	Low
Illegal firewood collection	Surrounding community	Illegal	High	Low
Timber cutting	Surrounding community	Illegal	High	Low
Grazing	Surrounding community	Illegal	Low	Low
Cultivation	Surrounding community	Illegal	Low	Low
Boundary and encroachment	Surrounding community	Illegal	High	Low

3.11 Opportunities

- Research / Education
- Bee keeping
- Climate regulation
- Tourism
- Cultural hostage

3.12 Proposed strategies

- Boundary re-opening and marking
- Enrichment planting
- Strengthening CFR
- Improved logistics and facilitation for the staff.

3.13 Visions

Local Representative's Vision
A well protected forest but with increased access to the forest for products and services

NFA Vision
A forest ecologically stable well stocked with indigenous tree species and well protected able to produce appropriate forest products and services on a suitable basis.

Potential for conflict of interest

- Accessibility and protection
- Conservationists and politicians interests

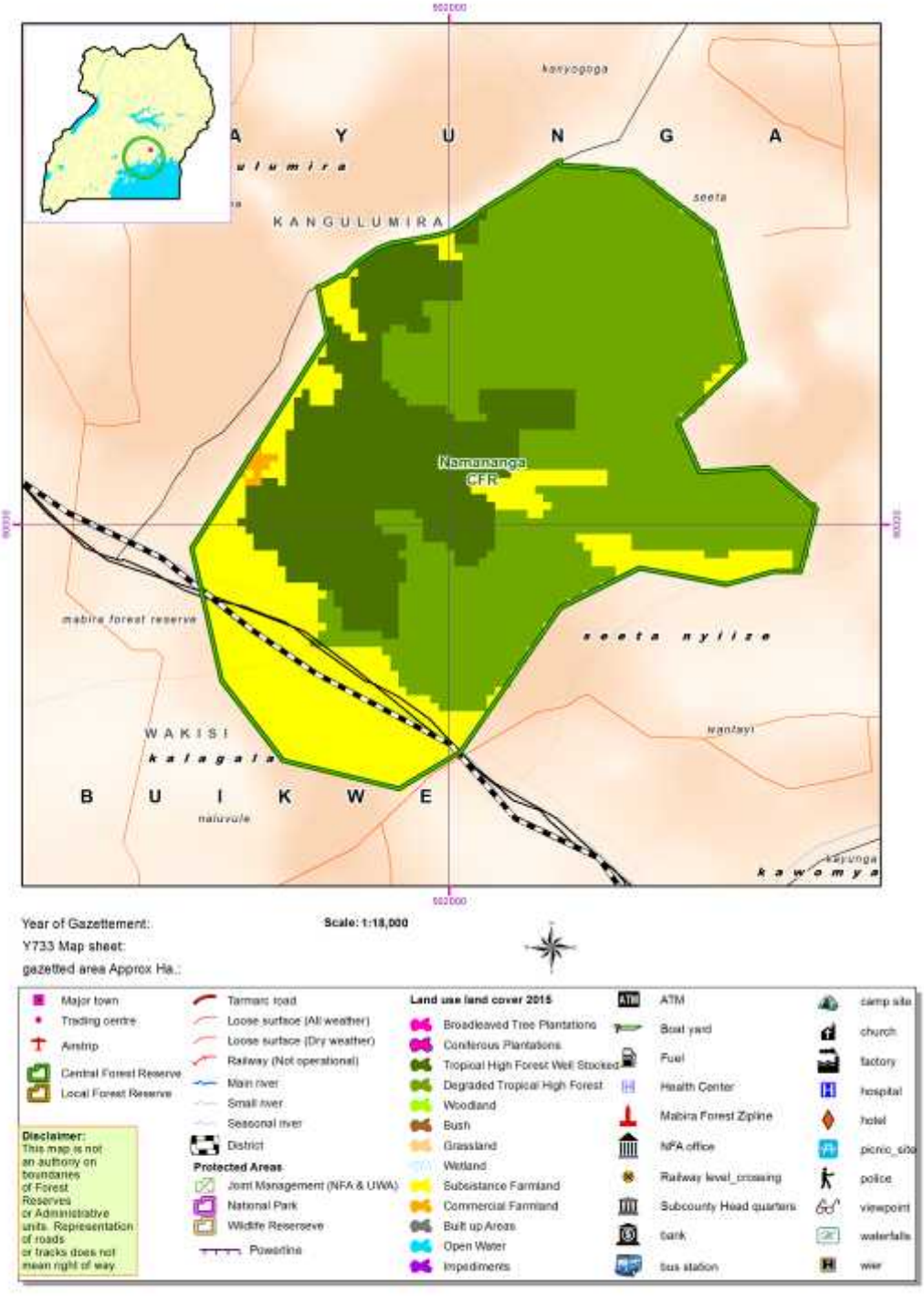
3.14 Obstacles/roadblocks to achieving vision

- Political interference
- Corruption
- Population growth
- Limited funding
- Unclear forest boundaries
- Poverty

3.15 Priority actions to address the above obstacles

- Institutional strengthening
- Increased funding
- Boundary opening and marketing
- Wealth creation programs should be extended to communities neighboring forest.

4. Namananga CFR



4 Namananga Central Forest Reserve

4.1 Size, location and brief description of the forest

Namananga Central FR covers 131 ha and is located about in Kangulumira sub county, Kayunga district. It is dominated *Broussonetia papyrifera.* However in 2016, the reserve was restored with indigenous tree species like Khaya spp, *Prunus Africana,* Cordia spp.

4.2 Legal category

Legal ownership

Gazetted in 1932 under SI No, 176 as a CFR

Legal "Constraints"/Disputes/claims related to CFR

Namananga is still managed under the provisions of the National Forestry and tree planting Act 2003 and the 2001 Forestry Policy

4.3 Original Management Objectives

At gazettement

To ensure the water catchment areas of river Musamya well protected

In subsequent working plans

Ensure that there is full protection and maintenance of the indigenous tree species which were planted in the restoration program of 2016.

4.4 Vegetation type – Total forest area - 131 ha

Vegetation Type	Brief description of vegetation type	Area (ha) or percentage of FR	Estimated canopy cover	Level of degradation from natural state
Tropical high low stock		97%		
Wetland		3%		

The majority of the reserve is covered by the invasive" *Broussonetia papyrifera*

4.5 Land Use and Forest Condition

Land Use Patterns

Within the FR are:

- Charcoal burning
- Grazing
- Firewood collection

Outside

- Agriculture (cultivation and grazing)
- Timber cutting
- Settlement
- Sand mining
- Brick making

- Firewood harvesting

4.6 Zonation

Existing zonation
Namananga is zoned as production zone

Proposed Zonation for Future Management

Zone	Criteria (why/reason for)	Proposed Management
Wetland	Protection to improve biological diversity	Low impact community use for crafts

4.7 Key Resources used/extracted

Timber Resources

Species	Uses	Users – who?	Estimated abundance	Annual allowable cut (if known)
Maesopsis eminii	Furniture	Local Community	Scattered	
Terminalia spp				

Non-timber Forest Products

Species	Uses	Users – who?	Estimated abundance	Annual Allowable cut (if known)
Palm tree	Making craft	Local Community	Low	-
Broussonetia papyrifera	Firewood	Local Community	Abundant	
Wild meat	Food	Local Community	Seasonal	-
Spathodea companulata	Medicinal	Local Community		-

4.8 Historical Trends related to Forestry

Date	Key Event	Significance to forest management
1900	Buganda Agreement	All forests were managed by Buganda kingdom
1932	Gazettement by British	Improved forest management
1968	Transfer to Ugandan government	Improved forest management
1972	Double production (forest encroachment)	The forest was heavily degraded
1989	Eviction	Forest land regained
2001	Forest policy	Improved management of the forest
2003/2004	Tree planting act was enacted	NFA entrusted with CFR
2006/2007	Mabira give away	Increased degradation
2015/2016	Restoration planting	Increased forest cover.

4.9 Issues/Concerns/Problems

	Direct Threats	Area ranking	Intensity ranking	Urgency ranking	Total ranking
	Forest Interior				
A1	Firewood cutting	2	3	3	8
A2	Charcoal burning	2	4	4	10
A3					
A4					
A5					
	Sub total				18
	Forest edge	**Area ranking**	**Intensity ranking**	**Urgency ranking**	**Total ranking**
B1	Boundary encroachment	4	3	5	12
B2	Grazing	1	1	1	3
B3					
B4					
	Sub total				15
	Grand total				**33**

4.10 Stakeholders Involved

Issues/Threat	Stakeholder(s)	Mandate/Right	Interest	Influence
Charcoal burning	community	Illegal	High	Low
Commercial firewood harvesting	Community	Illegal	High	Low
Grazing	community	Illegal	High	Low
Boundary cultivation	community	Illegal	High	Low

4.11 Opportunities

- Climate regulation
- Bee keeping
- Research and Education

4.12 Proposed strategies

- Boundary opening
- CFM (Collaborative forest management.)
- Increased logistics and facilitation for staff

4.13 Visions

Local Representative's Vision
A forest well managed and easily accessible by the local communities

NFA Vision
An ecologically, socially and economically stable forest reserve

Potential for conflict of interest

- Accessibility and protection

- Politics and conservation

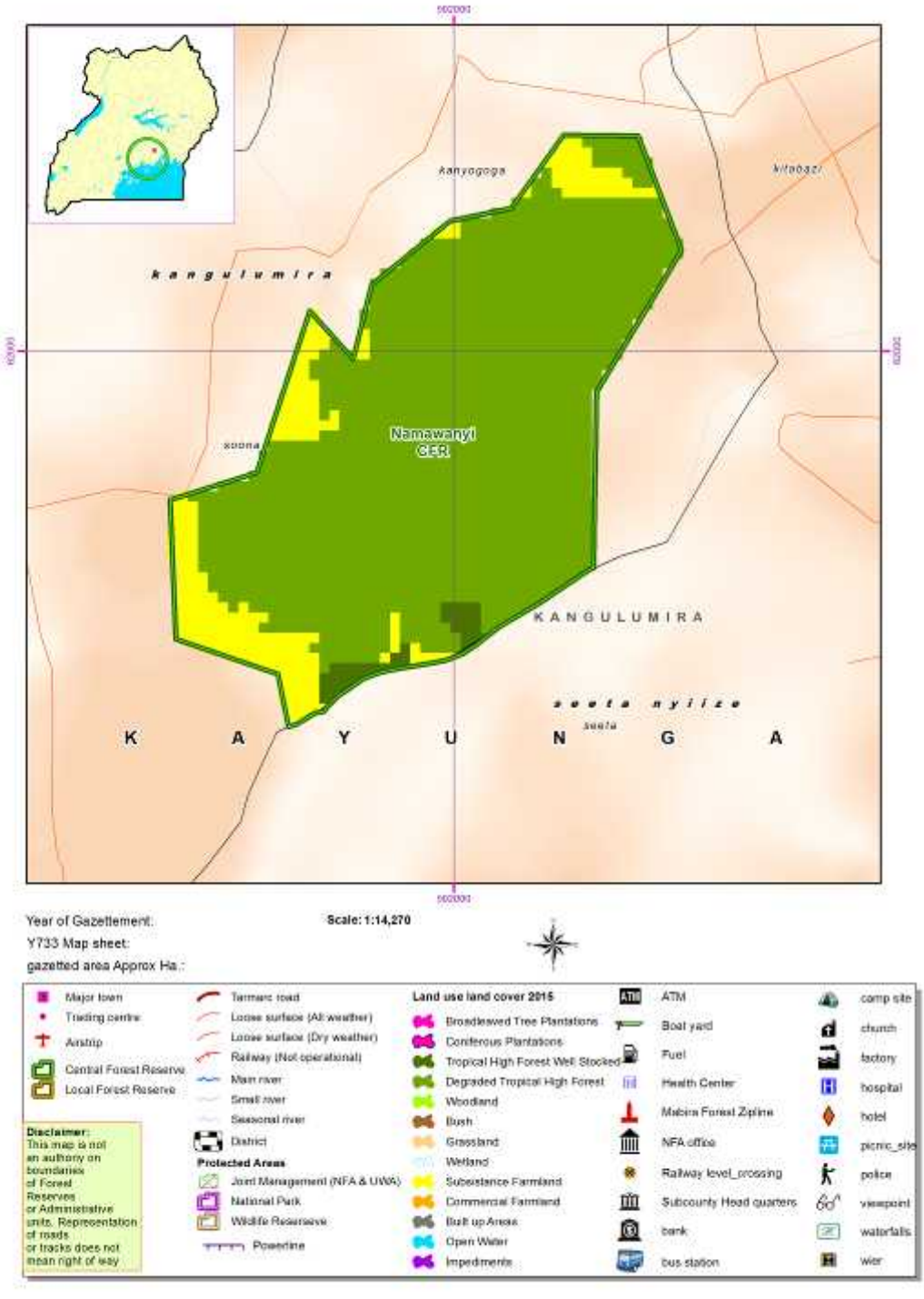
4.14 Obstacles/roadblocks to achieving vision

- Political interference
- Corruption
- Population
- Limited funding unclear boundary

4.15 Priority actions to address the above obstacles

- Institutional strengthening
- Increased funding
- Boundary opening
- Wealth creation programs targeting local communication

5. Namawanyi CFR



5 Namawanyi Central Forest Reserve

5.1 Size, location and brief description of the forest

Namawanyi Central FR covers 325 ha and is located about in Kangulumira sub county, Kayunga district. It is dominated *Broussonetia papyrifera.* However in 2016, the reserve was restored with indigenous tree species like Khaya spp, *Prunus Africana,* Cordia spp.

5.2 Legal category

Legal ownership
Gazzetted in 1932 under SI No, 176 as a CFR

Legal "Constraints"/Disputes/claims related to CFR
Namawanyi is still managed under the provisions of the National Forestry and tree planting Act 2003 and the 2001 Forestry Policy

5.3 Original Management Objectives

At gazettement
To ensure the water catchment areas of river Musamya well protected

In subsequent working plans
Ensure that there is full protection and maintenance of the indigenous tree species which were planted in the restoration program of 2016.

5.4 Vegetation type – Total forest area - 325 ha

Vegetation Type	Brief description of vegetation type	Area (ha) or percentage of FR	Estimated canopy cover	Level of degradation from natural state
Tropical high low stock		96.8%		
Wetland		3.2%		

The majority of the reserve is covered by the invasive" *Broussonetia papyrifera*

5.5 Land Use and Forest Condition

Land Use Patterns
Within the FR are:

- Charcoal burning
- Grazing
- Firewood collection

Outside

- Agriculture (cultivation and grazing)
- Timber cutting
- Settlement
- Sand mining
- Brick making

- Firewood harvesting

5.6 Zonation

Existing zonation
Namawanyi is zoned as production zone

Proposed Zonation for Future Management

Zone	Criteria (why/reason for)	Proposed Management
Wetland	Protection to improve biological diversity	Low impact community use for crafts

5.7 Key Resources used/extracted

Timber Resources

Species	Uses	Users – who?	Estimated abundance	Annual allowable cut (if known)
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Terminalia spp				

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1900	Buganda Agreement	All forests were managed by Buganda kingdom
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A3					
A4					
A5					
	Sub total				18
	Forest edge	**Area ranking**	**Intensity ranking**	**Urgency ranking**	**Total Ranking**
B1	Boundary encroachment	4	3	5	12
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B3					
B4					
	Sub total				15
	Grand total				**33**

5.10 Stakeholders Involved

Issues/Threat	**Stakeholder(s)**	**Mandate/Right**	**Interest**	**Influence**
Charcoal burning	Community	Illegal	High	Low
Commercial firewood harvesting	Community	Illegal	High	Low
Grazing	community	Illegal	High	Low
Boundary cultivation	community	Illegal	High	Low

5.11 Opportunities

- Climate regulation
- Bee keeping
- Research and Education

5.12 Proposed strategies

- Boundary opening
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- Increased logistics and facilitation for staff

5.13 Visions

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Potential for conflict of interest

- Accessibility and protection
- Politics and conservation

5.14 Obstacles/roadblocks to achieving the vision

- Political interference
- Corruption
- Population
- Limited funding unclear boundary

5.15 Priority actions to address the above obstacles

- Institutional strengthening
- Increased funding
- Boundary opening
- Wealth creation programmes targeting local

Appendix 3a: Diagnostic regeneration sampling from the Eastern block compartments

S/ N	Indigenous tree species present	Seedlings	Saplings	Poles
1.	*Alangium chinense*	2	2	1
2.	*Albizia zygia*	25	-	-
3.	*Alstonia boonei*	-	2	2
4.	*Antiaris toxicaria*	-	-	1
5.	*Blighia unijugata*	-	2	2
6.	*Caloncoba schweinfurthii*	-	-	-
7.	*Celtis durandii*	3	7	2
8.	*Celtis mildbraedii*	2	7	2
9.	*Celtis wightii*	1	1	2
10.	*Celtis zenkeri*	2	1	3
11.	*Chrysophyllum albidum*	2	1	1
12.	*Cola gigantea*	1	2	3
13.	*Ficus sur*	-	3	7
14.	*Ficus mucuso*	3	2	1
15.	*Holoptelea grandis*	3	2	1
16.	*Funtumia africana*	1	21	5
17.	*Entandrophragma angolense*	-	1	1
18.	*Margharíteria discoides*	-	2	2
19.	*Markhamia lutea*	25	20	6
20.	*Monodora myristica*	3	5	-
21.	*Lovoa trichilioides*	2	4	-
22.	*Trichilia prieureana*			
23	*Trilepisium madagascariensis*	5	3	4

Source: A field guide for assessing and restoring growth and development in degraded natural forests in Uganda 2006.

Appendix 3 b: Diagnostic sampling of regeneration in Namawanyi and Namananga CFRs

S/N	Species	Seedlings	Saplings	Poles
1.	*Broussonetia papyrifera*	779	883	165
2.	*Blighia unijugata*	58	70	2
3.	*Diospyros abyssinica*	40	10	0
4.	*Acalypha neptunica*	2	62	2
5.	*Celtis spp*	0	16	3
6.	*Coffea*	7	11	0
7.	*Artocarpus heterophyllus*	2	10	4
8.	*Ficus spp*	8	13	2
9.	*Acalypha senegalensis*	6	5	0
10.	*Teclea nobilis*	6	2	1
11.	*Antiaris toxicaria*	2	12	1
12.	*Trichilia dregeana*	3	5	0
13.	*Senna spectabilis*	0	5	2
14.	*Funtumia spp*	5	6	1
15.	*Markhamia lutea*	8	12	1

16.	*Tapura fischeri*	6	1	0
17.	*Lasiodiscus mildbraedii*	4	2	0
18.	*Albizia spp*	3	10	0
19.	*Aphania senegalensis*	3	2	0
20.	*Phoenix reclinata*	4	5	0
21.	*Syzigium guajava*	2	3	0
22.	*Maerua duchesnei*	0	2	0
23.	*Melanodiscus spp*	2	1	0
24.	*Terminalia spp*	0	0	0
25.	*Rothmannia whitfieldii*	1	1	0
26.	*Spathodea companulata*	0	1	1
27.	*Cola gigantea*	0	0	1
28.	*Mimusops bagswawei*	0	0	0
29.	*Rinorea ilicifolia*	0	1	0
30.	*Vernonia*	2	3	0
31.	*Phyllanthus magariteria*	2	0	0
32.	*Citrus*	0	0	1
33.	*Pilostigma thorningii*	0	1	0
34.	*Trema orientalis*	1	0	0

Appendix 4: Valuation of the various forest products and services in the MPA

The total economic value (TEV) of the forests is made up of use (UV) and non-use values (NUV). Whereas the use values consist of direct (DUV) and indirect use values (IUV); the non-use values consist of options (OV), bequest (BV) and existence values (EV).

Mathematically; TEV= UV+NUV----------i

UV= (DUV+IUV) +NUV----------ii

NUV= OV + BV+ EV----------iii

Despite the importance of the valuation of forests and nature, market failure or absence of markets and policy failures do not totally allow for total valuation of environmental resources- and as such these resources are still undervalued (Lette & de Boo 2002).

While the costs and benefits related to goods and services traded on the market, may be easy to appreciate and value, there are other numerous functions of forests for which markets malfunction, are distorted or simply do not exist. In addition, the price for a particular forest good may not reflect all the costs involved in producing that good because there may be other benefits or costs respectively enjoyed or borne by others and not directly involved in the production of the good, what are called externalities (Lette & de Boo 2002)

Example of links between value category, functions and valuation tools

USE VALUES			**NON-USE VALUES**		
USE	1. Direct use value	2. Indirect use value	3. Option value	4. Bequest value	5. Existence value
FUNCTIONS	Wood products (timber, fuel) Non-wood products (food, medicine, genetic material) Educational, recreational and cultural uses Human habitat	Watershed protection Nutrient cycling Air pollution reduction Micro-climatic regulation Carbon storage	Possible future uses of the goods and services mentioned in 1&2 (Use Values) by actual stakeholders	Possible future uses of the goods and services mentioned in 1&2 (use Values) by the offspring of actual stakeholders	Biodiversity Culture, heritage Benefits to stakeholders of only knowing of the existence of goods or services without using them
	Tool to be used:	**Tool to be used:**	**Tool to be used:**	**Tool to be used:**	**Tool to be used:**
VALUATION TOOLS	Market Analysis Related Goods Approaches Travel Cost Method Contingent Valuation Method Hedonic Pricing	Restoration Cost Preventive Expenditure Production Function Approach Replacement Costs	Contingent Valuation Method	Contingent Valuation Method	Contingent Valuation Method

Source: Lette & de Boo (2002)

The analytical approach adopted in the valuation process consisted of the following;

i. Resource values were estimated from the perspective of net benefit streams, annualized, and then their present values obtained by capitalizing the average annual benefits stream using the Government of Uganda's social6 opportunity cost of capital of 12 percent. Benefit-cost analysis is based on discounting the benefits and costs attributable to a project over time and then comparing the present value of costs (PVC) with the present value of benefits (PVB). The present value of benefits is the sum of the *discounted values* of benefits in each year. Thus:

$$PVB = \sum_{t=1}^{t=n} \frac{B_t}{(1+i)^t}$$

$$PVC = \sum_{t=1}^{t=n} \frac{C_t}{(1+i)^t}$$

n = number of years being considered; t = each individual year; and i = the discount rate expressed as a decimal fraction

The decision-making criteria; after the discounting has been completed, the present value of the benefits (PVB) is compared to the present value of all the costs (PVC). For a project to be considered profitable at a given discount rate, the present value of benefits should exceed that of costs i.e. PVB > PVC. The net present value(NPV) which is sometimes called "net present worth" is obtained by subtracting the present value of costs from that of benefits i.e. NPV = PVB - PVC or, mathematically:

$$NPV = \sum_{t=1}^{t=n} \frac{B_t - C_t}{(1+i)^t}$$

Where: t = individual years; n = number of years over which the project is evaluated; B = the sum of benefits in a given year; C = the sum of costs in a given year; and i = the discount rate expressed as a decimal.

For a project to be acceptable, PVB > PVC i.e. the net present value should *be positive.* The net present value gives a good idea of the total profit, in present value terms, of the project. The NPV shown above is used to give a present value for a single ecosystem service. However, for all the different ecosystem services that are obtained from Mabira CFR, the Total Present Value is calculated. The Total Present Value is the sum of the net present values of all the ecosystem services i.e.

$$TPV = \sum_{s=1}^{m} NPV_s$$

Where;

TPV = Total Present Value; NPV= Net Present Value; and $s_{(1-m)}$ = all ecosystem services from 1 to m

Note: Simple calculus shows that TPV is equivalent to the quotient of the NPV divided by the discount rate (i)

$$TPV = \frac{NPV}{i}$$

The following considerations were made;

i. For Mabira CFR, the volume of the standing timber is the capital stock from which benefits are derived.
ii. In calculating the streams of benefits arising from timber, poles and firewood, stumpage values were used.
iii. *Non-timber forest products* are harvested from Mabira forest ecosystem and PA landscape. This study used the extensive research of Bush *et al* (2004) on community livelihoods in representative forests in Uganda...
iv. The basis for calculating the value of forests for ecotourism is the consumer surplus, representing the price tourists are willing-to-pay, up and above what they actually pay for the ecotourism experience.
v. *Non-timber forest products* are harvested from Mabira forest ecosystem and PA landscape. This study used the extensive research of Bush *et al* (2004) on community livelihoods in representative forests in Uganda.
vi. Carbon sequestration values were derived from Bush et al (2004) where average values of tonnes of carbon per unit area per year have been estimated multiplied by the appropriate domestic market price prevailing then for carbon.

Biodiversity values were estimated using secondary data from research in comparable areas.

Timber values by compartment

Cpt	Cpt Area (Ha.)	No. Plots	Mgt. zone	10-30	30-50	50-70	70-90	90+	30+	40+	50+	Relict	Fair	Good
			Buffer zone											
			Buffer zone											
			Buffer zone											
			Buffer zone											
457			Buffer zone											
442														
563	479		Production zone											
373	586		Production zone											
427	428	26	Production zone	10,943	12,842	6,075	1,805	9,207	29,930	24,250	17,088	6,376	5,323	5,388
502	437	48	Production zone	13,008	16,216	15,804	11,049	14,387	57,456	48,698	41,241	9,507	15,386	16,347
360	514	111	Production zone	20,905	21,621	21,617	8,024	5,919	57,182	46,766	35,561	4,823	12,037	18,701
617	377	74	Production zone	18,485	19,041	13,236	14,579	9,877	56,733	46,935	37,692	6,167	10,897	20,628
408			Production zone											
336			Production zone											
379	337	49	Production zone	16,152	20,000	13,168	6,707	9,441	49,316	39,001	29,316	4,490	11,046	13,780
365	384	46	Production	15,636	18,784	12,314	7,973	5,867	44,938	35,756	26,154	991	12,889	12,274

			zone											
542	384	112	Production zone	16,262	16,706	11,421	16,593	12,588	57,308	48,735	40,602	5,614	15,193	19,795
378	566	126	Production zone	19,652	27,575	25,397	17,965	10,985	81,922	69,393	54,347	5,517	18,707	30,122
423	386	73	Production zone	15,954	20,194	16,155	14,049	16,709	67,108	57,580	46,913	11,829	10,589	24,495
415	429	109	Production zone	16,129	20,418	15,257	14,243	7,864	57,782	47,271	37,364	4,244	10,914	22,206
324	432	99	Production zone	17,016	16,939	23,061	17,787	10,136	67,923	59,522	50,984	7,886	21,552	21,546
334	319	35	Production zone	7,454	9,318	6,787	9,081	6,578	31,764	27,861	22,446	5,374	12,525	4,547
459	284	23	Production zone	6,991	10,485	9,884	9,129	3,922	33,421	28,599	22,936	7,189	4,264	11,482
916	411	67	Production zone	14,469	13,867	18,400	14,890	9,872	57,030	50,126	43,163	8,398	12,726	22,038
			Production zone											
352	534	195	Production zone	22,800	23,112	24,887	23,725	12,999	84,723	73,838	61,611	6,004	20,201	35,406
333			SNR											
557			SNR											
418			SNR											
412			Buffer zone											
284			Buffer zone											
389			SNR											
455			SNR											
406			Buffer zone											
868			Buffer zone											
			Recreation											
597			Recreation											

433			Recreation											
533			Recreation											
429			Buffer zone											
622			SNR											
559			SNR											
497			SNR											
330			SNR											
655	711	129	Buffer zone	20,983	25,515	19,557	16,683	14,899	76,654	62,159	51,139	7,695	23,477	19,966
814														
519	835	167	Production zone	27,402	29,471	27,943	30,329	36,636	124,379	110,569	94,908	12,077	39,905	42,926
825	453	82	Production zone	18,675	18,649	16,487	15,302	19,037	69,475	60,783	50,826	8,724	16,784	25,318
430	523	101	Production zone	23,017	28,729	24,708	13,673	6,381	73,491	59,267	44,762	9,561	17,886	17,315
525	508	126	Production zone	19,818	25,684	25,240	18,740	17,350	87,015	74,219	61,331	14,274	19,347	27,710
532			Recreation											
483			Recreation											
572			Recreation											
421	405	40	Production zone	11,311	13,824	17,912	17,206	15,925	64,867	57,656	51,043	10,802	6,473	33,767
395	343	79	Production zone	10,680	12,693	13,200	10,769	4,894	41,556	35,135	28,863	3,128	9,555	16,179
338	288	9	Production zone	5,643	2,977	5,632	10,597		19,206	17,298	16,229		11,558	4,671
694	679	59	Production zone	18,732	36,078	13,046	7,841	10,761	67,727	48,983	31,648	10,131	13,348	8,170
580	611	33	Production zone	16,348	14,444	7,545	7,299		29,289	17,034	14,844	3,738	4,326	6,780
	415													
405	403													

362	365													
341	451													
447	424													
403	651	50	Production zone	16,589	18,357	28,772	24,753	20,377	92,260	83,802	73,903	5,835	26,426	41,641
653	453	115	Production zone	14,015	16,586	18,270	20,410	8,863	64,128	55,087	47,542	5,667	10,414	31,461
461	333	79	Production zone	6,175	9,542	9,661	11,303	9,705	40,211	35,759	30,669	2,130	5,044	23,496
336	381		Production zone											
358	515		Production zone											
516	488		Production zone											
489	315		Production zone											
Total				**441,245**	**519,668**	**461,438**	**392,506**	**311,179**	**1,684,791**	**1,422,080**	**1,165,124**	**188,175**	**398,794**	**578,155**

It should be noted that the figures given in the table above are a partial quantification of the stock as the inventory did not take care of the trees in the buffer and SNR since they had not been planned for harvesting.

According to the ISSMI data of 2006, the total standing volume was 6,398,030 m^3 as the value of the natural stock that was producing the diverse benefit streams. Considering that grading and sorting have not been done and the data is not updated, a conservative price of UGX 175,000 /m^3 (USD 50) as average price for tropical moist timbers was used. The value stands at a stock capital of UGX 1,119,655,250,000 (USD 319,901,500). Capitalized at the social cost of capital at 12% translates to a value of UGX 9,330,460,416,667(USD2, 665,845,833)

Poles and Firewood

Pole and firewood production for commercial purposes is not permitted in Mabira MPA. However, harvesting the products in limited quantities for domestic use is permissible. In addition, where commercial timber harvesting is being undertaken, firewood and charcoal production from harvesting waste is allowed as a way of maximizing utilization and cleaning the forest the forest especially for enrichment planting.

The approach used to calculate the value is to estimate the combined stream of values from poles and firewood using household livelihoods. Bush *et al,* 2004 established that the value of wood (largely poles and firewood) and non-wood products from a typical protected tropical high forest in Uganda was UGX 18,074 / ha /year which was equivalent to USD 6.455/ha/year at the 2003/2004 exchange rate.

In order to estimate the value of poles and firewood used by the forest adjacent communities (FACs), USD 6.455/ha/year is multiplied by the total area of the CFRs in the MPA, which amounts to USD 201, 996 (UGX 706,986,000). Capitalising this annual benefit stream of UGX 706,986,000 by the government-borrowing rate, 12%, gives a net present value of UGX 5,891,550,000 (USD 1,683,300), as value for poles and firewood.

Non-timber forest products

The demand for handicraft products such as baskets, bee hives, chairs and stools is rising both for household uses and as souvenirs. Forest foods such as fruits, tubers, honey, vegetables to mention but a few are also on increasing demand by the FACs.

Studies by Bush *et al* (2004), showed that typical tropical high forest protected areas (PAs) generate non-timber benefit streams, amounting to UGX 9,579/ha/year. On the other hand (while assessing livelihood strategies of the Sango bay ecosystem dependent communities Kabi; (2002) estimated that use of the forest for non-timber products by communities constituted an annual saving in livelihood sustenance of UGX 3,844,308 (US$1,373)/household/ year. Mabira PA landscape is located in the major urban areas of Jinja, Kampala, Mukono, Lugazi, Buikwe, Kangulumira, Njeru and Kayunga among others where unemployment levels are high and livelihood sustenance is increasingly forest based because of lack of other livelihood options for the communities therein. This figure of UGX 3,844,308 (USD1, 373)/household/ year for Sango Bay has been has been adopted for estimating the value of non-timber forest products in the Mabira MPA.

The population of the FACs was estimated to be 771,078persons, at an average of four (4) persons per household, representing 183,906 households (UBOS 2014). The value of non-timber forest products therefore is estimated to be USD 252,502,938 (UGX 883,760,283,000) per year. Capitalising this annual benefit stream by 12% (social discount rate) gives a net present value of UGX 7,364,669,025,000 (USD 2,104,191,150) for non-timber forest products.

Carbon storage and sequestration

In a standing forest there are two values of carbon. The first is the value of the carbon stored in a standing forest that is close to carbon balance. The second is the value of carbon sequestered in a growing forest. In other words the carbon storage value is the value held in the growing stock or standing timber volume. The sequestration value is the value of the amount of additional carbon absorbed by the forest as it adds more volume annually.

Brown and Pearce (1994) provide some benchmark figures for carbon containment in a tropical forest (*Table1*). A closed primary forest has 283tC/ha of carbon.

Table1; Carbon containment in different states of tropical forests

Forest type	**Forest original Carbon(tC/ha)**
Closed primary forest	283
Closed secondary forest	194
Open forest	115

Source: **Brown and Pearce (1994)**

During photosynthesis forest plants sequester carbon dioxide from the atmosphere to form cellulose used in tree development and growth. Forests therefore are an important carbon sink, helping to reduce accumulation of greenhouse gases and hence global warming that would arise there from.

Emerton & Muramira (1999) and Bush *et al* (2004) give the following carbon sequestration values for different Ugandan vegetation types: primary closed forest UGX 54,660/ha/year; degraded forest UGX 32,538/ha/year; and woodland, bush land and grassland UGX 2,603/ha/year.

The Mabira forest ecosystem is zoned into different management areas so as to take care of the interests of the various stakeholders and maximize benefits. Carbon sequestration values for the different management zones of the Mabira PA ecosystem have been calculated using the average value for a primary closed forest and a degraded forest and deducting grassland values.

Therefore, the encroached areas and the recreation/buffer zone would have carbon values equivalent to a degraded forest. The production (low impact) zone on the other hand should have carbon sink values somewhere between the primary and degraded forests. The economic value of carbon sink/ha/year for the production/encroachment and recreation/buffer zone was therefore estimated at UGX 32,358(USD 11.6)/ha/year

Using GIS and satellite imagery NFA has assessed national biomass and the land use levels of Uganda. Multiplying the carbon sink values by the area of the compartment, the table below shows the economic value of sequestering carbon/compartment /yr. as well as the value of carbon in stock. The carbon stock value is UGX 28,880,467,000 (USD 8251,565) while the value of sequestering is UGX 1,987,932,800/year (USD 567,981)

From above, the total benefit of carbon processing by the ecosystem is equal to the annual benefit stream of sequestering and the total carbon stored which therefore amounts to UGX 30,868,399,800(USD 8,819,545). Capitalising this annual benefit stream by 12% (social discount rate) gives a net present value of UGX 257,236,740,000 (USD 73,496,211) for sequestering and storing carbon

Carbon storage and sequestration values by compartment

Cpt	Cpt Name	Cpt Area Ha.	Mgt. Zone	Econ Value of Carbon Sequestration /Cpt (UGX)	C-Value USD/ha/Yr	Carbon Stock sequestered tC/ha (and leakage if converted	Carbon Stock sequestered/ compartment (and leakage if converted)	Value of Carbon Stock sequestered/comp artment (and leakage if converted)@2004 exchange rate (1US$=2800)	Carbon Sequestration Value /Cpt /year US$ @2004 exchange rate (1US$=2800)	Value of Carbon Stock sequestered/Cpt (and leakage if converted) UGX (1US$=3500)	Econ Value of Carbon Sequestration /Cpt/yr UGX as @2017 1US$=3500
240			Buffer zone	32,538	11.6	283	0	0	0	0	0
239			Buffer zone	32,538	11.6	283	0	0	0	0	0
238			Buffer zone	32,538	11.6	283	0	0	0	0	0
237			Buffer zone	32,538	11.6	283	0	0	0	0	0
236	Namanang a Namawany i	457	Buffer zone	32,538	11.6	194	88,658	1,028,433	5,301	310,303,000	18,554,200
235	Nandagi	479	Production zone	54,660	20	283	135,557	2,711,140	9,580	474,449,500	33,530,000
234	Sezibwa South	563	Production zone	54,660	20	283	159,329	3,186,580	11,260	557,651,500	39,410,000
233	Sezibwa North	373	Production zone	54,660	20	283	105,559	2,111,180	7,460	369,456,500	26,110,000
232	Sezibwa	427	Production zone	54,660	20	283	120,841	2,416,820	8,540	422,943,500	29,890,000
231	Basima	502	Production zone	54,660	20	283	142,066	2,841,320	10,040	497,231,000	35,140,000
230	Waluke	360	Production zone	54,660	20	283	101,880	2,037,600	7,200	356,580,000	25,200,000
229	Nagojje	**614**	Production zone	54,660	20	283	173,762	3,475,240	12,280	608,167,000	42,980,000
228	Lunya	408	Production zone	54,660	20	283	115,464	2,309,280	8,160	404,124,000	28,560,000

227	Kiwala South	336	Production zone	54,660	20	283	95,088	1,901,760	6,720	332,808,000	23,520,000
226	Kiwala North	379	Production zone	54,660	20	283	107,257	2,145,140	7,580	375,399,500	26,530,000
225	Bulanga West	365	Production zone	54,660	20	283	103,295	2,065,900	7,300	361,532,500	25,550,000
224	Busolo	542	Production zone	54,660	20	283	153,386	3,067,720	10,840	536,851,000	37,940,000
223	Wantuluntu West	378	Production zone	54,660	20	283	106,974	2,139,480	7,560	374,409,000	26,460,000
222	Namulaba	423	Production zone	54,660	20	283	119,709	2,394,180	8,460	418,981,500	29,610,000
221	Bulungeza West	415	Production zone	54,660	20	283	117,445	2,348,900	8,300	411,057,500	29,050,000
220	Kitavunja	**319**	Production zone	54,660	20	283	90,277	1,805,540	6,380	315,969,500	22,330,000
219	Namukupa	**284**	Production zone	54,660	20	283	80,372	1,607,440	5,680	281,302,000	19,880,000
218	Bulengeza East	**459**	Production zone	54,660	20	283	129,897	2,597,940	9,180	454,639,500	32,130,000
217	Wantuluntu East	**916**	Production zone	54,660	20	283	259,228	5,184,560	18,320	907,298,000	64,120,000
216	Musamya West	909	SNR	54,660	20	283	257,247	5,144,940	18,180	900,364,500	63,630,000
215		333	SNR	54,660	20	283	94,239	1,884,780	6,660	329,836,500	23,310,000
214	Musamya West	333	Production zone	54,660	20	283	94,239	1,884,780	6,660	329,836,500	23,310,000
213	Bulanga East	557	SNR	54,660	20	283	157,631	3,152,620	11,140	551,708,500	38,990,000
212	Namanyama North	418	Buffer zone	32,538	11.6	194	81,092	940,667	4,849	283,822,000	16,970,800
211	Namanyama Central	412	Buffer zone	32,538	11.6	194	79,928	927,165	4,779	279,748,000	16,727,200
210	Namanyama	284	SNR	54,660	20	283	80,372	1,607,440	5,680	281,302,000	19,880,000
209	Kanogola	389	SNR	54,660	20	283	110,087	2,201,740	7,780	385,304,500	27,230,000
208	Namaganda	455	Buffer zone	32,538	11.6	194	88,270	1,023,932	5,278	308,945,000	18,473,000

207	Namagandа South	406	Buffer zone	32,538	11.6	194	78,764	913,662	4,710	275,674,000	16,483,600
206	Namusa West	868	Recreation	32,538	11.6	194	168,392	1,953,347	10,069	589,372,000	35,240,800
205	Griffin	597	Recreation	32,538	11.6	194	115,818	1,343,489	6,925	405,363,000	24,238,200
204	Lwankima	433	Recreation	32,538	11.6	194	84,002	974,423	5,023	294,007,000	17,579,800
203	Dangala South	533	Recreation	32,538	11.6	194	103,402	1,199,463	6,183	361,907,000	21,639,800
202	Sese	429	Buffer zone	32,538	11.6	194	83,226	965,422	4,976	291,291,000	17,417,400
201	Namusa East	622	SNR	54,660	20	283	176,026	3,520,520	12,440	616,091,000	43,540,000
200	Butuku	559	SNR	54,660	20	283	158,197	3,163,940	11,180	553,689,500	39,130,000
199	Namagandа East	497	SNR	54,660	20	283	140,651	2,813,020	9,940	492,278,500	34,790,000
198	Namatogonya	330	SNR	54,660	20	283	93,390	1,867,800	6,600	326,865,000	23,100,000
197	Namagandа North	**655**	Buffer zone	32,538	11.6	194	127,070	1,474,012	7,598	444,745,000	26,593,000
196	Zintengeze North	814	Production zone	54,660	20	283	230,362	4,607,240	16,280	806,267,000	56,980,000
195	Naluvule	519	Production zone	54,660	20	283	146,877	2,937,540	10,380	514,069,500	36,330,000
194	Zintengeze South	**453**	Production zone	54,660	20	283	128,199	2,563,980	9,060	448,696,500	31,710,000
193	Kyoga North	430	Production zone	54,660	20	283	121,690	2,433,800	8,600	425,915,000	30,100,000
192	Kyoga South	525	Production zone	54,660	20	283	148,575	2,971,500	10,500	520,012,500	36,750,000
191	Bugoma North	532	Recreation	32,538	11.6	194	103,208	1,197,213	6,171	361,228,000	21,599,200
190	Bugoma South	572	Recreation	32,538	11.6	194	110,968	1,287,229	6,635	388,388,000	23,223,200
189	Najjembe North	421	Recreation	32,538	11.6	194	81,674	947,418	4,884	285,859,000	17,092,600
188	Najjembe South	**421**	Production zone	54,660	20	283	119,143	2,382,860	8,420	417,000,500	29,470,000
187	Lugala West	**395**	Production zone	54,660	20	283	111,785	2,235,700	7,900	391,247,500	27,650,000
186	Buwala	**338**	Production zone	54,660	20	283	95,654	1,913,080	6,760	334,789,000	23,660,000

185	Kasota	694	Production zone	54,660	20	283	196,402	3,928,040	13,880	687,407,000	48,580,000
184	Mulonge	580	Production zone	54,660	20	283	164,140	3,282,800	11,600	574,490,000	40,600,000
183	Maligita	405	Production zone	32,538	20	283	114,615	2,292,300	8,100	401,152,500	28,350,000
182	Liga	362	Production zone	32,538	20	283	102,446	2,048,920	7,240	358,561,000	25,340,000
181	Kyabana North	341	Production zone	2,603	20	283	96,503	1,930,060	6,820	337,760,500	23,870,000
180	Kyabana Central	447	Production zone	32,538	20	283	126,501	2,530,020	8,940	442,753,500	31,290,000
179	Kyabana South	403	Production zone	32,538	20	283	114,049	2,280,980	8,060	399,171,500	28,210,000
178	Sango East	**653**	Production zone	54,660	20	283	184,799	3,695,980	13,060	646,796,500	45,710,000
177	Sango South	**461**	Production zone	54,660	20	283	130,463	2,609,260	9,220	456,620,500	32,270,000
176	Lugala East	336	Production zone	54,660	20	283	95,088	1,901,760	6,720	332,808,000	23,520,000
175	Bugule	358	Production zone	54,660	20	283	101,314	2,026,280	7,160	354,599,000	25,060,000
174	Luwala	515	Production zone	54,660	20	283	145,745	2,914,900	10,300	510,107,500	36,050,000
173	Senda	488	Production zone	54,660	20	283	138,104	2,762,080	9,760	483,364,000	34,160,000
172	Senda North	320	Production zone	54,660	20	283	90,560	1,811,200	6,400	316,960,000	22,400,000
171	Wakisi	617	Production zone	54,660	20	283	174,611	3,492,220	12,340	611,138,500	43,190,000
Totals							**8,251,562**	**153,317,675**	**567,981**	**28,880,467,000**	**1,987,932,800**

Pharmaceutical value

The value of biodiversity lies partly in the development of plant-based pharmaceuticals (Bush *et al* 2004; Emerton & Muramira 1999; Mendelsohn & Balik 1995; Howard 1995; Pearce & Moran 1994; Ruitenbeek 1989). Medicinal plants like *Prunus Africana, Waburgia ugandensis, Cyphostema sp Mormodica foetida, Fluggea (Securinega), Virosa roseus , Cantharanthus, Mondia whitei, Cytropsis articulata and Casein sp among others* have been used by communities therein and have greatly improved on community welfare as a financial saving.

In addition to undiscovered plant-based pharmaceuticals it has been reported that there is potential in wild coffee genetic material (Howard, 1995). According to Bush *et al* (2004), Uganda's farmed coffee is being hit by a *Fusarium* wilt against which no known cultural or chemical practices appear to succeed to save the coffee industry.

Wild coffee is known to be resistant to fusarium wilt and therefore can be a solution to the problem of the coffee wilt .The studies have been done in various regions and countries of the world to estimate the value of forest biodiversity. Ruitenbeek (1989) estimated the biodiversity of Korup Park in Cameroon at £0.1/ha/year. Mendelsohn & Balik (1995) estimated the value of THF for undiscovered plant-based drugs in tropical forest with average plant endemism at USD 3/ha. Pearce & Moran (1994) provided a range of values for tropical forest, ranging from USD 0.1/ha to USD 21/ha, and Bush *et al* (2004), estimated the value at USD1.50/ha/year.

In this regard while still an under estimate, Pearce and Moran's upper value of USD 21/ha seems more reasonable. Using this to estimate the biodiversity value of Mabira MPA is done by multiplying this figure by the area, thus USD 21x31,293 which is equivalent to USD 657,153 or UGX 2,300,035,500 for the Mabira MPA. Capitalised at 12 %, this perpetual annual benefit streams would translate into benefits estimated at a present economic value of UGX 19,166,962,500 (USD 5,476,275).

Domestic water conservation

Bush *et al* (2004) estimated the mean value of water provision for both humans and livestock per household at UGX 18,415 per annum, and ranges from UGX 12,078 per annum for Budongo CFR to UGX 30,928 per annum for Rwenzori Mountains National Park. In this report, the value for Budongo CFR that is relatively similar to Mabira CFR was used in estimating community water benefits.

Focus group discussions with the FACs in Mabira MPA indicated that water harvesting was at an average of 10-30 20L jerrican/household/day at a price of 500-1200/jerrican during water stress or drought , depending on whether one has livestock or not. Taking a central working value of 15 jerricans at a price of UGX1, 000, consumption of water translates into UGX 15,000 (US$ 4.3)/day and multiplying the mean value of provision of water for domestic and farm use of UGX 15,000 (USD 4.3)/day by the number of households (183,906) as given by UBOS 2014 amounts to UGX 2,758,590,000 (USD 788,169 per day) which aggregates to UGX 1,006,885,350,000 (USD 287,681,529) for all the FAC households per year.

Capitalised at 12 %, this perpetual annual benefit streams would translate into benefits estimated at a present economic value of UGX 8,390,711,250,000 (USD 2,397,346,071).

Watershed protection

Soil erosion is a major environmental threat to the productivity and sustainability of agriculture in Eastern Africa and in Uganda in particular, it has reached alarming levels. Erosion reduces soil rooting depth, removes plant nutrients and causes loss of water leading to an overall reduction in soil productivity. Soil erosion results in economic, political, social and environmental implications due to both on-site and off-site effects (Kefi and Yoshino, 2010). It is estimated that for Uganda 4 to 12% of Gross Domestic Product (GDP) is lost through environmental degradation (Slade and Weitz, 1991; NEMA, 2001), with 85% of this attributed to soil erosion, nutrient loss and changes in crops (Olson and Berry, 2003). If this situation is not checked, the country faces a serious problem especially in view of an increasing population majority of which is dependent on agriculture.

The functions forests play in watershed regulation include; soil conservation (siltation and sedimentation), water flow regulation (including flood and storm protection, water supply, water quality regulation – including nutrient outflow). Unfortunately, economic studies of watershed protection functions are few, nonetheless progress is being made. From existing studies Krieger (nd) was able to arrive at average values of tropical forests as follows: water regulation (USD 6/ ha or UGX 21,000/ha); water supply/quality (USD 8/ha or UGX 28,000/ha); erosion control and sediment retention (USD 245/ha or UGX 857,500/ha); resulting in a total of USD 259/ ha or UGX 906,500/ha). When these average values for all tropical forests of the world are applied to the Mabira MPA, it translates into

annual watershed protection values of UGX 28,367,104,500 (USD 8, 104,887) and present value of UGX 236,392,537,500 (USD 67,540,725).

According to Hamilton & King (1983), care needs to be taken not to exaggerate these estimates. Yaron (2001) estimated the value of flood protection (using the value of avoidable crop and tree losses as a basis) and came up with a figure of $0- 24/ha. Using Yaron's upper estimate of $24/ha, the flood protection value for the Mabira MPA would be UGX 2,628,612,000 (USD 751,032/year) and would give a present value of UGX 21,905,100,000 (USD 6,258,600) capitalized at 12%.
While this conservative estimate applies to flood protection and not the other watershed functions, the values may however be summed up to give a total protection value of the Mabira MPA in terms of erosion control and prevention of floods as thus UGX 236,392,537,500 (USD 67,540,725) + UGX 21,905,100,000 (USD 6,258,6000) which amounts to UGX 258,297,637,500 (USD 73,799,325).

Ecotourism

According to Pearce & Pearce (2001) ecotourism is a growing activity and contributes a potentially valuable non-extractive use of tropical forests. A review of some estimates of tourism values shows enormous variations in unit values of ecotourism. For example Maille and Mandelsohn (1993) estimated the value of tropical forest ecotourism in Madagascar at USD360 – 468/ha based on a study of consumer's surplus using the travel cost method (TCM). On the other hand, other tropical forest ecosystem values are as follows; USD 650/ha benefit of no logging over continued logging in a forest in the Philippines (Hodgson & Dixon 1988); consumer's surplus estimates of USD 1/ha for a site in Mexico (Adger et al 1995); USD740/ha for forest recreation areas in Malaysia (Garrod &Willis 1997); and USD 950 – 2305/ha for two forested parks in Costa Rica (Shultz et al 1998). Generally, very high popularity sites generate much higher values as demonstrated by the Schultz *et al* study.

According to Muramira (2000), Uganda's tropical high forests have some of the richest biodiversity of plant and animal life in the world. However, compared to other national forests, the biodiversity inventory for Mabira CFR revealed that the forest has average biodiversity attributes (Davenport *et al* 1996). The ecotourism value of Mabira lies in the fact that it is the only THF protected area within the Lake Victoria shore crescent. Furthermore, Mabira CFR is close to the urban centres of Kampala (53km) and Jinja (21km). There is increasing interest in ecotourism in Mabira CFR as shown in *Table 20*. Finally, in addition to the Ecotourism Centre operated by the NFA, there are three (3) more tourism sites in the MPA managed by Ecolodges, MAFICO and Adrift. These developments, amongst others, point to an accelerated growth in ecotourism in Mabira CFR.

For purposes of calculating the value of ecotourism for Mabira MPA, the lower case value (USD 360/ha or UGX 1,260,000/ha) for Madagascar from the study of Maille and Mandelsohn (1993) could be a reasonable average estimate. Multiplying this value by the area of the MPA gives the estimated value of ecotourism of Mabira MPA as UGX 39,429,180,000 (USD 11,265,480/year; and the present value of UGX 328,576, 500, 000 (USD 93,879,000.

Option and existence values

According to Nature Uganda report , the option and existence values is that they may be 'capturable' through mechanisms such as debt-for-nature swaps, official aid, donations to conservation agencies, and pricing mechanisms (Pearce &Pearce 2001). According to Swanson & Kontoleon (2000), an example of using a price is the suggestion that visitors to China would have the option of paying USD 1 extra for a panda stamp' in their passports, along with their visa, to indicate that they have donated towards panda conservation in China.

Some option and existence value estimates for the world's tropical forests have been reported elsewhere including; Sri Lankan forests (villagers, rural and urban groups of use, bequest and existence values) by Gunawardena *et al* (1999) using a contingent valuation method (CVM); and US residents' willingness to pay 'one-off' payment of USD 21-31 per household for protection of 5 percent more of the world's tropical rain forests (Kramer &Mercer 1997). However, for purposes of arriving at a relevant estimate for the impact area in Mabira three studies are particularly pertinent. The first concerns use of a willingness to pay study to estimate the implied 'world' willingness to pay for limited forest areas covered by debt-for-nature swaps at USD5/ha (Pearce 1996). The second study is a similar one by the same author on implied 'world' willingness to pay via the Global Environmental Facility (GEF) of USD2/ha. The third study was estimates of option and existence values revealed in a study of debt-for-nature swaps and grant aid to Mexico forest conservation of USD2/ha. For the Mabira MPA, the implied willingness to pay via the GEF facility was chosen mainly because it represents the most conservative estimate but also because Uganda has been a beneficiary of several GEF funding arrangements. From the foregoing, the unit option and existence value for the Mabira MPA is USD 2/ha, which when multiplied by the 31,293 translates into USD 62,386/year (or UGX 218,351,000/year and a present value of about UGX 1,819,591,667 (USD 519,883)

Appendix 5 a: Distribution of volume (m^3/ha) of some species in different compartments

Distribution of volume (m^3/ha) of some species in different compartments													
Cpt. No	***Holoptelea grandis***	***Milicia excelsa***	***Entandrophragma spp***	***Olea welwitschii***	***Lovoa spp***	***Fagara spp***	***Albizia spp***	***Antiaris toxicaria***	***Ficus spp***	***Maesopsis eminii***	***Celtis spp***	***Broussonetia papyrifera***	**Total no. of species**
176	10.65	-	-	-	-	-	15.82	6.01	10.47	-	55.48	0.79	55
177	2.81	0.63	0.16	-	0.04	0.20	11.78	5.78	10.71	0.17	67.94	2.96	73
178	4.04	0.64	0.34	-	-	-	5.97	6.20	11.67	-	47.24	3.06	52
184	-	-	-	-	-	-	1.15	1.92	7.23	-	21.92	28.13	25
185	1.77	-	-	0.26	-	-	0.85	1.82	11.96	0.12	23.62	47.31	48
186	-	-	-	-	-	-	-	-	5.24	-	19.27	15.32	14
187	0.88	0.34	0.09	0.03	-	-	18.19	10.74	5.17	1.66	57.47	0.09	61
188	-	-			-	-	28.90	15.58	20.20	0.44	46.52	0.28	61
192	4.89	0.11	0.30		0.28	-	14.68	6.00	15.54	0.49	66.26	2.49	96
193	5.24	0.06	0.27		-	0.76	12.44	2.99	11.08	0.28	57.18	15.59	92
195	6.29	0.38	0.21		-	0.03	16.99	12.90	10.69	0.09	54.30	2.65	98
197	5.23	-	0.12	0.36	0.93	-	11.32	1.58	12.16	0.19	33.06	25.63	71
217	27.75	0.10	0.08	1.86	-	0.06	12.11	1.69	5.04	0.33	68.23	0.39	75
218	16.94	0.39	-	0.15	-	-	5.12	0.71	9.36	-	58.47	0.74	55
219	7.81	-	-	3.51	-	-	9.12	2.09	8.08	-	60.03	-	31
220	5.79	-	-		-	-	3.54	1.96	8.01	0.20	37.93	0.09	36
221	17.10	0.61	-	2.71	-	-	14.74	5.41	6.45	0.42	36.67	-	71
222	11.18	0.37	0.38	0.67	0.31	-	6.61	9.88	3.13	-	67.36	0.21	80
223	11.71	0.10	-	2.37	-	0.27	5.04	14.95	15.88	0.45	66.06	-	75
224	12.49	-	0.63	0.52	-	-	6.24	4.83	11.51	-	66.81	0.17	75
225	6.60	-	-	2.14	0.03	-	23.83	6.10	9.77	0.26	41.39	-	88
227	2.25	-	-	0.96	-	0.17	19.73	10.00	16.61	0.84	69.14	-	71
228	1.05	0.81	1.51	-	-		15.24	8.46	6.60	0.64	36.25	1.40	77
229	3.49		5.48	-	0.14	0.05	16.16	17.70	10.55	0.46	76.27	0.89	102
230	1.61	-	0.26	-	0.11	-	7.63	23.50	6.84	0.47	47.32	-	64
231	0.36	-	0.54	-	0.05	-	14.56	27.80	24.36	1.64	47.86	0.44	94
232	3.09	-	0.15	-	-	0.29	9.90	11.57	11.98	-	34.67	-	63
233		0.32	-	-	-		13.16	7.18	8.56	1.27	16.13	-	40

Appendix 5 b: Summary of standing stock of timber in Mabira										
Block	**10 -19**	**20 -29**	**30 -39**	**40 – 49**	**50 - 69**	**70 - 89**	**90+**	**Bole Vol**	**Net Vol**	**Basal Area**
1	*121*	*94*	*67*	*67*	*34*	*20*	*20*	*255.1*	*237.3*	*26.9*
2	*133*	*27*	*27*	*-*	*33*	*14*	*-*	*160.9*	*104.0*	*22.1*
3	*376*	*118*	*62*	*28*	*26*	*10*	*4*	*232.2*	*135.6*	*35.9*
4	*176*	*106*	*46*	*48*	*10*	*8*	*4*	*214.8*	*115.5*	*29.9*
5	*215*	*63*	*46*	*31*	*17*	*9*	*6*	*202.1*	*117.0*	*29.2*
6	*126*	*84*	*39*	*18*	*26*	*7*	*1*	*151.7*	*95.5*	*23.2*
7	*240*	*132*	*79*	*29*	*30*	*12*	*2*	*264.4*	*156.7*	*38.6*
8	*288*	*101*	*39*	*28*	*12*	*9*	*1*	*165.9*	*89.4*	*25.3*
9	*299*	*70*	*40*	*15*	*18*	*2*	*-*	*113.7*	*55.5*	*19.7*
12	*472*	*136*	*40*	*24*	*20*	*2*	*2*	*324.8*	*228.0*	*35.3*
13	*255*	*82*	*29*	*14*	*23*	*-*	*3*	*120.6*	*69.7*	*20.6*
14	*233*	*88*	*38*	*20*	*17*	*6*	*4*	*153.9*	*90.8*	*24.8*
15	*255*	*97*	*42*	*2141*	*22*	*8*	*7*	*218.3*	*126.9*	*32.5*
16	*264*	*70*	*56*	*20*	*6*	*8*	*2*	*145.5*	*93.2*	*23.1*
17	*280*	*93*	*33*	*15*	*21*	*5*	*-*	*122.0*	*74.2*	*21.4*
18	*293*	*57*	*20*	*37*	*10*	*7*	*7*	*159.6*	*52.0*	*25.7*
19	*53*	*20*	*7*	*13*	*7*	*-*	*-*	*33.5*	*1.5*	*6.8*
20	*222*	*74*	*44*	*23*	*17*	*6*	*1*	*138.4*	*81.8*	*22.6*
21	*374*	*127*	*53*	*33*	*-*	*14*	*7*	*502.6*	*109.8*	*45.9*
24	*328*	*62*	*34*	*18*	*30*	*16*	*4*	*243.8*	*153.1*	*34.0*
25	*580*	*55*	*25*	*5*	*20*	*-*	*-*	*109.6*	*61.6*	*20.5*
26	*320*	*67*	*27*	*13*	*20*	*7*	*-*	*116.0*	*65.8*	*20.2*
29	*266*	*94*	*60*	*33*	*27*	*7*	*-*	*183.6*	*97.4*	*29.1*
30	*316*	*104*	*73*	*35*	*19*	*7*	*4*	*203.8*	*116.7*	*32.6*
31	*430*	*110*	*38*	*28*	*20*	*-*	*3*	*158.0*	*102.0*	*26.0*
32	*252*	*80*	*34*	*18*	*22*	*4*	*-*	*138.8*	*85.5*	*22.4*
33	*352*	*120*	*32*	*20*	*26*	*7*	*2*	*187.5*	*125.5*	*29.8*
35	*102*	*29*	*26*	*6*	*3*	*-*	*-*	*39.5*	*21.9*	*7.1*
36	*200*	*90*	*20*	*50*	*30*	*-*	*-*	*156.8*	*91.1*	*26.6*
37	*180*	*80*	*25*	*5*	*15*	*-*	*10*	*143.1*	*76.9*	*21.4*
39	*280*	*113*	*42*	*28*	*18*	*2*	*1*	*179.5*	*108.6*	*27.1*
40	*296*	*105*	*47*	*29*	*27*	*3*	*4*	*205.6*	*95.8*	*31.6*
41	*432*	*128*	*56*	*20*	*16*	*8*	*-*	*177.8*	*114.7*	*29.7*
42	*220*	*93*	*47*	*27*	*19*	*2*	*-*	*129.2*	*61.0*	*22.7*
43	*296*	*82*	*42*	*29*	*19*	*6*	*1*	*166.9*	*101.0*	*26.3*
44	*252*	*92*	*39*	*24*	*20*	*4*	*2*	*149.2*	*82.2*	*25.0*
45	*248*	*88*	*48*	*28*	*22*	*6*	*8*	*359.9*	*77.7*	*37.2*
46	*160*	*57*	*32*	*9*	*17*	*9*	*3*	*119.3*	*62.0*	*19.8*
51	*218*	*110*	*43*	*31*	*19*	*7*	*3*	*183.4*	*87.6*	*29.0*
52	*293*	*193*	*53*	*18*	*8*	*9*	*5*	*185.6*	*105.0*	*33.8*
53	*372*	*122*	*54*	*27*	*14*	*13*	*4*	*221.7*	*136.9*	*35.2*
54	*432*	*96*	*47*	*20*	*12*	*9*	*4*	*190.8*	*90.6*	*30.9*
55	*308*	*112*	*42*	*17*	*10*	*4*	*3*	*136.6*	*64.3*	*24.2*
56	*152*	*55*	*36*	*22*	*10*	*9*	*2*	*104.4*	*28.7*	*19.5*
58	*232*	*110*	*38*	*24*	*26*	*4*	*5*	*204.7*	*90.4*	*30.1*
59	*144*	*74*	*46*	*12*	*18*	*16*	*6*	*205.9*	*118.5*	*28.6*
60	*140*	*107*	*39*	*25*	*25*	*19*	*6*	*252.4*	*138.3*	*35.9*

Appendix 5 b: Summary of standing stock of timber in Mabira										
Block	**10 -19**	**20 -29**	**30 -39**	**40 – 49**	**50 - 69**	**70 - 89**	**90+**	**Bole Vol**	**Net Vol**	**Basal Area**
61	320	90	60	10	50	10	-	216.1	139.0	35.5
62	360	100	55	25	30	5	-	201.2	135.5	31.7
63	254	100	44	17	6	-	-	88.3	44.5	18.4
64	232	90	36	24	23	5	6	198.8	105.6	29.0
65	80	81	50	22	17	6	3	144.3	72.8	23.2
66	200	100	46	42	31	4	2	199.9	103.1	30.7
67	152	60	52	4	22	4	6	160.4	96.5	23.0
68	173	97	53	27	13	17	-	188.1	115.5	28.1
69	54	100	40	20	13	7	-	141.4	86.4	21.3
70	160	93	36	32	16	8	2	180.6	113.2	27.2
71	160	100	56	26	11	9	-	147.7	72.7	24.1
72	349	113	40	30	16	2	2	156.9	61.5	27.6
73	228	137	59	27	21	8	8	250.1	108.5	37.2
74	256	105	45	21	31	12	2	212.8	127.6	33.0
75	224	130	31	18	30	12	2	189.8	110.3	30.4
76	292	119	40	23	23	6	3	179.9	108.4	29.5
77	284	97	35	30	24	6	3	197.9	116.4	30.4
79	220	105	75	45	55	5	15	379.1	241.9	51.4
80	180	99	37	26	23	11	2	177.6	87.1	27.8
81	272	117	36	29	20	9	5	218.8	135.6	32.0
82	276	125	30	17	33	25	4	277.8	182.7	41.4
83	340	188	66	31	13	10	4	219.9	110.1	37.5
84	180	91	46	28	19	16	3	212.9	102.5	32.9
85	204	99	68	22	22	15	3	250.9	164.4	34.1
88	137	111	66	49	17	14	3	249.1	187.1	34.6
89	289	84	57	21	17	3	-	125.6	60.1	22.9
90	284	98	52	32	24	9	2	202.9	126.0	32.0
91	308	123	49	19	26	5	3	232.5	128.0	33.0
92	272	102	36	30	23	7	2	187.1	120.0	28.7
93	264	132	38	26	22	19	4	248.0	131.9	37.9
94	252	104	37	13	25	8	2	165.9	99.4	26.5
95	280	114	60	12	6	4	-	114.0	31.9	20.6
97	200	102	40	11	13	8	2	130.1	47.5	23.5
98	260	111	34	22	30	11	3	208.5	122.4	32.4
99	228	76	23	20	16	5	-	115.3	65.3	20.5
100	292	103	43	26	35	11	1	217.2	137.9	33.5
101	255	93	42	21	17	3	1	132.5	72.0	22.5
102	232	100	32	14	10	6	-	123.2	75.5	20.0
103	200	95	33	15	8	18	8	259.7	199.3	31.3
104	203	73	45	17	19	14	2	190.6	81.6	27.1
105	176	121	42	16	29	11	4	186.5	61.7	32.0
106	265	139	43	23	32	22	4	259.9	133.2	40.8
107	240	118	35	22	20	11	4	190.4	107.4	30.4
108	186	98	44	16	29	2	4	165.3	71.7	26.9
110	156	65	27	13	14	3	3	105.5	42.3	17.7
111	170	75	31	24	9	11	4	146.2	56.2	24.1
182	280	126	60	26	30	13	-	214.0	153.2	35.0

Appendix 5 b: Summary of standing stock of timber in Mabira										
Block	**10 -19**	**20 -29**	**30 -39**	**40 – 49**	**50 - 69**	**70 - 89**	**90+**	**Bole Vol**	**Net Vol**	**Basal Area**
202	*144*	*49*	*27*	*17*	*18*	*8*	*6*	*157.5*	*81.3*	*23.4*
203	*180*	*83*	*36*	*24*	*17*	*14*	*6*	*210.7*	*124.4*	*30.0*
204	*173*	*87*	*39*	*25*	*19*	*15*	*6*	*231.0*	*139.4*	*32.8*
205	*12*	*11*	*2*	*2*	*2*	*-*	*1*	*19.5*	*12.5*	*2.7*
206	*84*	*50*	*19*	*16*	*24*	*7*	*4*	*155.3*	*101.8*	*21.3*
207	*140*	*69*	*51*	*23*	*27*	*12*	*3*	*199.1*	*132.2*	*30.0*
208	*168*	*50*	*34*	*34*	*34*	*14*	*2*	*206.0*	*124.9*	*29.7*
209	*240*	*97*	*49*	*19*	*29*	*15*	*4*	*225.6*	*135.9*	*34.7*
212	*240*	*76*	*27*	*16*	*16*	*2*	*-*	*108.1*	*71.3*	*17.6*
213	*212*	*93*	*63*	*16*	*30*	*9*	*1*	*188.7*	*114.6*	*30.0*
214	*200*	*107*	*58*	*20*	*22*	*15*	*3*	*209.5*	*129.3*	*32.6*
215	*333*	*119*	*32*	*10*	*15*	*20*	*3*	*212.6*	*146.4*	*31.3*
216	*231*	*87*	*39*	*28*	*25*	*9*	*2*	*184.6*	*122.6*	*28.9*
217	*84*	*93*	*64*	*28*	*25*	*23*	*7*	*286.6*	*175.5*	*39.9*
218	*112*	*35*	*25*	*8*	*12*	*4*	*-*	*74.8*	*47.6*	*12.0*
219	*64*	*18*	*6*	*4*	*4*	*-*	*-*	*23.2*	*13.0*	*4.1*
220	*223*	*89*	*34*	*21*	*18*	*6*	*6*	*203.5*	*127.4*	*29.6*
221	*220*	*73*	*25*	*17*	*30*	*11*	*2*	*199.9*	*130.3*	*28.7*
224	*232*	*42*	*8*	*4*	*10*	*2*	*-*	*66.6*	*40.9*	*11.5*
225	*128*	*40*	*8*	*4*	*20*	*-*	*4*	*99.9*	*79.0*	*14.3*
227	*68*	*35*	*14*	*10*	*12*	*8*	*1*	*91.9*	*55.8*	*14.0*
240	*116*	*73*	*16*	*4*	*11*	*16*	*-*	*90.3*	*54.1*	*17.1*
301	*190*	*86*	*52*	*33*	*24*	*8*	*6*	*240.7*	*104.2*	*33.8*
302	*160*	*92*	*48*	*30*	*22*	*14*	*7*	*272.6*	*158.9*	*37.0*
303	*396*	*118*	*40*	*20*	*23*	*12*	*6*	*225.8*	*124.1*	*35.8*
304	*171*	*71*	*45*	*22*	*19*	*4*	*2*	*120.8*	*74.4*	*21.9*
305	*238*	*97*	*59*	*26*	*24*	*8*	*5*	*217.8*	*110.8*	*33.4*
306	*246*	*92*	*56*	*22*	*22*	*9*	*2*	*180.2*	*94.1*	*29.4*
307	*232*	*91*	*50*	*24*	*20*	*6*	*2*	*160.2*	*85.1*	*26.3*
308	*203*	*85*	*52*	*23*	*21*	*10*	*3*	*190.9*	*82.1*	*30.3*
309	*148*	*94*	*43*	*20*	*20*	*3*	*-*	*122.6*	*53.5*	*21.5*
310	*316*	*98*	*53*	*19*	*12*	*1*	*1*	*127.7*	*65.6*	*22.6*
311	*279*	*88*	*44*	*25*	*27*	*9*	*2*	*189.2*	*93.5*	*30.1*
312	*191*	*93*	*52*	*27*	*26*	*12*	*1*	*199.6*	*79.9*	*30.5*
313	*224*	*94*	*58*	*32*	*14*	*8*	*2*	*162.1*	*83.2*	*27.6*
314	*171*	*84*	*60*	*6*	*8*	*4*	*-*	*97.0*	*55.3*	*18.7*
315	*389*	*102*	*49*	*31*	*19*	*6*	*1*	*178.4*	*103.4*	*30.5*
316	*240*	*115*	*36*	*33*	*21*	*9*	*9*	*238.4*	*133.1*	*36.2*
317	*304*	*119*	*50*	*21*	*21*	*7*	*7*	*233.0*	*120.0*	*35.1*
318	*270*	*113*	*30*	*25*	*38*	*21*	*10*	*305.9*	*164.0*	*43.3*
319	*120*	*80*	*45*	*70*	*15*	*15*	*-*	*208.4*	*113.7*	*32.9*
320	*220*	*79*	*37*	*32*	*31*	*19*	*7*	*291.7*	*172.6*	*39.1*
321	*240*	*101*	*41*	*28*	*24*	*6*	*5*	*198.5*	*114.5*	*29.4*
322	*360*	*125*	*36*	*28*	*11*	*7*	*1*	*159.0*	*91.7*	*26.4*
323	*154*	*65*	*34*	*10*	*14*	*7*	*1*	*114.6*	*63.0*	*18.6*
324	*192*	*98*	*20*	*4*	*4*	*2*	*-*	*62.8*	*29.3*	*13.2*
325	*134*	*33*	*13*	*-*	*-*	*-*	*-*	*21.4*	*5.9*	*4.6*

Appendix 5 b: Summary of standing stock of timber in Mabira										
Block	**10 -19**	**20 -29**	**30 -39**	**40 – 49**	**50 - 69**	**70 - 89**	**90+**	**Bole Vol**	**Net Vol**	**Basal Area**
326	*40*	*20*	*-*	*20*	*-*	*-*	*53.2*	*20.1*	*9.5*	
327	*196*	*66*	*36*	*10*	*12*	*5*	*2*	*168.4*	*111.8*	*20.6*
328	*196*	*99*	*34*	*19*	*17*	*4*	*7*	*186.2*	*104.9*	*27.1*
329	*224*	*107*	*37*	*13*	*15*	*8*	*-*	*145.7*	*63.9*	*23.8*
330	*220*	*94*	*29*	*20*	*14*	*11*	*4*	*241.4*	*145.5*	*29.5*
331	*263*	*72*	*43*	*14*	*20*	*9*	*-*	*129.8*	*58.6*	*22.3*
332	*187*	*75*	*12*	*16*	*17*	*4*	*3*	*135.7*	*54.8*	*21.4*
333	*88*	*50*	*22*	*2*	*14*	*18*	*10*	*189.8*	*100.4*	*26.7*
334	*53*	*40*	*14*	*-*	*-*	*-*	*7*	*98.6*	*11.9*	*16.6*
336	*60*	*23*	*8*	*5*	*13*	*8*	*-*	*69.7*	*45.9*	*10.7*
338	*248*	*92*	*63*	*29*	*9*	*2*	*2*	*119.5*	*42.5*	*23.8*
339	*112*	*41*	*41*	*14*	*7*	*1*	*1*	*78.6*	*36.8*	*13.4*
Total	**34513**	**13640**	**6108**	**3245**	**2918**	**1222**	**492**	**26787.2**	**14733.9**	**4090.5**

Appendix 5 c: Stand table of total volume (m^3) by species

Species	**Diameter classes**							
	10-20	**20-30**	**30-40**	**40-50**	**50-60**	**60-70**	**70+**	**Total**
Group I								
Entandrophragma spp	485	559	451	386	461	363	380	**3085**
Milicia excels	141	141	349	238	662	437	317	**2285**
Lovoa spp	111	69	-	-	-	-	-	**1114**
Khaya spp	-	-	-	-	-	-	-	**72**
Holoptelea grandis	334	716	2041	6440	9547	16319	45448	**80845**
Olea welwitschii	63	146	436	1764	632	330	2948	**6319**
Guarea cedrata	139	131	104	72	-	-	-	**446**
Fagara spp	66	117	230	193	251	-	-	**857**
Albizia coriaria	82	-	-	-	-	-	-	**82**
Group II								
Albizia spp	4422	6108	9127	14847	16168	22126	77198	**149996**
Alstonia boonei	497	813	1190	2720	3209	7027	51852	**67308**
Aningeria altissima	1122	1648	2283	1787	908	766	4174	**12688**
Antiaris toxicaria	5496	6351	8892	9376	8535	11125	56593	**106368**
Canarium schweinfurthii	349	231	102	223	635		687	**2227**
Celtis spp	47188	75925	81338	88142	94594	69110	184506	**540803**
Chrysophyllum spp	5219	6378	6774	12237	12105	12595	23154	**76462**
Cordia millenii	121	127	216	63	-	-	-	**527**
Diospyros abyssinica	161	1313	1575	1781	1392	1638	825	**8685**
Dombeya mukole	230	393	499	477	627	1115	-	**3341**
Funtumia africana/elastic	24487	27194	17709	3917	896	138	13449	**87790**
Fagaropsis angolense	26	204	222	501	426	500	380	**2259**
Maesopsis eminii	688	1212	1177	1166	346	-	-	**4589**
Morus lacteal	715	1300	1316	1436	2167	1298	2662	**10894**

Species	Diameter classes							
	10-20	20-30	30-40	40-50	50-60	60-70	70+	Total
Myrianthus holstii	563	1122	1639	1322	597	243	528	**6,014**
Markhamia lutea	1688	1994	1436	1570	1826	2718	2570	**13802**
Trichilia spp	9172	14933	18968	12072	3674	2617	41127	**65553**
Group III								
Baikiaea insignis	1834	5396	5387	4403	935	537	337	**18829**
Blighia unijugata	1945	1224	1655	1294	905	1044	1927	**9994**
Cola gigantean	537	479	437	1260	1364	651	8611	**13339**
Croton macrostachys	528	328	1069	508	478	551	531	**3993**
Ficus spp	9461	9843	11195	12567	10884	7178	88895	**142023**
Lasiodiscus mildbraedii	17979	17486	5145	376	-	-	-	**40986**
Margharitteria discoides	1149	1685	2439	2791	2140	1546	6140	**17890**
Sapium ellipticum	162	214	250	458	188	449	1285	**3006**
Teclea nobilis	2928	1563	1106	-	352	-	-	**5949**
Trilepisium madagascariensis	11895	14568	17796	21555	16065	12530	39291	**133700**
Broussonetia papyrifera	12,812	16,136	25289	13858	7570	1424	6043	**83135**

Source: Data extracted from summary of the 2002 EI in all compartments of the Production WC (Low impact) except Cpts 226 and 194 and from Cpts 178, 184 and 185 of the Production WC (Encroached), Mabira FR

Appendix 6: Current Mabira eco-tourism tariffs in UGX

Category	East Africans	Non East Africans	Foreigners
a) Entrance fees			
Persons 16years and above	5,000	10,000	20,000
Persons between 5 and 16 years	1,500	5,000	10,000
Children below 5 years	Free	Free	Free
Services offered			
b) Forest Nature walk			
Guided nature walk per person above the 16 years (0-4 hrs.)	15,000	30,000	35,000
Guided nature walk per person above the 16 years (above 4 hrs.)	20,000	40,000	40,000
Guided nature walk per person aged 5-16 years (0-4 hrs.)	3,500	10,000	10,000
c) Bird watching			
Half day(Inclusive of guiding services) for a maximum of 8 persons per group	80,000	90,000	90,000
Full day(Inclusive of guiding services) for a maximum of 8 persons per group	110,000	120,000	120,000
d) Camping			
Private camp site	10,000	20,000	20,000
Tent hire (Maxim 5 persons)	30,000	30,000	30,000
Tent hire (Above 5 persons)	50,000	50,000	50,000
Picnic site (per person per day)	3,000	5,000	5,000
e) Mangabey/ Monkey tracking	20,000	40,000	40,000
f) Accommodation			
Single Banda	20,000	30,000	30,000
Double Banda	30,000	50,000	50,000
Family unit	30,000	60,000	60,000
Dormitory style (per person per day)	5,000	10,000	10,000
g) Other services			
Biking	20,000	20,000	20,000
Bike hire	40,000	40,000	40,000
Filming (per person per day)	200,000	300,000	400,000
Research (Students/ academic)	Free	100,000 per month	100,000 per month
Research (Applied and PhD)	100,000 per month	200,000 per month	200,000 per month

Appendix 7: Records

No	Type of Records	Importance and Purpose
1	Reports	All reports inherited from FD and those compiled since April 2004 showing how activities have been carried out in the FMPA.
2	Revenue and expenditure records	Files on how revenues and expenditures were and are being made.
3	Rainfall measurement records	Taken at Mabira weather station to keep track or the rainfall consistency to be sure of planting seasons and species to continue planting.
4	Compartment record sheets	Showing how the CFRs were compartmented and managed previously.
5	Silvicultural records	To follow up the rate and quality of growth of trees right from where the seed came from through nursery work, establishment, management up to harvesting.
6	Harvesting records	To track volumes, quality of logs, areas and species felled and plan for reforestation.
7	Equipment inventories	Showing those held previously, current ones and entries for new ones.
8	Fire records	To record fire incidences, frequency, months of occurrence, types of damage and plan to take precautions in future.
9	Annual adjustments to the plan	All agreed on changes in the FMP including adjustments in each AOP.
10	Administrative records	To take record of all staff and administrative matters including instructions from various offices as regards the management of the FMPA.
11	Establishment records	To have records of compartments and coupes that show seasons and years of establishment in the past and planned activities including preparations for planting following felling cycles.
12	Permanent Sample Plot records	To show location of sample plots in all CFRs and keep all growth and treatment records that will help tell the performance of species on different sites. Compartment and reserves.
13	Forest Reserve Profiles	To show detailed historical and current information/data on all the 8 CFRs.

Appendix 8 a: Criteria and Indicators

ITTO Criteria and Indicators

Criterion 1: Enabling conditions for sustainable forest management

Policy, legal and governance framework

1.1 Existence and implementation of policies, laws and regulations to govern forest management
1.2 Forest tenure and ownership

Economic framework

1.3 Amount of funding in forest management, administration, research and human resource development
1.4 Existence and implementation of economic instruments and other incentives to encourage sustainable forest management

Institutional framework

1.5 Structure and staffing of institutions responsible for sustainable forest management
1.6 Number of professional and technical personnel at all levels to perform and support forest management
1.7 Existence of communication strategies and feedback mechanisms to increase awareness of sustainable forest management
1.8 Existence of, and ability to apply, appropriate technology to practice sustainable forest management and the efficient utilization and marketing of forest products

Planning framework

1.9 Capacity and mechanisms for planning sustainable forest management and for periodic monitoring, evaluation and feedback on progress
1.10 Public participation in forest management planning, decision-making, data collection, monitoring and assessment
1.11 Existence of forest management plans

Criterion 2: Extent and condition of forests

2.1 Extent (area) and percentage of total land area under comprehensive land-use plans
2.2 Extent (area) of forests committed to production and protection
2.3 Extent (area) and percentage of total land area under each forest type
2.4 Percentage of PFE with boundaries physically demarcated
2.5 Changes in forested area
2.6 Forest condition

Criterion 3: Forest ecosystem health

3.1 Extent and nature of forest encroachment, degradation and disturbance caused by humans and the control procedures applied
3.2 Extent and nature of forest degradation and disturbance due to natural causes and the control procedures applied

Criterion 4: Forest production

Resource assessment

4.1 Extent and percentage of forest for which inventory and survey procedures have been used to define the quantity of the main forest products
4.2 Actual and sustainable harvest of wood and non-wood forest products
4.3 Composition of harvest
4.4 Total amount of carbon stored in forest stands

Planning and control procedures

4.5 Existence and implementation of:

(a) Forest harvesting/operational plans (within forest management plans); and
(b) Other harvesting permits (small-, medium- and large-scale permits without forest management plans)

4.6 Extent of compartments/coupes harvested according to:

(a) harvesting/operational plans; and
(b) Any other harvesting/cutting permit

4.7 Existence of a log-tracking system or similar control mechanisms
4.8 Long-term projections, strategies and plans for forest production
4.9 Availability of historical records on the extent, nature and management of forests

Silvicultural and harvesting guidelines

4.10 Availability and implementation of silvicultural guidelines for timber and non-wood forest products
4.11 Availability and implementation of harvesting guidelines for timber and non-wood forest products
4.12 Area over which silvicultural and harvesting guidelines are effectively implemented

Criterion 5: Biological diversity

Ecosystem diversity

5.1 Protected areas containing forests
5.2 Protected areas connected by biological corridors or 'stepping stones'

Species diversity

5.3 Existence and implementation of procedures to identify and protect endangered, rare and threatened species of forest-dependent flora and fauna
5.4 Number of endangered, rare and threatened forest-dependent species

Genetic diversity

5.5 Measures for in situ and/or ex situ conservation of genetic variation within commercial, endangered, rare and threatened species of forest flora and fauna

Procedures for biodiversity conservation in production forests

5.6 Existence and implementation of procedures for the protection and monitoring of biodiversity in production forests by:

(a) Retaining undisturbed areas;
(b) Protecting rare, threatened and endangered species;
(c) Protecting features of special biological interest (e.g. nesting sites, seed trees, niches, keystone species, etc.); and

(d) Assessing recent changes in (a), (b) and (c) above through inventories, monitoring/ assessment programs and comparison with control areas

5.7 Extent and percentage of production forest that has been set aside for biodiversity conservation

Criterion 6: Soil and water protection

Extent of protection

6.1 Extent and percentage of total forest area managed exclusively for the protection of soil and water
6.2 Procedures to ensure the protection of downstream catchment values

Protective functions in production forests

6.3 Procedures to protect soil productivity and water retention capacity within production forests
6.4 Procedures for forest engineering, including:

(a) Drainage requirements;
(b) Conservation of buffer strips along streams and rivers;
(c) Protection of soils from compaction by harvesting machinery; and
(d) Protection of soil from erosion during harvesting operations

6.5 Extent and percentage of areas in production PFE that have been defined as environmentally sensitive (e.g. very steep or erodable) and protected

Criterion 7: Economic, social and cultural aspects

Socioeconomic aspects

7.1 Value and percentage contribution of the forestry sector to gross domestic product (GDP)
7.2 Value of domestically produced wood, non-wood forest products and environmental services in:

(a) Domestic markets;
(b) Export markets; and
(c) Informal markets including subsistence and illegal activities (estimate)

7.3 Forest products' industry structure and efficiency
7.4 Existence and implementation of mechanisms for the equitable sharing of the costs and benefits of forest management
7.5 Existence and implementation of conflict-resolution mechanisms for resolving disputes between forest stakeholders
7.6 Number of people depending on forests for their livelihoods
7.7 Training, capacity-building and manpower development programs for forest workers
7.8 Existence and implementation of procedures to ensure the health and safety of forest workers
7.9 Area of forests upon which people are dependent for subsistence uses and traditional and customary lifestyles
7.10 Number and extent of forest sites available primarily for:

(a) Research and education; and
(b) Recreation

Cultural aspects

7.11 Number of important archaeological, cultural and spiritual sites identified and protected

Community and indigenous peoples' rights and participation	
7.12	Extent to which tenure and user rights of communities and indigenous peoples over publicly owned forests are recognized and practiced
7.13	Extent to which indigenous knowledge is used in forest management planning and implementation
7.14	Extent of involvement of indigenous peoples, local communities and other forest dwellers in forest management capacity-building, consultation processes, decision-making and implementation

Appendix 8b: New FSC Principles

Principle 1: Compliance with Laws
Principle 2: Workers'* rights and employment conditions.
Principle 3: Indigenous Peoples'* Rights
Principle 4: Community Relations.
Principle 5: Benefits from the Forest.
Principle 6: Environmental Values and Impacts
Principle 7: Management Planning
Principle 8: Monitoring and Assessment
Principle 9: High Conservation Values
Principle 10: Implementation of Management Activities