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THE REPUBLIC OF UGANDA

MINISTRY OF WATER AND ENVIRONMENT

FOREST MANAGEMENT PLAN FOR NORTH RWENZORI CENTRAL FOREST RESERVE

FOR THE PERIOD 2012 TO 2037

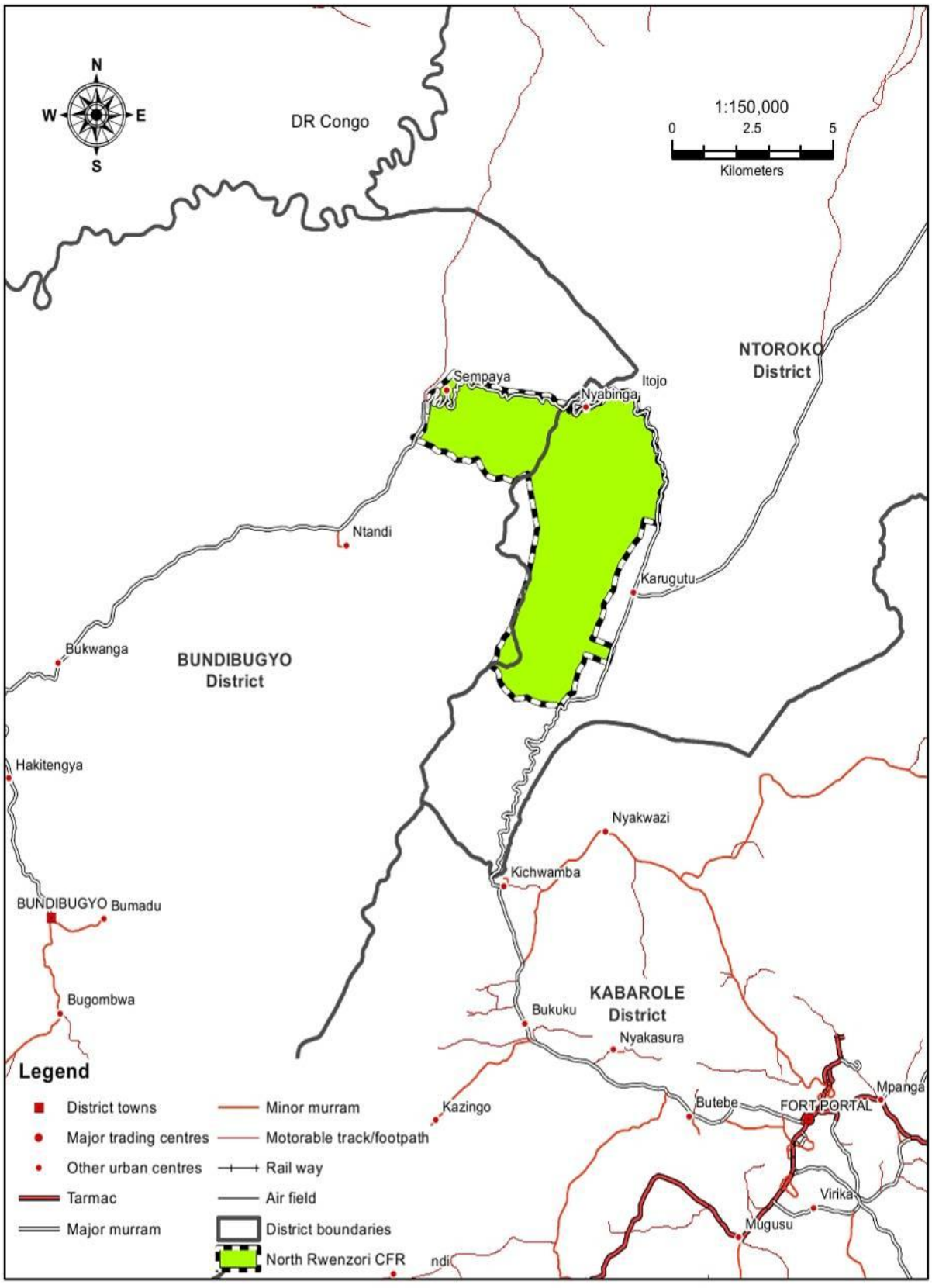
NFA National Forestry Authority

THE WORLD BANK

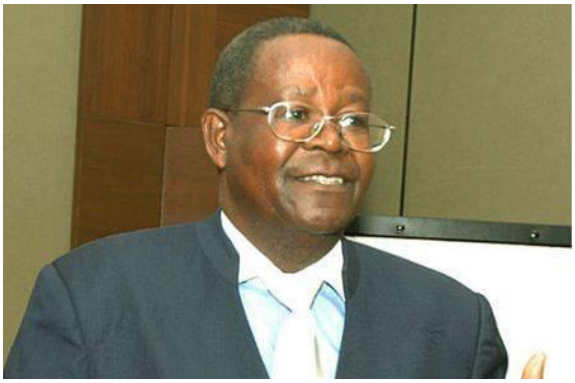
Prepared by: National Forestry Authority, December 2012

Financed by: The World Bank

Figure 1: Location of North Rwenzori Central Forest Reserve



FOREWORD



Section 28 of the National Forestry and Tree Planting Act, 2003 provides that Central Forest Reserves must be managed in accordance with approved Forest Management Plans.

This Plan for North Rwenzori Central Forest Reserve takes into account international instruments and arrangements that have been coming out of the international forestry policy dialogue since the Rio Summit in 1992. It is also in line with the national macro-economic policies like the Poverty Eradication Plan, the Plan for Modernisation of Agriculture, the Environment & Natural Resources Sector Investment Plan, and the Uganda Vision 2035.

This Forest Management Plan has been prepared in consultation with stakeholders and especially the local communities. The objectives of, and activities in this Forest Management Plan will be implemented during the next 20 years, in line with the national development theme of *Growth, Employment and Prosperity for All*. Therefore, all stakeholders of North Rwenzori Central Forest Reserve are obliged to align their activities with this Forest Management Plan.

Implementation of the activities in this Forest Management Plan will lead to increased forest health that will benefit local communities, Ugandans and the international society as a whole, in terms of livelihood improvement, revenue for government and contribution towards environmental stability. The Plan provides opportunities for local communities, civil society organisations, the private sector and other investors to participate and benefit from the sustainable management of North Rwenzori Central Forest Reserve.

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

Hon. Prof Ephraim Kamuntu

Minister of Water and Environment

Date:

ACKNOWLEDGEMENTS

The preparation of this forest management plan was made possible with support of the World Bank through the Environmental Management Capacity Building Project (EMCBPII). We wish to acknowledge the financial and technical support rendered by the World Bank in preparation of this plan and implementation of planting activities in the reserve.

Several NFA staff are acknowledged for their involvement in the development of this Forest Management Plan. Initial stakeholder consultations and preparation of this Plan which was initially part of Itwara Forest Management area was carried out by Lamton Omoya Forest supervisor, North Rwenzori, Benjamin Kamukama Sector Manager Itwara and Thomas Muteeba, Range Manager Muzizi River Range. This provided a background to develop a specific plan for North Rwenzori Central Forest Reserve given the scale up of tree planting activities and this . The revised draft was compiled by Paul Asiimwe, Natural Forest Management Specialist and Assistant Project Coordinator, EMCBPII.

Further technical input was provided by Israel Kikangi- Director Plantation, Xavier Mugumya-Coordinator Climate Change; Paul M. Buyerah-Director Corporate Affairs, Hudson J. Andrua-Director Natural Forests, Obed Tugumisirize, Ag. coordinator Planning, Levi Etwodu –Ag. Coordinator Natural Forests, Edward Ssenyonjo and Joseph Mutyaba all of GIS and Mapping and Tom Rukundo, E.I.A Specialist.

Carbon project technical input was provided by UNIQUE Forestry Consultants. The Environmental Impact Assessment was done by Urban Research Consults Ltd. Stakeholder input was obtained from surrounding communities and the Environment Officers for Ntoroko, Bundibugyo and Kabarole districts. Typesetting, editing and graphics were done by Personal Assistants Kiwanuka Millie and Kellen Twasiima. We are grateful to the forest edge communities who attended meetings, expressed concerns and suggested ideas that have been incorporated in this Forest Management Plan.

Finally, we are very grateful to the NFA Board of Directors and all members of SMT for the various inputs and comments they made on the draft plan.

Michael Mugisa

Executive Director,

National Forestry Authority

DEFINITION OF TERMS

Biodiversity: The variability among living organisms from all sources including, *inter alia*, terrestrial ecosystems and aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and ecosystems.

Block: An area of forest plantation/natural forest composed of several compartments.

Compartment: The smallest management unit of a specified area or plantation where one operational activity should be done in the same year and all records for a compartment should be maintained together throughout, i.e. from planting to harvesting.

Encroachment: Unauthorised/illegal cultivation or settlement in a forest reserve contrary to Section 32 of the National Forestry and Tree Planting Act, 2003.

Enrichment Planting: Planting up of gaps or open areas in a natural forest with species of high value or as selected to suit the purpose and increase the stocking.

Forest Plantation: A forest crop or stand raised artificially, either by sowing or Planting (Ford-Robertson 1971 *in* Evans 1992).

Forest Reserve: An area declared to be a central or local forest reserve under the National Forestry and Tree Planting Act, 2003.

Illegal Activity: Unauthorised activity or activities done contrary to provisions of the National Forestry and Tree Planting Act, 2003.

Management Plan

The collection of documents, reports, records and maps that describe, justify and regulate the activities carried out by any manager, staff or organisation within or in relation to the Management Unit, including statements of objectives and policies (Source: FSC 2011)

Natural Regeneration: The growing of trees in a forest or elsewhere under the influence of nature with no intervention of human activity.

Pruning: Careful cutting off of branches from a growing tree in order to produce knot-free timber outside the core, as part of silvicultural tending and prevent spread of fire to the crown. Pruning can also be done just to reduce branches and minimize the effect of shade outside plantations.

Silviculture: A process associated or in relation to the science of growing and nurturing trees from seed to a mature tree.

Thinning: Systematic reduction of trees in a plantation at specified intervals of time or schedules to allow the best quality trees grow up to maturity, i.e. to the end of the rotation period.

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 Afrotropic Ecozone with the flagship Albertine Rift forests that extend to Congo (DRC), Burundi, Rwanda, and Tanzania (TheFreeDisctionary.com Encyclopaedia). Normally forests are evergreen although some species may shed their leaves periodically.

Other Wooded Lands (locally known as "woodland"): Land that has a crown cover (or equivalent stocking level) of more than 30% of trees not able to reach a height of 5 metres at maturity (FAO 2000a (FRA 2000 Main Report) but modified to reach canopy cover of 30% instead of 10%)

Savannah: Grassland dotted with trees. Grasses form the predominant vegetation type, usually mixed with herbs and shrubs, with trees scattered individually or in small clumps (TheFreeDisctionary.com Encyclopaedia

FOREWORD

Present day Forest Plantation Management poses special problems, which include involving local communities with no previous experience in forest management. They are nevertheless very important stakeholders if the land is to remain under public ownership and government trust-ship and tree crops planted there on to survive and be economically productive. It is the expressed policy of the NFA that no communities will be left out in the management of the forest reserves be they natural or plantations.

At the foot hills of Mt. Rwenzori, North Rwenzori Central Forest Reserve was specifically gazetted with an objective of soil stabilisation and protecting the area against landslides. It is well known that trees are important in this role as they bind and hold soils together reducing the threat of erosion and increase water infiltration in the soil. In addition, the area is a catchment for various rivers that flow out of it and hence the plantation will protect these environmental services. The NFA, the private sector and the communities are therefore obliged to undertake the establishment of plantation forest in this forest reserve. It is therefore necessary that partnerships to achieve this objective are nurtured.

Modern plantation establishment requires that natural belts and areas of ecological and high value biological interests are preserved and maintained in their natural state. There are guidelines on how this should be undertaken and the NFA should guide its partners in making sure that these green-belts are protected. It may also be necessary that enrichment planting is undertaken with indigenous species to enrich production of these green belts.

The stakeholders in North Rwenzori CFR consist of small scale tree planters mainly from the community and a local Community Forestry Group; Rwenzori Mountains United Farmers Association (RAMFA) which has membership from all surrounding community groups. NFA staff will ensure that the interests of various partners are taken care of.

ACRONYMS

AAC	Annual Allowable Cut
AFO	Assistant Forest Officer
AWP	Annual Work Plan
BZ	Buffer Zone
CBO	Community Based organisation
CCBA	Climate Community Biodiversity Alliance
CFM	Collaborative Forest Management
CFR	Central Forest reserve
Cm	Centimeter
CPT	Compartment
CU.M (M3)	Cubic Metre
^{o}C	Degree Centigrade
DDP	District Development Plan
DEP	District Environment Profile
DFDP	District Forestry Development Plan
DFO	District Forest Officer
DFS	District Forestry Services
DLG	District Local Government
DSO	Department Standing Orders
D3& D4	Vegetation Classification Symbols used by Langdale Brown 1964
DFS	District Forestry Services
EC	European Commission
EI	Exploratory Inventory
EU	European Union
FD	Forest Department
FD	Forestry Department
FMP	Forest Management Plan
FNCMP	Forest Nature Conservation Master Plan
FR	Forest Reserve
FRMCP	Forest Resources Management and Conservation Programme
FMP	Forest Management Plan
FR	Forest Reserve
FSC	Forest Stewardship Council
G	Gram
GoU	Government of Uganda
Ha	Hectare
ISSMI	Integrated Stock Survey Management Inventory
Kg	Kilogramme
Kg	Kilogram
L.N.	Legal Notice

LC	Local Council (1,2,3 & 5 of Uganda)
LFR	Local Forest Reserve
M	Metre
MDLG	Mukono District Local Government
M.o.U	Memorandum of Understanding
M^3	Cubic metre
MAI	Mean Annual Increment
MWE	Ministry of Water and Environment
MPA	Management Plan Area
MoU	Memorandum of Understanding
MWLE	Ministry of Water. Lands and Environment
NBS	National Biomass Study (of FD)
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NFM & CP	Natural Forest Management and Conservation Project
NaFORRI	Forestry Research Institute
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non-governmental Organisation
NPK	Nitrogen Phosphate Potassium
NTSC	National Tree Seed Centre
NFTP	Non-Timber Forest Products
PSP	Permanent Sample Plot
WPA	Working Plan Area
SFM	Sustainable Forest Management
SI	Statutory Instrument
SNR	Strict Nature Reserve
UPDF	Uganda People's Defense Forces
UWA	Uganda Wildlife Authority

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EXECUTIVE SUMMARY

North Rwenzori Central Forest Reserve is located within Bundibugyo and Ntoroko districts. The Reserve covers 3,665 Ha and is owned by People of Uganda under the stewardship of government of Uganda which mandated the National Forestry Authority, a body with a constitutional mandate to manage Central Forest Reserves in Uganda.

The reserve lies basically on a high altitude with topography with mid altitude hill ranges from 1,400 metres to 1800 metres above sea level. The area is drained by numerous streams such as Ngisi, Nyabisikoma, Itojo, Sempaya and Nyakabale that drain out of the reserve.

The parent rock is made up of a basement complex that was extruded by great pressure above the surrounding. The soils are derived from the underlying pre-cambrian rocks. The annual temperature ranges between 15 to 27^0C while annual rainfall ranges between 1,150 to 1,280mm.

The area is largely covered by grass land and colonising forests around streams and wetlands. Forest areas are dominated by *Albizzia, Terminalia, Combretum, and other* tree species, which occur in valleys. There has never been large scale planting in the area but a 6 year stand on 21.5Ha of *Pinus caribaea* has already shown impressive growth and potential. The area is in low rainfall zone, but its high altitude means that its evaporation is relatively low. This ensures that soil moisture is available for a long period.

With Bundibugyo, Ntoroko, Fort Portal towns and other small towns in the region urbanising rapidly, the market for saw timber is available for any amount of saw timber, which can be produced. The communities, who are close to the reserves, have been catered for by setting aside areas for their use to plant trees for own benefit.

Fire is the main threat to the productivity of the plantation and fire protection shall be given top priority in allocation of funds and personnel. The surrounding communities depend on the plantation for fuel wood and construction poles. As the plantation occurs on steep terrain, establishment of tree crops and harvesting of mature timber will ensure that they don't cause soil erosion. Opportunities for carbon markets exist and planting of fast growing species will ensure carbon sequestration.

There will be three management circles namely:

1. NFA Sawlog production circle;
2. Biodiversity conservation and Ecotourism development circle and
3. Community and Private sector circle.

About 420 Ha will be used by local communities and small scale private tree planters under license. NFA will plant and maintain up to 2,085 Ha during the period of this plan. The area of the natural forest will be protected and enriched with high value native species. The rest of the production area outside the natural forest will be planted with *Pinus caribaea*. The annual planting program averaged about 500 ha to 1,000 ha by NFA and 30 ha to 110 ha for the communities and private tree planters over the past 3 years. A road density of 3% of plantable area will be aimed at.

Pruning to improve the quality of timber will be carried in three phases from 2m up to 10 m high. Thinning is another operation which will be done in three phases aiming at final number of

standing trees of 350-450 per Ha. This is necessary because it is the final crop that is profitable and the more volume that can be finally cut the more the revenue.

All the activities shall be carried out in such a manner that they are not harmful to the environment. The community has been allowed to establish their own forest plantation on 150 Ha of the Central Forest Reserve. This will make them important stakeholders. All the activities will be monitored to ensure that principles of good forest management are followed.

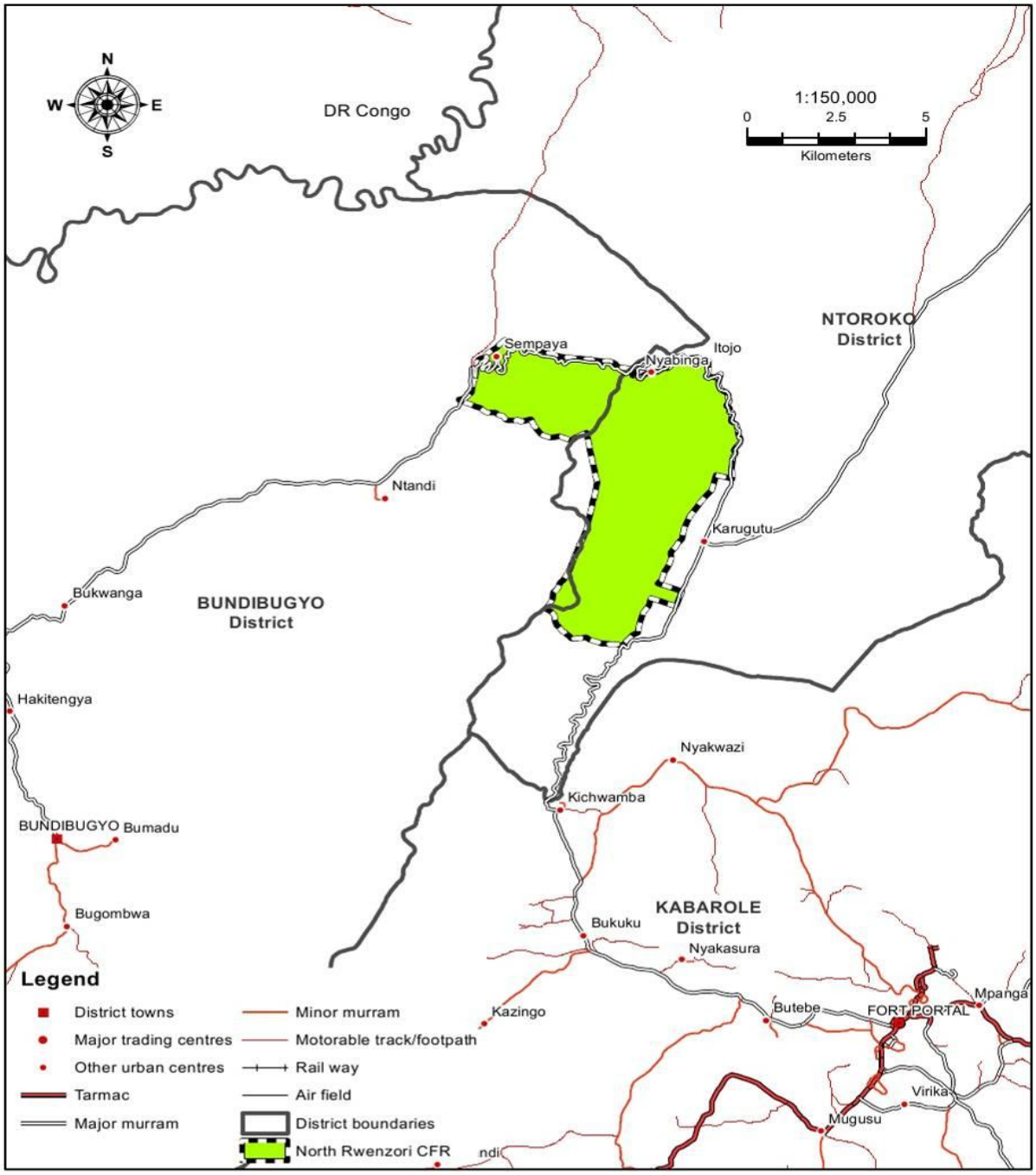
PART 1: GENERAL DESCRIPTION

1. PHYSICAL DESCRIPTION

1.1 Location, Boundaries and Area

North Rwenzori Central Forest Reserve is located within the parishes of Itojo, Ibanda, Nyambiga, Busayiro, Karambi, Nyabikungu and Ndaribana (Karugutu Subcounty), Masandana (Nombe Subcounty) and Karugutu Town council in Ntoroko District as well as Kasitu and Burondo parishes of Bundibugyo district. The Forest Reserve covers about 3,665 hectares out of which 26.6% fall within Bundibugyo district and 73.4% fall within Ntoroko district.

Figure 2: Location map of North Rwenzori CFR



The exact positions of the boundaries are shown on Boundary Plans no. 1555 for North Rwenzori Central Forest Reserve. Most of the boundaries are artificial, consisting of straight lines which originally ran between earth cairns while the rest of the boundary length is marked by natural features like rivers. The northern boundary of the reserve is marked by River Sempaya while the Southern boundary is marked by River Nyakabale. The east side of the reserve is marked by the Fort Portal Bundibugyo road. From River Nyabisokoma the boundary is marked by road as it extends to Buranga pass. The Western Boundary follows approximately the Crest of North Rwenzori hills from the source of River Nyakabale to the source of Mongiro River and is marked by a cut and cairned line and some *Eucalyptus* and *Erythrina* trees planted at wide intervals. The boundary then follows the Mongiro River from its source to the main Fort Portal Bundibugyo road south of Sempaya River. The boundary has been recently re-surveyed and marked with concrete pillars measuring 1 metre above the ground.

1.2 Legal status

North Rwenzori CFR is managed by the National Forestry Authority (NFA), on behalf of the Government of Uganda based on Section 54 of the National Forestry and Tree Planting Act 8/2003. The reserve was first gazetted in 1940 under Legal Notice No. 275 of 1940 and subsequent Legal Notice Numbers 247/1947 as Crown Land and 167 of 6th July 1963 that left Forest Department in control of all Central Forest Reserves until the Forest Department was later replaced by the National Forestry Authority in 2004. The present constitution of the Reserve is contained in Statutory Instruments of 1998 No. 63 supplement No. 23 (Forest Reserves – Declaration Order).

No rights exist within the Forest Reserve save for the domestic use of forest produce subject to the management plan. Section 33 of the National Forestry and Tree Planting Act says in part;

> *"Subject to the management plan, a member of a local community may, in a forest reserve or local community forest, cut and take free of any fee or charge for personal domestic use in reasonable quantities, any dry wood or bamboo" 2700*

1.3 Topography and Altitude

North Rwenzori CFR is part of the mountainous massif of the Rwenzoris, which lies on the eastern side of the Western Rift Valley. The Western side of the reserve from the sources of River Nyakabale to Mongiro is over 1666m above sea level with the highest ridges in the South Western reaching 2167m a.s.l altitudes. The land falls away steeply between 1100m and 1333m to the east and north and to under 1000m near Sempaya. About one quarter of the reserve is over 1667m and about half is over 1500m.

1.4 Geology, Drainage and Soils

The underlying rocks are the basement complex, which have been extruded by great pressure above the surrounding. Much faulting occurs which causes frequent earth tremors in the area. Soils are derived from the pre-cambrian rocks and belong to the Harrops classification series (1960). Harrop divided the mountain soils into three units based roughly on the vegetation zones, which in turn are dependent on altitude i.e. the Alpine, broad leaved mountain, and tall grassland.

1.5 Climatic conditions

The annual temperature range for North Rwenzori is between 15^0C to 27^0c. The annual rainfall ranges between 1,150 to 1280mm but on the eastern side, the area receives below 1333mm, it is somewhat lower than this. There are two rain seasons; the short rains extending from the end of March to the beginning of June and the long rain season is from August to November. The periods December to March and June to July are comparatively dry. The prevailing wind is easterly during the dry season with hot winds from Ntoroko flats that cause rapid drying out on the steeper slopes and shallow soils.

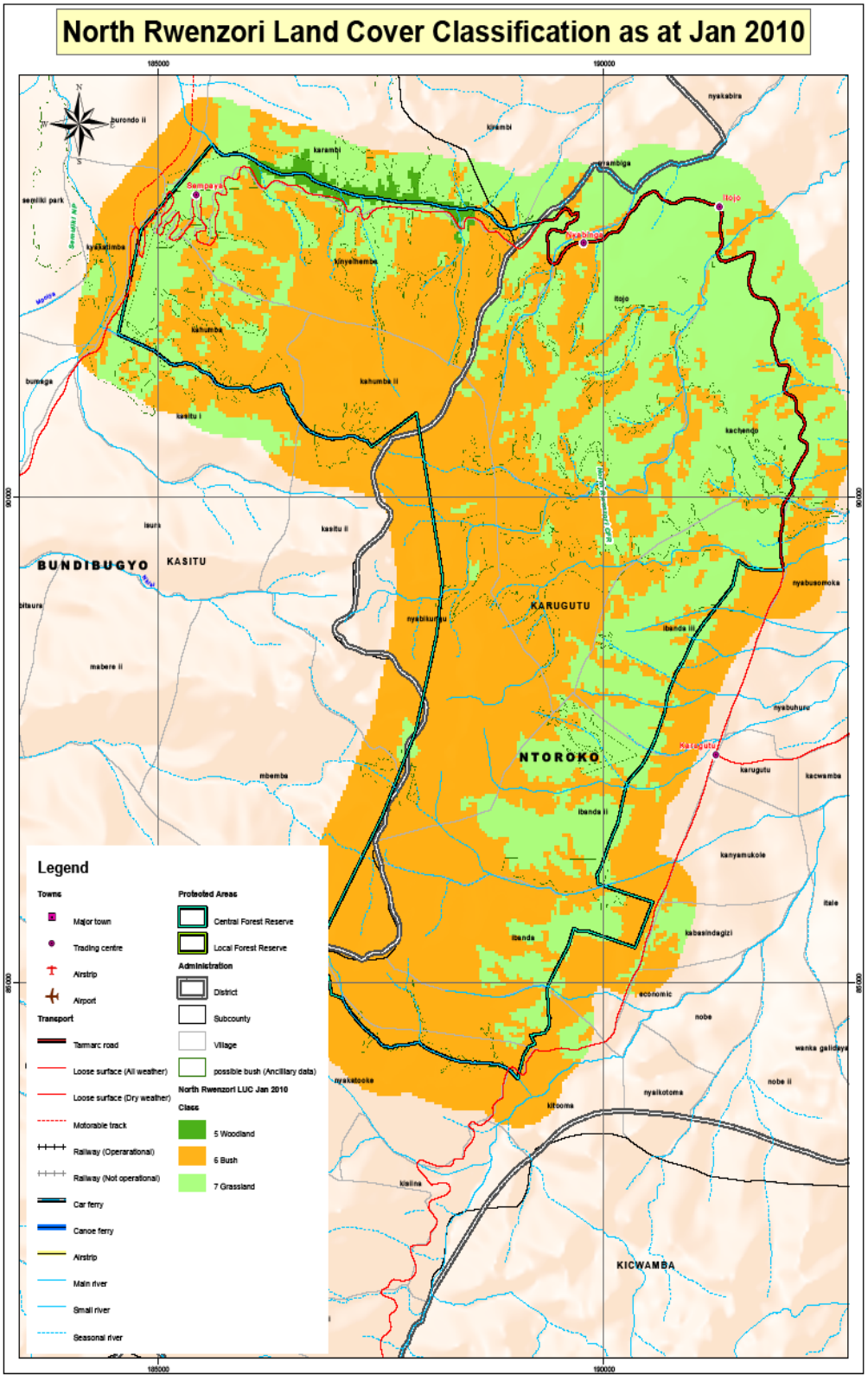
1.6 Natural Vegetation

About 70% of the land was originally colonized by vegetation classified as Bush Land while 20% of the area is occupied by area classified Grassland and 10% by colonizing forest. Common Tree Species in north Rwenzori include:

Bridelia Sceroneurodes, Combretum guenzii, Cussonia arbarea, Erythrina abyscinica, Grewia mollis, Maytenus Senegalensis, Pilostigma thorningii, Stereospermum kunthianum, Terminalia brownie, Vitex doniana, Acacia hockii, Annona chrysophlla, Acacia polycantha, Borassus spp,, Gardenia jovis-tonantis, Albizia spp

1.7 Land use/ cover map 2010

Figure 3: Land use /cover map for North Rwenzori CFR January 2010



1.8 Plantation development

North Rwenzori Central Forest Reserve has a total plantable area of 2510 ha. A total of 1,700 ha were established under the Environmental Management Capacity Building Project (EMCBPII) including 90 hectares established by the local communities. NFA has allocated 270 hectares to small scale private tree farmers. It is also planned that 1,022 hectares of wood lands will be managed through improved enrichment planting and management of well wooded and colonizing forest.

The plantation was divided into 5 blocks (Ngisi, Kyamutema, Nyabisokoma, Itojo and Mungilo), ranging between 560 ha to 820 ha and further sub divided into 53 compartments. 4 blocks (consisting of 50 compartments ranging between 20 ha to 110 ha) being for plantation development and the fifth (Ngisi), consisting of 3 compartments, set aside for conservation and ecotourism development. The divisions were based on physical features like rivers and streams, and other permanent infrastructure like roads and fire breaks and year of planting for planted areas.

The major species planted were majorly *Pinus caribaea* while some limited trials of indigenous species like *Prunus africana*, *Cidrella ordorata, Terminalia brownii* and other native species were established on 10 hectares.

2. DESCRIPTION OF THE EXISTING FOREST RESOURCES

2.1 Ecological resource

The nature of North Rwenzori and the inherent vegetation in the reserve makes the area one of the most important areas as a water catchment, protection of biodiversity, protection of river banks, lakeshores and stabilising of steep slopes.

2.1.1 Natural Forest

Riverine natural forests occur in the valleys. These forests are characterised by colonising species occurring in the riverine valleys and appear to be young probably less than 100 years old and most of them grow in a pattern that follows streams, rivers or water courses. Such species include*Bridelia sceroneurodes, Combretum guenzii, Cussonia arbarea, Erythrina abyscinica, Grewia mollis, Maytenus senegalensis, Pilostigma thorningii, Stereospermum kunthianum, Terminalia brownii, Vitex doniana, Acacia hockii, Annona chrysophlla, Acacia polycantha, Borassus sp and Gardenia jovis-tonantis.* Some scattered stands exist within the grassland but rarely form canopies.

2.1.2 Biodiversity

The biodiversity status of North Rwenzori has never been assessed. It is not known if there are rare, endemic or restricted species in the area. However, the reserve shares the same biodiversity characteristics with Rwenzori and Semliki National Parks whose biological diversity was is documented in the National Biodiversity Assessment Report Series of 1996. In this plan, it is expected that due effort will be carried out to ensure that vegetation within valleys (natural belts) are conserved to maximise conservation of some of the critical biodiversity existing in the area.

2.1.3 Regulation and Support Services

North Rwenzori adjoins a complex network of protected areas in the region that maintains the water table ensuring re-charges of domestic and commercial water supplies to Uganda. The government's "water for production" programme in support of the Poverty Eradication Action Plan (PEAP) would be rendered unviable because it requires these natural regulators and reservoirs of water flow. The whole country would be rendered unviable for cattle grazing and agriculture without CFRs like North Rwenzori. Forests play an important role of ameliorating climate conditions and thus sustain agricultural production that employs over 80% of the Ugandan Population. As the trees grow they absorb CO_2 and help reduce CO_2 emissions and mitigating climatic conditions. The increase in vegetation will help regulation of water flows and enhance steady supplies for domestic & industrial use.

2.2. Land Resource

The 5% of plantable land will be licensed to communities and small scale private forest plantation developers. The other area will be set aside for NFA plantation development.

About 2,500 ha is open grassland savannah. This is the only land that has been/ may be used for establishment of plantations.

2.3. Timber Forest Resources

There is no record of previous authorised or licensed harvesting in these forests or any inventory indicating potential timber quantities. It is only feasible to keep the existing natural forests intact until maturity of plantations to be established which then can be harvested in a systematic manner.

2.4. Non-Timber Resources

Communities surrounding these forests are subsistence farmers. They depend on CFRs for the supply of leaves and fibres, fodder, herbal medicines, water, land for tree growing. Handcraft products from leaves and fibre are used for domestic purposes and household income generation.

2.5. Cultural Resources and Ecotourism potential

There are no significant cultural sites within the CFRs which could be used as a resource for tourism. However, the ranges within the reserve provide good scenic beauty. This will be enhanced as the trees grow and may be a good future potential for ecotourism. This is exemplified by the waterfalls on Mongilo stream on the North Western part of the reserve.

2. SOCIO-ECONOMIC ENVIRONMENT

2.1. Total economic value of the forest

No valuation of the reserve has been done and as such there are several attributes that are under reported. However the potential total asset portfolio includes but is not limited to natural forests and woodland biomass, non-timber assets held by the wood as carbon, non wood and non timber products such as minerals, water catchments and hydrological services by the forest, provision of habitats for both plants and animals. The area has also been providing grazing ground for the community animals.

The CFRs play an important role in the socio-economic environment of the districts in terms of supporting community livelihood and development aspects. This takes into account fuel/firewood for domestic and commercial purposes, poled for household use or the building industry and other monetary and non-monetary benefits enjoyed by communities that are derived from both natural and plantation forests. The rich river network within the reserve also provides water for both domestic and commercial purposes. In addition gravity water scheme within Karugutu Town Council originates from the reserve.

2.2. Potential timber and non-wood supplies

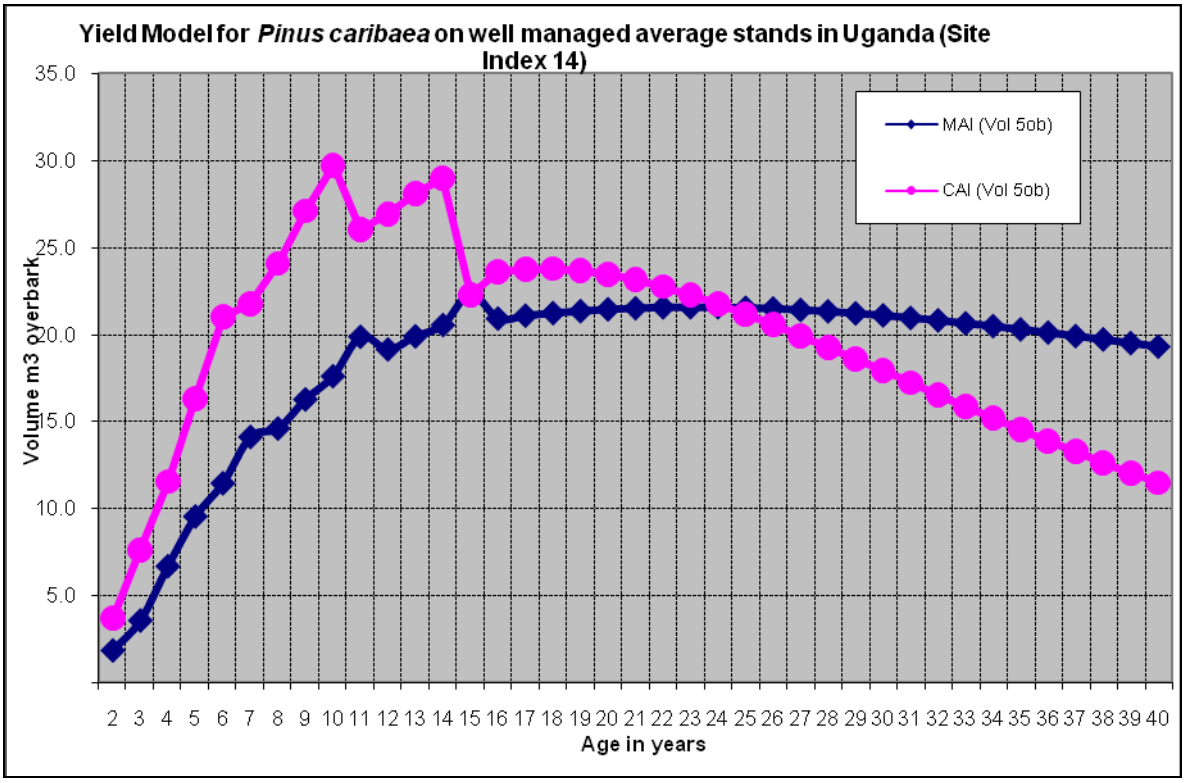
Currently there are no timber supplies coming from the reserve. Timber supplies will come from standing crop of 21.5 hectares aged 6 years and the 1,607 hectares established by NFA under EMCBPII, 83 ha established by private farmers and 90 planted by the local community under CFM arrangement. The planned forest plantation at North Rwenzori Central Forest can produce as much as 600,000m^3 in one rotation. Due to the current limitations of funding for establishing plantations under NFA, only the existing and the area established under EMCBPII Project covering 1,802 ha has been used in the estimations.

The main role of North Rwenzori CFR in the forest industry will be its ability to supply saw logs to the market. The market for most of the sawn timber is Kampala (330 km away). The local demand for forest products is growing as the urban areas of Bundibugyo, Ntoroko and Fort Portal keep growing. The stability of the neighbouring countries of Rwanda, Congo and South Sudan continues to create opportunities for supporting a sizeable forest industry. The area is at the periphery of the newly discovered oil fields and thus will in future be a vital source of building materials for the associated development of infrastructure.

Pinus caribaea being the major species planted is known to exhibit excellent early fast growth. It has a small conical crown, small branches, termite resistant, develops a thick bark within three years, which considerably reduces damage impact by fires. It tolerates a

wide range of sites including poor sites. It performs well on high altitudes between 800m and 1700m above sea level. The mean annual increment is expected to be 16 m^3/ha/year at year 25 as shown in Figure 3 and Table 4.

Figure 4: Projected Yield and growth of P. *caribaea* in North Rwenzori



Adapted from Yield and growth of models for P. caribaea in Uganda (Alder, Drichi, Elungat 2005)

Table 1: Yield Model for *Pinus caribaea* var hondurensis in North Rwenzori

Site index	14		*Planting N/ha*	1111		Survival %	90%		*Density index %*	75%
Main crop before thinning						**Thinnings**			**MAI**	**CAI**
Age	**Hdom**	**N/ha**	**Dg**	**G/ha**	**Vol_{5ob}**	**Vol_{10ub}**	**Thin%**	**N/ha**	**Dg**	**Vol_{5ob}**	**Vol_{10ub}**	**Vol_{5ob}**	**Vol_{10ub}**	**Vol_{5ob}**
2	2.3	1000	7.0	3.8	4	2						1.8	0.8	3.7
3	3.8	1000	9.3	6.8	11	5						3.6	1.7	7.6
4	5.3	1000	12.4	12.1	27	14						6.7	3.6	11.5
5	6.8	1000	14.6	16.7	48	27						9.5	5.4	16.3
6	8.3	1000	15.8	19.7	69	40	25%	250	13.3	12.1	7.1	11.5	6.7	21.0
7	9.8	750	18.9	21.1	87	54						14.1	8.7	21.7
8	11.2	750	19.4	22.2	105	66						14.6	9.1	24.0
9	12.6	750	20.7	25.3	134	87						16.3	10.4	27.1
10	14.0	750	21.8	27.9	164	108	27%	199	18.4	31.3	20.6	17.6	11.5	29.7
11	15.3	550	25.1	27.3	175	121						19.9	13.5	26.0
12	16.6	550	24.9	26.8	186	128						19.2	13.0	26.9
13	17.8	550	25.8	28.9	215	150						19.9	13.7	28.0
14	18.9	550	26.7	30.8	244	173	27%	151	22.7	48.4	34.2	20.6	14.3	29.0

Site index	14		*Planting N/ha*	1111		Survival %	90%		*Density index %*	75%
Main crop before thinning						**Thinnings**			**MAI**	**CAI**
Age	**Hdom**	**N/ha**	**Dg**	**G/ha**	**Vol_{5ob}**	**Vol_{10ub}**	**Thin%**	**N/ha**	**Dg**	**Vol_{5ob}**	**Vol_{10ub}**	**Vol_{5ob}**	**Vol_{10ub}**	**Vol_{5ob}**
15	20.0	400	30.4	29.0	244	179						22.4	16.1	22.2
16	21.0	400	29.6	27.5	243	177						20.9	15.0	23.6
17	22.0	400	30.3	28.8	267	196						21.1	15.2	23.7
18	23.0	400	31.0	30.1	291	216						21.2	15.4	23.7
19	23.9	400	31.6	31.3	314	235						21.4	15.6	23.6
20	24.7	400	32.2	32.5	337	254						21.5	15.8	23.4
21	25.5	400	32.7	33.6	360	273						21.5	16.0	23.1
22	26.3	400	33.2	34.6	383	292						21.6	16.1	22.7
23	27.0	400	33.7	35.6	405	310						21.6	16.2	22.3
24	27.7	400	34.2	36.6	426	329						21.6	16.3	21.7
25	28.4	400	34.6	37.5	447	346						21.5	16.3	21.2
26	29.0	400	35.0	38.4	467	364						21.5	16.4	20.5
27	29.6	400	35.3	39.2	487	380						21.4	16.4	19.9
28	30.1	400	35.7	40.0	506	397						21.3	16.4	19.2
29	30.6	400	36.0	40.7	524	412						21.2	16.4	18.6
30	31.1	400	36.3	41.4	542	428						21.1	16.3	17.9
31	31.6	400	36.6	42.1	558	442						21.0	16.3	17.2
32	32.0	400	36.9	42.7	575	457						20.8	16.2	16.5
33	32.4	400	37.1	43.3	590	470						20.7	16.1	15.8
34	32.8	400	37.4	43.9	605	483						20.5	16.0	15.2
35	33.2	400	37.6	44.4	619	495						20.3	15.9	14.5
36	33.6	400	37.8	44.9	633	508						20.1	15.8	13.9
37	33.9	400	38.0	45.3	645	519						19.9	15.7	13.2
38	34.2	400	38.2	45.8	658	530						19.7	15.6	12.6
39	34.5	400	38.4	46.2	669	540						19.5	15.4	12.0
40	34.8	400	38.5	46.6	681	550						19.3	15.3	11.5

Adapted from Yield and growth of models for P. caribaea in Uganda (Alder, Drichi, Elungat 2005)

There are no similar growth curves for indigenous species and hence only a small area of the plantation will established with natural species like *Prunus africana, Cidrella ordarata*. A growth curve for *Maesopsis eminii* will be used to predict their growth. However, their values will not be used in the financial analysis.

2.3. Stakeholders and Partnerships

Local communities' dependence on the reserve is visible from the products they depend on and where they are derived from the forest. The main requirements by different stakeholders include water for people and animals, fuel wood for domestic use, honey, local herbal medicines for humans and animals, timber for local and big business people, poles for domestic and commercial construction, grass for grazing animals, poles for tool handles, weaving materials, soils and sand for building, mushrooms and vegetables for domestic use and charcoal for sale in urban areas as source of employment The managerial implication of community and stakeholder requirements is that we have to cater for them in planning and implementation.

Forest legislation and other statutory provisions bind NFA to consult and co-ordinate activities with other institutions e.g. National Environment Management Authority (NEMA), Uganda Wildlife Authority (UWA) and District Forestry Services (DFS). The Local Government Act 1997 and Decentralization Policy/System also require NFA to liaise with District Local Governments, also reflected in the National Forestry and Tree Planting Act 8/2003 Sections 54(2) (a) to (f).

Until 2004, North Rwenzori CFR was managed by the Forest Department of the Ministry of Water, Lands and Environment. This government institution was restructured and this mandate transferred to NFA. Effective commencement of management by NFA was in 2004.

Although there are many stakeholders in the area, the management of the reserve is the responsibility of the NFA. However the National Forestry and Tree Planting Act, 8, 2003, requires that NFA manages the reserves in close collaboration and consultations with the different stakeholder categories.

2.4. Threats and conflicts

2.4.1 Threats

Protection of North Rwenzori CFR against fire, conversion to other land uses other than forestry and against losses to encroachers and unlawful logging is taken seriously. For the planted areas, detailed annual fire plans will be made and followed.

However, the period between 1971-1979 when the country public systems failed due to political upheavals, the forests were not well protected. And 1996-2003 during the ADF invasions, people entered into the forest and cultivated it, illegal logging took place and fires were not checked. The result was burnt up crops, reduction of tree cover and conversion of the reserve to grazing land. When full control was restored, financial capacity to reforest the degraded areas was not available. The then forested areas used to harbour wild animals, vermins and criminals.

The managerial implication of this is that fire protection, and boundary patrol systems need to be re-established for a better protection of the reserve and one of the ways is to enlist the support of communities.

2.4.2 Conflicts

Grazing and cultivation by forest adjacent communities remain the major conflicts to the management of the central forest reserve. The present plantation of 27.5 ha has always been a target of grazers leading to the loss of some trees. This therefore causes a danger to the expansion of future planting.

Another conflict has been on land for cultivation. Right from the period of insurgency caused by ADF, the Local communities have always seen the forest reserve as free land

for cultivation and this has brought about conflict between the field staff and the encroachers.

2.5. Community use of forest products

The forest is situated in a part of the country with a medium population. According to the 2002 Uganda Population Census, the population of Ntoroko district where the reserve is located was 51,100 and the annual rate of population growth stands at 4% per annum. The reserve lies next to the Karuguttu Trading Centre, a fast growing centre and therefore pressure on the forest for firewood, building poles, grazing and other non timber forest products will continue to grow.

The main requirements by different stakeholders include water for people and animals, fuel wood for domestic use, honey, local herbal medicines for self and animals, timber for local and commercial business, poles for domestic and commercial construction, grass for grazing, poles for tool handles, weaving materials, soils and sand for building, mushrooms and vegetables for domestic use, charcoal for sale in urban areas and many more.

2.6. Infrastructure

The reserve is easily accessed by the Fort Portal Bundibugyo road that marks part of the boundary. At the moment this road is being upgraded into a tarmac road and hence accessibility to the reserve will be improved. Currently there are 9Km of public road within North Rwenzori CFR. This is equivalent to a road density of 0.18km/ha. This is too low and given the area the road density should be at least 2% of total area. This would mean nearly 83 km of roads need to be constructed. Some 30Km of more roads were constructed to improve access in the area in past 1 year, however, this was not up to standard (gradient and width) and will thus be regarded as firebreaks. This will be supplemented with some fire breaks that may work as access roads. More roads that are up to standard will be constructed in coming years.

2.7. Staff and labour

The current staffing consists of one Range Manager, one Sector Manager, two Forest Supervisors, one Range Accountant and two Drivers. The Forest Supervisors and drivers are based at the forest station at Karuguttu and report to the Sector Manager based in Fort Portal and they are supported by the Range Manager and the Range Accountant based at Kyenjojo. This number is inadequate for all the forest operations to be undertaken during the period of this management plan. Contract labour is readily available and additional responsibility will be devolved to communities under the collaborative forest management.

2.8. Revenue and expenditure

2.8.1. Expenditure

There are no records of previous expenditure that cover the costs of labour before NFA. This was partly due to the fact that only one forest supervisor had been employed at Karuguttu Forest Station and there wasn't much forestry activity in the reserve until the planting of 21.5 hectares that was planted in 2005. The anticipated revenues and expenditure are detailed in the management costings but selected components are indicated for staff costs (Table 2), overhead costs and plantation establishment (Table 3).

Table 2: Staff Salary Costs (Ushs) for the period 2006 to 2012

Staff Designation/ Nos/ Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Project year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Range Manager (1)	1,900,000					12,540,000	12,540,000
Sector Manager (1)	1,500,000					18,810,000	18,810,000
Accounts/ Administrator (1)	1,051,000					11,098,560	11,098,560
Forest Supervisors (3)	1,190,000	15,708,000	15,708,000	15,708,000	15,708,000	47,124,000	47,124,000
Transport Assistants (2)	430,000					11,352,000	11,352,000
Other Support Staff (1)	200,000					2,640,000	2,640,000
Total (9)		**15,708,000**	**15,708,000**	**15,708,000**	**15,708,000**	**103,564,560**	**103,564,560**

Table 3: Capital costs (Ushs) for the period 2006 to 2012

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Item/ Project year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Pick up (1)						99,925,004	
Tractor (1)						176,212,500	
Motorcycles (2)	6,419,760					19,839,186	26,395,353
House Karugutu (1)	2,000,000					0	54,388,200
House Itojo (1)	-					0	64,706,200
Static tanks (5)	-					0	15,000,000
Nursery site (1)	-					62,150,222	6,281,768
Boundary resurvey and marking (28Km)	-				22,561,488	78,375,713	26,308,763

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Item/ Project year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Road Construction (30Km)	-					90,355,479	70,109,430
Road maintenance (30Km)	-						
Total	**8,419,760**	**0**	**0**	**0**	**22,561,488**	**526,858,104**	**263,189,714**

Table 4: Plantation establishment costs (Ushs) by NFA for the period 2006 to 2012

Activity/ Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Project year	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Rate of planting (ha)	22				460	1,054	93
Bush clearing					101,028,300	246,681,400	11,740,000
Land Preparation and Planting	6,450,000				45,084,280	167,169,600	133,923,680
Cost of seedlings including transport	9,288,000				147,837,335	726,679,077	159,169,868
Weeding and Climber cutting costs	8,600,000	8,600,000	8,600,000	8,600,000	10,716,000	567,003,999	561,448,132
Fire management					1,200,000	15,494,000	28,269,000
Forest patrol					4,139,836	4,139,836	13,617,206
Tools					45,908,800	69,194,710	227,602,881
Tending						47,000,000	
Growth Monitoring							
Total WPA	**24,338,000**	**8,600,000**	**8,600,000**	**8,600,000**	**355,914,551**	**1,843,362,621**	**1,135,770,767**

2.8.2. Revenue for the period 2006-2012

There was no significant revenue collected during the period.

3. ENVIRONMENTAL CONSIDERATIONS

3.1. Conservation of Biological Diversity

The biodiversity status of North Rwenzori has never been assessed. It is not known if there are rare, endemic or restricted species in the area. However, the reserve shares the same biodiversity characteristics with Rwenzori and Semliki National Parks whose biological diversity is documented in the National Biodiversity Assessment Report Series of 1996. In this plan, it is expected that due effort will be accorded to ensure that vegetation within valleys (natural belts) are conserved to maximise conservation of some of the critical biodiversity existing in the area.

North Rwenzori used to be a biodiversity corridor connecting other conservation areas. However, human pressure and grazing threatened the animals, so much so that these animals are now a rare occurrence in the area. In addition, this area now isolated from the other protected areas by human settlements.

3.3. Ecological function (watershed, carbon sequestration)

North Rwenzori serves an important watershed role. It is the source of streams Ngisi, Nyabisikoma, Itojo, Sempaya and Nyakabale. These streams then form part of the watershed for Lake Albert. The reserve also acts as a carbon sink through its colonising riverine forests and presents potential for carbon sequestration through afforestation of grassland areas.

3.4. Potential markets for environmental services

To meet the growing demand of wood resources in the country (hardly any mature timber plantations remain in Uganda) and to reduce the pressure on the remaining natural forests in the region, Uganda has to substantially expand its wood resources. To do this, establishment of commercial plantations in the proposed Forest Management Pan area (with the potential to allow for involvement of community based investments) was undertaken.

The establishment of these plantations (mainly conifers-pine) and mixed broad-leaved native species) was managed in such a way that they maintain, and where possible enhance environmental services. Such environmental services that the management plan area is expected to maintain and enhance includes but is not limited to: contribute to climate regulation especially micro-climate amelioration; carbon stocks maintenance and sequestration watershed services (soil and water conservation in the watersheds); purify and deliver reliable flows of water to the ecosystem and to the lowland agricultural systems, and conservation of biological diversity;

Financing for such activities will be through: Carbon Finance through the sale of emission reductions, seeking of direct government and donor financing, value addition to the timber and other products; tourism development, biodiversity offsets and other incentives stemming from a broad range of ecosystem services and products that the management plan area may generate.

In order to be able to realise the investment required to finance the management area activities that will then deliver the services, we need to utilize Payments for Ecosystem Services (PES) by incorporating the cost of environmental degradation into the cost of this plan. We need to bear in mind that consideration of transactions for ecosystem services in the management plan area should incorporate social elements (food security, poverty alleviation) and value livelihood of the communities.

3.5. Wetlands, River/stream banks

The forest reserve is a major catchment area for many streams that supply water to the neighbouring communities who occupy the lower parts of the area and the various streams that drain into Lake Albert. It is important that stream banks are protected by exceeding the mandatory 20m band of natural vegetation, which includes the forest, on either side of the stream, i.e. 40m along the valleys will not be cleared for plantation establishment of exotic tree species. In addition, to the mandatory band, such areas could be buffered by another variable band which itself could be planted with indigenous high value trees.

3.6. Vulnerable/ ecologically fragile areas

The fact that the land earmarked for plantation establishment occurs on some of the steep slopes, up to greater than 45^{o} in some places, makes it ecologically fragile. In the past, landslides were quite common as can be seen along areas bordering the old Fort Portal-Karugutu-Bundibugyo road. Past establishment of conifer plantations took place in mountainous areas like Mafuga and Rwoho CFRs. Given the fact that the area in question is mostly grassland, establishment of plantations will prevent soil erosion and landslides. The local community in such areas testify to the fact that planting trees on steep slopes is the best land use option compared with cattle grazing which was the practice prior to 1956 when the first crop of trees was established in such areas. However, it is vital, that natural forest wherever it exists be left intact and that alignment of planting rows should follow the contour lines and not along the slope. Spot hoeing rather than strip hoeing should be practiced because the fragile thin soil may be eroded. Fire protection is also important, not only for tree crop protection, but also against exposing the topsoil to the forces of erosion.

3.7. Social-cultural sites

There are no social-cultural sites within North Rwenzori CFR. However, the reserve is in an area traditionally inhabited by the Bakonjo who only live in this particular region. It is possible that some cultural sites may be in the reserve but not yet identified. In case such

areas are identified during the course of plantation development, they will be protected with respect to their degree of sensitivity.

3.8. Problems and issues

The following are potential environmental concerns in the areas as identified during the preparation of the management plan. The managerial implication of all these positive and negative impacts on the environment are that people need to be taken into account and mitigation measures suggested. To this end, a detailed EIA report was prepared and the following were identified.

Current Environmental Problems

- Grazing: By animals owned by communities living in the area, leading to erosion and trampling of the soils.
- Firewood and Charcoal Burning: High demand for fuel and charcoal from the nearby communities and urban centres.

Potential Environmental Problems when plantation work is undertaken

- Erosion: disturbance of the forest under storey and soil occurs, increases susceptibility to soil erosion.
- Slope Stability: road cuts across sloping land and clearing of vegetation on slopes can result in landslides.
- Structure: compaction and loss of organic matter may lead to changes in soil structure, reduced infiltration, and water holding capacity, aeration and root penetration, also laterization.
- Species composition: species diversity in the planted area will be decreased.
- Weeds: weed invasion may increase on opening area for plantation development.
- Slash: logging debris can be a fire hazard and can impede regeneration of preferred tree species.
- Dust: Logging activities and log transport on stone dirt roads can generate large amounts of dust in dry season conditions.
- Wildlife habitat: large mammals will reduce in number as they pose threat to planted trees.
- Extremes of flow: soil infiltration and water holding capacity of plantation area may be reduced, leading to runoff and some flooding.
- Contamination: pollution from petroleum products, herbicides and organic wastes associated with logging operations.

- Local economic and social customs: impacts on labour market and labour availability for food production; a shift to a more cash-based economy, alteration of daily living patterns and political power structure changes can occur.
- Land tenure and traditional forest uses: hunting, gathering and traditional exploitation of forest resources may be disrupted; limited access to forest resources by local populations of people.

4. HISTORY OF MANAGEMENT

The first management plan for North Rwenzori CFR was prepared by Dale in 1948 with the main objective; to obtain tree cover over the area. The plan had three main prescriptions, namely;

- Early burning from top of the hills down slope which would be done annually
- Tending of existing trial plots. Although the heavy cost of future extraction could not justify establishment of timber plantations, it was considered essential to know what tree species would best grow on the hills and hence the need to maintain the plots.
- Inspection of boundary corner cairns was to be carried out annually since there was little encroachment in the CFR. In addition, *Senna spectabilis* and other easily recognisable prominent species would be planted for 50 yards along the boundary on each side of all corners.

During the implementation of the plan, burning was done annually but with no supervision. In the same year the operation started late and severe fires resulted. The main trial plots on the northern slopes of Ngisi hill were tended and in 1950s, plots of *Pinus taeda*, *Pinus patula* and *Pinus lougigolia* were added. In 1956, however, fire destroyed most of the plots and then the experiment was abandoned. Since then, no other management plan has ever been made and the level of activities remained low. In 2005, 21.5 ha located at the lower slope next to the forest station at Karugutu were planted with *Pinus caribaea* var. *hondurensis*. This plantation has already shown promising fast growth potential.

PART 2: PLANNED MANAGEMENT

5. BASIS OF THE PLAN AND OBJECTIVES OF MANAGEMENT

5.3. Basis of the Plan

A well managed North Rwenzori CFR will contribute to a "sufficiently forested, ecologically stable and economically prosperous Uganda." It will also contribute to the national forest plan and National Development Plan (2010/11-2014/15) forestry objectives;

1. Restore forest cover

2. Restore degraded natural forests in forest reserves; and climate change

3. Promote low carbon economic development path

To achieve this, North Rwenzori CFR will be managed on a sustainable basis producing timber, non-timber forest products and environmental services in cooperation with local, national and international stakeholders.

5.4. Vision

Sustainably managed forest resources contributing to better community livelihood and national development

5.5. Mission

Improved and cost effective forest management to raise productivity, environmental and socio-economic values of the forest resources in the MPA

5.6. Management Circles

North Rwenzori MPA shall consist of three management circles. Each management circle will meet the minimum environmental and sustainable management of forests standards. Research will be distributed amongst all the circles.

1. **The Production management circle** will consist of all the plantable area in the grassland; and all the area to be restored in the woodland cover class. Within these cover classes, there are areas planted by the NFA and the Private Sector (Individuals, Companies and local communities. The area available for this circle is about 2,500 ha.
2. **The Conservation, ecotourism and environmental protection management circle** will consist of areas:
    - non-plantable area in the grassland; all the woodland cover class and the tropical rain forest cover class.

- Within these cover classes, there are areas planted by the NFA and Private Sector.
- Natural forests, Mongilo falls, and other recreation sites; North rwenzori CFR is comprised of many undulating hills with a steep gradient. The valleys have natural vegetation belts which enhance the beauty and provide a home for birds and other wild life. The combination of these hills and the narrow valleys provide beautiful scenery as well as panoramic view of the surrounding low lands. The surrounding communities also have reach culture that can be exploited for tourism including dances, traditional sites and traditional cuisine**.**

This will cover areas where there exists natural forest. It will also include all wetland and valley bottoms. The area available for this circle is about 1020 ha.

3. **Community livelihoods and private sector management circle will consist of**:
   - Area allocated to communities under the production circle (150 ha);
   - Area allocated to the private sector under licence in the production circle (270 ha);
   - Administrative Parishes directly neighboring the CFR;
   - Other area that is defined in CFM agreement

This will cover areas of North Rwenzori that will involve community and private sector participation in the implementation of the management objectives. They include those areas designated as Community planting through a Collaborative Forest Management Agreement, the wooded area outside the nature reserve. The management circles are outline in table 5.

Table 5: Management Circles by area (see also map below)

CIRCLE	**DETAIL**	**AREA (HA)**
Sawlog Production Management Circle	All Palatable Area in North Rwenzori CFR	2,500
Biodiversity conservation, ecotourism and protection management circle	All areas designated as Valley and wooded areas in North Rwenzori CFR	1020
Community and private sector management circle	Community Planting Areas, private tree famers in production circle and other areas that may be allocated for non consumptive activities within the conservation circle	0
TOTAL		**3,520**

5.7. Management objectives

Objectives of Management

1. Manage the CFR for Integrate local communities in participatory forest management to contribute towards improvement of their livelihoods.
2. Manage the CFR for protection of biodiversity and ecologically fragile areas
3. Restore encroached and degraded areas of the CFR to ensure sustainable supply of forest products and services.
4. Establish forest plantations in the grassland areas of the CFR for sustainable supply of forest products to contribute towards meeting local and national needs, international needs.

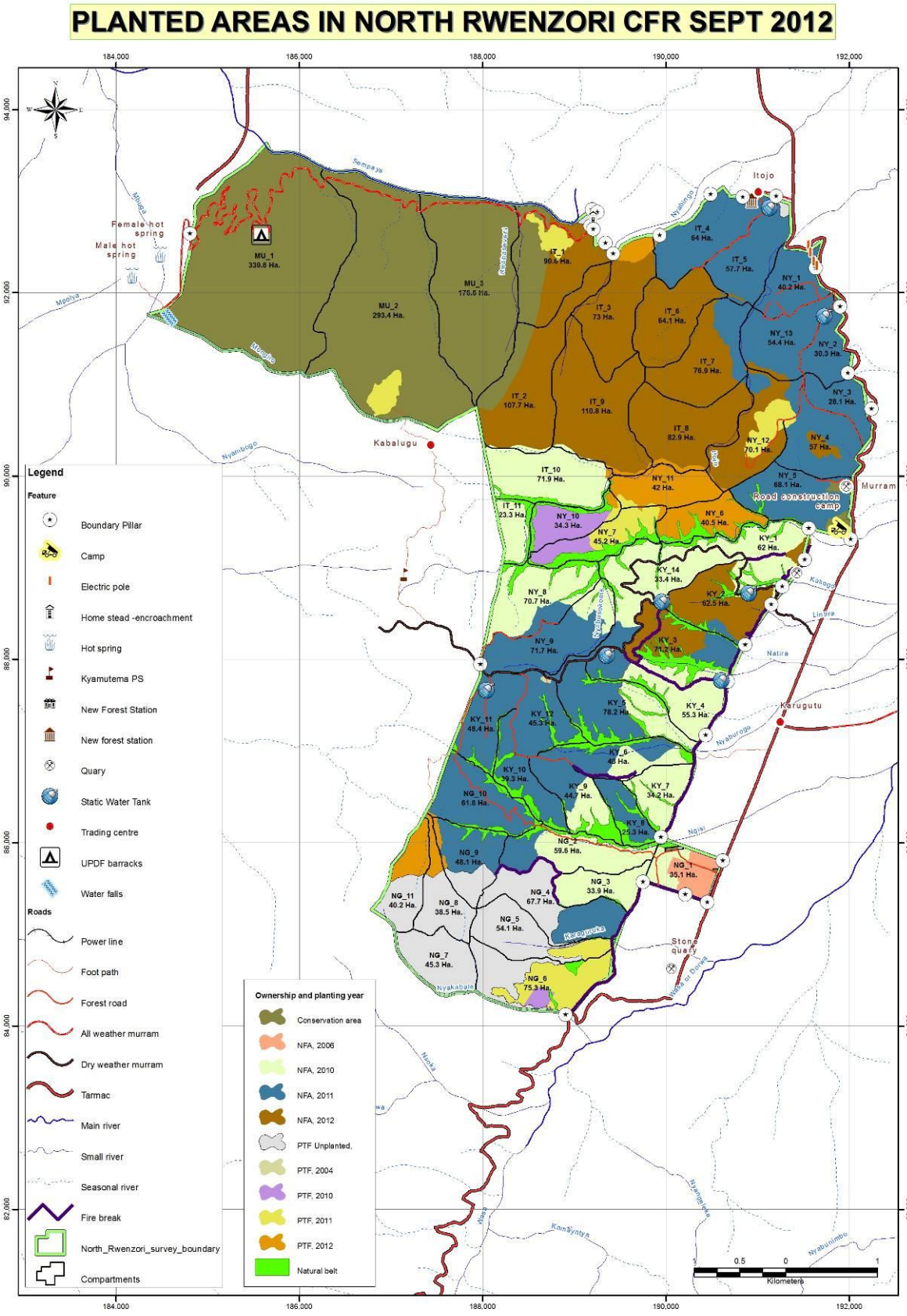
The forest will be managed according to internationally recognised standards in particular those of the Forest Stewardship Counsel (FSC) and The Climate, Community & Biodiversity Alliance (CCBA). The management will integrate community-based groups and respect their livelihoods needs. Details of the management objectives as linked to the resources being targeted per management circle in table 6.

Table 6: Management Objectives per management circle and resources targeted

MANAGEMENT CIRCLE	RESOURCE TARGETED	OBJECTIVE FOR EACH RESOURCE
Sawlog Production Management Circle	Timber	To increase the area planted for timber production
	Carbon	To generate Kyoto and where necessary non-Kyoto compliant carbon offsets in North Rwenzori CFR
	Financial	To turn the cash flow from negative to positive and to maintain it as a positive cash flow
	Protection	To maintain forest health and protect the forest
	Community livelihoods	Integrate community forest needs into forest management activities
	Research	Establish and maintain research plots
Biodiversity conservation and protection management circle	Biological Diversity	To maintain and where possible enhance the biological and nature conservation values
		To promote natural forest regeneration
	Watershed	To retain and enhance soil and water quality
	Protection	To maintain forest health and protect the forest
		To protect natural forest from illegal activities
	Timber	To increase the area planted for timber production
	Research	Establish and maintain research plots
Community	Timber	To plant and raise trees on land allocated to communities in accordance with

MANAGEMENT CIRCLE	RESOURCE TARGETED	OBJECTIVE FOR EACH RESOURCE
and private sector management circle		acceptable standards
	Community livelihoods	Integrate community forest needs into forest management activities
	Community livelihoods	To support non consumptive community livelihood activities compatible with forestry

Figure 5: Map showing Management circles for North Rwenzori Central Forest Reserve



5.8. Period of the Plan

This FMP shall be implemented over a period of twenty five (25) years, from 1st July 2012 to 30th June 2037. It shall be reviewed after five (5) years (starting in 2017) by partners and key stakeholders including local communities to incorporate emerging issues and in compliance with the law**.**Revision of the FMP will start not later than 1st January 2017.

6. PLANNED MANAGEMENT ACTIVITIES

6.3. Sawlog Production Management Circle

The Sawlog production management circle will cover all the plantable area in North Rwenzori CFR which area is designated as a carbon sequestration area, community planting, existing plantation area and allocations to private tree farmers. The area available for this circle is about 2,500 ha.

To increase the area planted for timber production, the following activities will be undertaken in North Rwenzori CFR

i) All the area classified for planting shall be fully planted by the 10th year of this management plan. All this area is designated as NFA plantation area, community planting areas, private tree farming areas. This area covers about 2,500 ha.

ii) Management of these areas is detailed below but in any case the timber volumes produced from North Rwenzori shall be monitored to make sure that they are within the range expected of the area planted.

iii) Community and private tree farming activities will be monitored to ensure that the area licensed to them is planted in accordance with the license offer conditions.

To generate Kyoto and where necessary non-Kyoto compliant carbon offsets in North Rwenzori CFR

(i) Feasibility studies carried out have indicated that a plantation in the area has potential to generate carbon credits (Certified Emission Reductions) .All the activities necessary for the generation and delivery of CERs generated by the Project will be implemented.

(ii) A Project Design Document (PDD) shall be prepared and registered with the UNFCCC or any interested participant under the voluntary market

(iii) All verifications for North Rwenzori Afforestation Project shall be undertaken.

(iv) A forest management information system will be developed so as to maintain information that will be necessary to certify the emissions fixed.

To maintain forest health and protect the forest, the main activities shall be to:

(i) Control the occurrence or spread and increase in populations of weeds, pests, insect and fungal attack.

(ii) Monitor and manage fire through strict adherence to the fire safety and rules, to procure and utilise equipment and to enlist the cooperation of adjacent communities in fire management.

To integrate community forest needs into forest management activities

(i) The staff will supervise the plantation activities of areas allocated to communities

(ii) The staff will involve community members in the plantation activities of the forest

(iii) NFA will provide free seedlings to the community and field staff will provide free technical support to the communities.

For research and growth monitoring purposes,

(i) Research plots shall be established and performance assessed every two years.

(ii) Permanent sample plots (PSPs) shall be established for every 30 ha planted and assessed every two years.

(iii) Species and provenance trials will be established for a variety of species and provenances and performance monitored every two years.

Existing plantations

The young crop will be thinned and pruned as per tending schedule and will be clear felled at age 25. The new plantings will be weeded and tended as per schedule of operations in the guidelines.

New planting

This consists of 1,607 ha of new planting by NFA and 71 ha of Community Forestry Management Groups. The private sector consists of local community and medium/ small-scale investors currently totalling 11 who have established commercial plantations/ woodlots mainly of conifer species on 83 hectares.

The annual planting programme for NFA will be 50 ha starting 2013 over a 10 year period. The communities and private individuals will be supported to plant between 25 ha to 30 ha annually in the 10-year period.

Blocks and Compartments

North Rwenzori plantation was divided into 5 blocks (Ngisi, Kyamutema, Nyabisokoma, Itojo and Mungilo), ranging between 560 ha to 820 ha and further sub divided into 53 compartments. 4 blocks (consisting of 50 compartments ranging between 20 ha to 110 ha) being for plantation development and the fifth (Ngisi), consisting of 3 compartments, set aside for conservation and ecotourism development. The

divisions were based on physical/ natural features like rivers and streams, ridge tops, and other permanent infrastructure like roads and fire breaks. The Block names followed names of feature like hills and streams. The compartments are serially numbered.

Compartments are homogenous in species composition and year of planting. If however variability within a compartment is unavoidable, there will be further sub division into sub compartments as will be necessary. Each sub compartment must be homogenous in age and planting stock, and every effort was made to simplify boundaries and maximize the area. Sub compartments will be identified by the number of the compartment in which they are located, with letters suffixed in alphabetical sequence. Sub-compartment boundaries may be changed but only at time of clear felling in order to prevent discontinuities within stand histories. A compartment register for each compartment will be maintained and strictly updated regularly for any activities carried out or any events that may change the area or status of the plantation in that compartment.

Road construction

There will be three classes of different road widths that will be constructed. A width of 7m will be for class I (primary roads), 5m for class II (secondary roads) and 4 m for class III (tertiary roads). Class I roads will be all-weather murram while class II roads will join from the primary roads and both will be constructed ahead of planting. Class III will be fully opened during harvesting but can act as firebreaks and compartment/ sub compartment boundaries.

This being a hilly terrain, all roads will be carefully surveyed and aligned in such a way that steep gradients are avoided to minimise erosion. Adequate side drains, culverts and bridges will be constructed to minimise impact of water runoff.

Table 7: Required Road System

Plantation	Plantation area (ha)	Class I (km)	Class II (km)	Class III (km)	Total km	% Road intensity
North Rwenzori	2,500	20	50	80	150	3% or Road density is 1km of road for every ±17ha of plantation.
Equivalent area in Ha	75	14	25	32	71	

Width: Width for forest roads will be 5 m, to be increased or decreased, depending on purpose. A width of 7 m for class I roads, 5 m for class II roads and 4 m for class III roads will be left unplanted along these road traces during road alignment.

Gradients: The maximum gradient for forest roads will normally be 1/15 (6^0), but in plantations gradients of 1/9 (10^0) with the load and 1/12 (7.5^0) against the load shall be used for distances not exceeding 400 m, if cheaper and shorter alignments are thereby secured. In most forest areas, avoidance of soft ground is generally more important than

gradient and alignments shall make the best use of well-drained ridges and firm murram outcrops.

***Bridges and Culverts*:** Concrete culverts shall always be used in preference to wooden bridges on all except entirely temporary tracks. Bridges and culverts in plantations shall be designed to take a ten tonne static load plus 25% safety margin. The minimum width will be 3.6 m.

Curves: Minimum radius is 10m at the centre line (12 m is preferable) based on the turning radius of a seven tonne truck with a sight distance of 20-50m.

Camber: Proper camber shall be constructed and maintained on all roads, except the most temporary tracks, to expedite drainage.

Fire management system

Firebreaks will be opened along all boundaries of planted areas that lie adjacent to unplanted areas in order to minimize the possibility of fire spreading into the plantations from external areas. Firebreaks will be 6 m wide and cleared of vegetation at the onset of the dry season in June and December. Controlled burning and hoeing will be carried out during the operation. The officer in charge will be responsible for ensuring that all safety precautions are adhered to. Where plantations extend to cultivated lands it is only necessary that good liaison is maintained with the land owner and if necessary, assistance is given to him/her to ensure fire safety of the fields.

Preparation of "Fire safety rules" and procurement of equipment shall be completed not later than November of each year.

Preparation and implementation of a forest fire and control plan specifying among other things, area covered, access routes and location of water points and proposals for the construction of new water points shall be done by November of each year. Staff training and public education on the dangers of fire and fire suppression measures for local communities will be held every May and November.

Site species matching

Main species planted are *P. caribaea* and *E. grandis* in addition to indigenous species like *Prunus africana*, *Cidrella ordorata*, *Terminalia brownii/ superba* and *Markhamia lutea* and others. *P. caribaea* and *E. grandis* will be planted on the hill tops and slopes while *Prunus africana and other native species* will be planted in the valley bottoms and sheltered sites. Other species albeit on smaller scale will be *Entandrophragma excelsa*, *Entandrophragma utile, Newtonian buchananii*, *Eucalyptus grandis*, and *Albizzia corriaria*

An area designated as sawlog plantation area will be stocked with mainly timber species that are already introduced and tested in the area. The area under conservation will be enriched using indigenous species/ native species. *Prunus africana* will mainly be used for the bark that has medicinal properties[i]. Pine will be managed on a 20-year rotation cycle. The target diameter for pine is an average of 35 cm DBH.

Plantation establishment

Planning is an integral part of plantation development as the activities are weather dependent and must be carried out timely in order to avoid heavy losses and realize impact/effectiveness. The following are some of the major activities that have/ will be undertaken during plantation establishment.

Survey and compartmentation

The area earmarked for plantation was surveyed and divided into Blocks, compartments and sub-compartments. Also areas not to be planted like natural belts roads and firebreaks were marked off and separated by boundaries, which are 10-20 m wide. These boundaries will, where possible, also be used as roads and firebreaks.

Bush/ initial clearing and ground preparation

The cleared bush and other debris were cut down and collected well ahead of planting. Simple hand tools like machetes were used since the bush is not heavy and does not require use of bulldozers.

Plant spacing, lining out, marking and pitting

Spacing: Planting distance for pines was 3.0m x 3.0m such that the number of plants per ha is not less than 1111. This spacing is cost effective since genetically improved seed of 1st generation from Brazil was used.

Planting

Most of the planting was carried out during April-May rainy season or during the September-November rainy season. The first season (April-May) is more reliable as it is followed by a short dry season and then followed by a longer rainy season (Sept-Oct). By the time the long dry season of Dec-Feb sets in the trees will have established. Hence, most of the future planting will be carried out during this season. Planting will be carried out when moisture build up has been achieved.

All the planting shall be done as quickly as possible; therefore pitting shall be done before the rains start. The plants shall be taken out to the planting site and planted immediately. When planting has been completed, a stock checking shall be done to check that the stocking is correct, and to see if beating up (replacement planting) is necessary.

In drier areas and steep slopes it is important to form a temporary water basin around the base of the tree to encourage water penetration, whenever it rains. In order to eliminate unnecessary cost of replacement planting (blanking) and at the same time to ensure adequate stocking of the crop, replacement planting will normally be done during the same planting season i.e. in the middle of the season when initial planting is carried out. If,

however, there is no surplus of good plants after the major planting, then surplus plants for the next season may be used for planting early during the next rains.

A 10% assessment of survival was carried out two weeks after planting. Assessments were carried out in random plots of 5 by 5 trees in size. Survival of 90% or more for any block was considered adequate under all circumstances and we're not beaten-up except for isolated areas. Where survival was less than 90%, replacement planting was done. In case of failure to carry out replacement planting (beating up) in the same season when planting was done, it would be carried out first in the next season before any major planting is carried out and with the best plants. The details of plantings are in area statement in table.

Area Statement

Table 8: North Rwenzori Plantation Area Statement-Sept 2012

	Total								NFA				PRIVATE			
Block & Cpt	**Total Area**	**Plan-table**	**Planted**	**Un-planted**	**Roads**	**Firebreaks**	**Natural belt/ Con-serva-tion**	**Other**	**To-tal Area**	**Plant-able**	**Planted**	**Un-planted**	**Total Area**	**Plant-able**	**Planted**	**Un-planted**
ITOJO	**823.1**	**758.7**	**414.0**	**344.8**	**2.6**	**0.0**	**64.4**	**0.0**	**691.1**	**626.7**	**394.8**	**232.0**	**132.0**	**132.0**	**19.2**	**112.8**
IT_1	90.6	53.5	10.1	43.5	0.9		37.1	0.0	39.2	2.1	0.0	2.1	51.4	51.4	10.1	41.3
IT_2	107.9	90.6	2.3	88.3			17.2	0.0	106.8	89.6	2.3	87.3	1.0	1.0	0.0	1.0
IT_3	73.1	73.1	8.7	64.3			0.0	0.0	0.2	0.2	0.2		72.8	72.8	8.5	64.3
IT_4	64.1	64.1	64.0	0.0	0.7		0.0	0.0	63.4	63.4	63.3	0.0	0.7	0.7	0.7	
IT_5	57.7	57.7	55.6	2.1	0.9		0.0	0.0	57.7	57.7	55.6	2.1	0.0	0.0	0.0	
IT_6	64.1	64.1	63.7	0.5	0.0		0.0	0.0	64.1	64.1	63.7	0.5	0.0	0.0	0.0	
IT_7	76.9	76.9	72.0	4.9			0.0	0.0	76.8	76.8	72.0	4.8	0.1	0.1	0.0	0.1
IT_8	82.9	82.9	52.4	30.5			0.0	0.0	79.8	79.8	52.4	27.4	3.1	3.1	0.0	3.1
IT_9	110.8	110.8	1.2	109.6			0.0	0.0	108.8	108.8	1.2	107.6	2.0	2.0	0.0	2.0
IT_10	71.7	66.5	65.4	1.0			5.3	0.0	70.9	65.6	65.4	0.2	0.8	0.8	0.0	0.8
IT_11	23.3	18.5	18.5	0.0			4.8	0.0	23.3	18.5	18.5		0.0	0.0	0.0	
KYAMU TEMA	**693.5**	**598.4**	**598.4**	**0.0**	**5.9**	**4.5**	**95.1**	**0.0**	**693.0**	**597.8**	**597.8**	**0.0**	**0.5**	**0.5**	**0.5**	
KY_1	63.2	52.6	52.6	0.0	1.0	0.8	10.6	0.0	63.2	52.6	52.6		0.0	0.0	0.0	

	Total								NFA				PRIVATE			
Block & Cpt	**Total Area**	**Plan-table**	**Planted**	**Un-planted**	**Roads**	**Firebreaks**	**Natural belt/ Con-serva-tion**	**Other**	**To-tal Area**	**Plant-able**	**Planted**	**Un-planted**	**Total Area**	**Plant-able**	**Planted**	**Un-planted**
KY_2	62.7	58.2	58.2	0.0	0.2	0.5	4.6	0.0	62.7	58.2	58.2		0.0	0.0	0.0	
KY_3	71.2	55.2	55.2	0.0	0.2	0.9	16.0	0.0	71.2	55.2	55.2		0.0	0.0	0.0	
KY_4	55.6	51.9	51.9	0.0	0.1	1.3	3.7	0.0	55.6	51.9	51.9		0.0	0.0	0.0	
KY_5	78.2	65.0	65.0	0.0	0.0	0.1	13.2	0.0	78.2	65.0	65.0		0.0	0.0	0.0	
KY_6	48.0	41.2	41.2	0.0	0.2	0.5	6.8	0.0	48.0	41.2	41.2		0.0	0.0	0.0	
KY_7	34.4	31.4	31.4	0.0		0.5	3.0	0.0	34.4	31.4	31.4		0.0	0.0	0.0	
KY_8	25.3	18.9	18.9	0.0			6.4	0.0	25.3	18.9	18.9		0.0	0.0	0.0	
KY_9	44.7	36.3	36.3	0.0	0.2		8.3	0.0	44.7	36.3	36.3		0.0	0.0	0.0	
KY_10	39.3	30.3	30.3	0.0	0.3		9.1	0.0	39.3	30.3	30.3		0.0	0.0	0.0	
KY_11	48.5	45.5	45.5	0.0	0.9		3.1	0.0	48.5	45.5	45.5		0.0	0.0	0.0	
KY_12	45.3	40.5	40.5	0.0	0.5		4.8	0.0	44.7	39.9	39.9		0.5	0.5	0.5	
KY_13	43.7	38.6	38.6	0.0	1.4		5.1	0.0	43.7	38.6	38.6		0.0	0.0	0.0	
KY_14	33.4	32.9	32.9	0.0	1.0		0.6	0.0	33.4	32.9	32.9		0.0	0.0	0.0	
MUNGILO	**809.5**	**11.4**	**11.4**	**0.0**	**5.7**	**0.0**	**798.2**	**0.0**	**798.2**	**0.0**	**0.0**	**0.0**	**11.4**	**11.4**	**11.4**	
MU_1	339.6	0.0	0.0	0.0	4.0		339.6	0.0	339.6	0.0	0.0		0.0	0.0	0.0	
MU_2	293.4	11.4	11.4	0.0	0.9		282.0	0.0	282.0	0.0	0.0		11.4	11.4	11.4	
MU_3	176.6	0.0	0.0	0.0	0.8		176.6	0.0	176.6	0.0	0.0		0.0	0.0	0.0	
NGISI	**562.4**	**538.6**	**312.8**	**225.8**	**1.1**	**2.6**	**23.0**	**0.8**	**481.6**	**457.8**	**232.1**	**225.7**	**80.8**	**80.8**	**80.7**	**0.1**
NG_1	36.8	34.5	34.5	0.0	0.5	0.6	1.6	0.77	36.8	34.5	34.5		0.0	0.0	0.0	

	Total								NFA				PRIVATE			
Block & Cpt	**Total Area**	**Plan-table**	**Planted**	**Un-planted**	**Roads**	**Firebreaks**	**Natural belt/ Con-serva-tion**	**Other**	**To-tal Area**	**Plant-able**	**Planted**	**Un-planted**	**Total Area**	**Plant-able**	**Planted**	**Un-planted**
NG_2	59.6	53.2	53.2	0.0	0.6	0.5	6.4	0.0	59.6	53.2	53.2		0.0	0.0	0.0	
NG_3	34.0	33.3	33.3	0.0		0.2	0.7	0.0	34.0	33.3	33.3		0.0	0.0	0.0	
NG_4	67.7	66.5	27.8	38.7		0.4	1.2	0.0	67.7	66.5	27.8	38.7	0.0	0.0	0.0	
NG_5	54.1	53.4	10.4	43.0		0.1	0.6	0.0	43.7	43.0	0.0	43.0	10.4	10.4	10.4	
NG_6	76.3	73.6	43.7	29.9	0.0	0.6	2.7	0.0	32.5	29.8	0.0	29.8	43.8	43.8	43.7	0.1
NG_7	45.3	45.3	0.0	45.3			0.0	0.0	45.3	45.3	0.0	45.3	0.0	0.0	0.0	
NG_8	38.5	38.5	6.6	31.9			0.0	0.0	31.9	31.9	0.0	31.9	6.6	6.6	6.6	
NG_9	48.1	45.2	31.4	13.8		0.1	2.9	0.0	45.6	42.7	28.8	13.8	2.6	2.6	2.6	
NG_10	61.7	54.8	54.8	0.0			6.9	0.0	61.4	54.5	54.5		0.3	0.3	0.3	
NG_11	40.3	40.3	17.1	23.2			0.0	0.0	23.2	23.2	0.0	23.2	17.1	17.1	17.1	
NYABISOKOMA	**652.7**	**601.3**	**445.2**	**156.4**	**3.5**	**0.0**	**41.1**	**10.0**	**454.5**	**403.1**	**403.4**	**0.0**	**198.3**	**198.3**	**41.8**	**156.4**
NY_1	40.2	39.5	39.8	0.0	0.6		0.0	0.3	40.2	39.5	39.8		0.0	0.0	0.0	
NY_2	30.4	30.4	30.4	0.0	0.3		0.0	0.0	30.4	30.4	30.4		0.0	0.0	0.0	
NY_3	28.1	28.1	28.1	0.0	0.2		0.0	0.0	28.1	28.1	28.1		0.0	0.0	0.0	
NY_4	57.0	57.0	56.8	0.2	0.5		0.0	0.0	55.9	55.9	55.9		1.1	1.1	0.9	0.2
NY_5	68.1	56.0	55.9	0.1	0.2		2.5	9.7	68.0	55.9	55.9		0.1	0.1	0.0	0.1
NY_6	40.5	31.9	0.0	31.9			8.6	0.0	8.6	0.0	0.0		31.9	31.9	0.0	31.9
NY_7	45.2	32.0	19.7	12.2			13.2	0.0	13.2	0.0	0.0		32.0	32.0	19.7	12.2
NY_8	70.7	61.6	61.6	0.0	0.2		9.2	0.0	70.7	61.6	61.6		0.0	0.0	0.0	
NY_9	71.8	70.5	70.5	0.0	0.6		1.3	0.0	71.8	70.5	70.5		0.0	0.0	0.0	

	Total								NFA				PRIVATE			
Block & Cpt	**Total Area**	**Plan-table**	**Planted**	**Un-planted**	**Roads**	**Firebreaks**	**Natural belt/ Con-serva-tion**	**Other**	**To-tal Area**	**Plant-able**	**Planted**	**Un-planted**	**Total Area**	**Plant-able**	**Planted**	**Un-planted**
NY_10	34.3	28.1	1.7	26.4			6.2	0.0	6.2	0.0	0.0		28.1	28.1	1.7	26.4
NY_11	42.0	41.8	2.0	39.8			0.2	0.0	0.2	0.0	0.0		41.8	41.8	2.0	39.8
NY_12	70.1	70.1	26.9	43.2	0.5		0.0	0.0	9.5	9.5	9.5		60.6	60.6	17.5	43.2
NY_13	54.4	54.4	51.8	2.7	0.4		0.0	0.0	51.8	51.8	51.8		2.7	2.7	0.0	2.7
Grand Total	**3541.3**	**2508.4**	**1781.8**	**727.0**	**18.7**	**7.1**	**1021.8**	**10.8**	**3118.3**	**2085.4**	**1628.0**	**457.7**	**423.0**	**423.0**	**153.7**	**269.3**

Plantation maintenance

Weeding

The first three years are particularly crucial. By the third year the conifer species will begin to close canopy and there is no more need for weeding. Different types of weeding operations can be applied depending on the site. Timely weeding ensures faster initial growth. Weeding is normally by herbicide spray, hoeing and slashing. The frequency and sequence of operations will be varied according to local conditions.

Table 9: Weeding activities during plantation maintenance

ACTIVITY	REMARKS
Pre-plant spraying	5 to 6 litres of Glyphosate per ha depending on type of weed
Spot hoeing	Cover a radius of 0.5 m from the planted trees.
Clean slashing	At most 10cm from the ground
Strip hoeing	1 m width within the rows
Strip slashing	2 m width within the rows
Sprout cutting	Mainly in savannah areas
Post plant spraying	4 to 5 litres per ha

Clean weeding is needed in order to maintain a fast growing and healthy plantation and is carried out as early as possible to ensure that there are no weeds and that the ground is kept free of all weeds be they grasses or other herbs, coppicing trees and climbers.

Selected agricultural crops like legumes could considerably reduce costs of weeding, improve fertility, aeration through tillage in addition to food and income for farmers but poor supervision of farmers may greatly affect the growth of desired tree crops. Therefore, this practice will not be encouraged in the planted area.

Climber cutting

Climbers grow faster than the desired trees and end up strangling them. They will therefore be continuously uprooted whenever they are sighted. The initial high stocking is intended to promote apical growth. However, in later years, thinning will be carried out to promote radial growth.

Tending operations

Pruning: Involves removal of lower live branches from a tree that is meant for timber production and ensures that the proportion of large stems with clear timber is maximised to fetch a premium price on the market. Usually 4 to 5 m high prunings need to be carried out depending on the desired knot free bole length. Each subsequent higher

pruning operation will raise the pruned height by 2 to 3m. The main objectives of pruning are to:

- Produce 'clear wood' that is knot-free fetching a premium price on the market
- Improve access within the plantation (access pruning)
- Reduce risk of fire spread by preventing the spread of ground fires into the crowns

Pruning is expensive, therefore only the final crop trees (for higher prunings) should be pruned.

1st pruning ***(Rodent)*** **or** ***Low pruning*** to 25% of the tree height when trees are about 2-3 years old. This type of pruning is done at an early age and is simply correcting malformations to ensure the development of straight trees. It is more effective when these branches are small. It includes reducing the number of leaders to one where trees have multiple leaders; because the size of the green crown of the tree affects growth, it is important not to remove too many branches at any one time. It is also carried out when rats become serious vermin and are damaging the trees especially by feeding on bark at the base of trees. The objective is to remove lower branches and expose the hiding places at the base of trees, so that rats are exposed to their enemies, large birds.

2nd pruning also known as ***Access pruning*** to 2m high of all trees when trees are about 6 years old. Lower branches of trees are removed up to 2m, up the stems of trees. The purpose of this pruning is to enable staff to enter the plantation easily and carry out silvicultural operations. No more than half of the green crown should be removed at any one time. In the 2nd stage of pruning the tree should be pruned to leave a crown length of 3-4m. Therefore the mean height of the trees should be approximately 6-7m. This should allow the target Diameter Over Stub to be achieved. Pruning should start from the lowest branches and continue up the stem working around the tree.

Table 10: Pruning of conifer plantation trees

TABLE OF PRUNING	PRUNING HEIGHT	AGE YEARS	NO. OF TREES/HA TO BE PRUNED
Rodent pruning	Correction of malformations	2-3	All
Access pruning	2 metres	6	700-800
1st high pruning	4 "	8	700-800
2nd high pruning	6 metres	10	500-600
3rd high pruning	8 metres	12	300-400
4th high pruning	10	14	300-400

The 1st 2nd 3rd and 4th prunings are aimed at producing Knot free wood in conifers. The branches, most of which grow around the stem in clusters called whorls, need to be pruned. After pruning, the branch stubs occlude (or grow over). To hasten occlusion, the branch stubs left after pruning should be short, but not so short as to damage the branch collar. Cutting the branch too close to the stem not only damages the branch collar but also increases the size of the wound and delays occlusion. The wounds from pruning bigger branches take longer to occlude than small ones. Generally, there is a 1.5 cm occlusion scar before the wound is fully healed, but once the branch stubs have occluded clear wood is produced. The appearance of the whorls on the bark will persist long after the branches have been pruned but clear wood will continue to be produced. When these branches are removed, the diameter of the pruned stem determines the size of the 'defect core', which is the inner cylinder of the tree containing the branch stubs and occlusion scars as well as any bends in the pruned stem.

Minimising the diameter over the stubs of the defect core maximises the volume of clear wood available. The size of the defect core is a compromise between producing as much clear wood as possible while not penalising the growth of the tree by pruning too much or too early.

The 3rd high pruning will be up to about 8 m, while the 4th high pruning will be up to about 10 m which will enable production of standard knot free timber from the first two logs. Preferably, all prunings will be carried out at the beginning of the rainy season and will not cover trees destined for subsequent thinning. Pruning of stems with a diameter less than 10 cm shall be avoided. The area will be slash-weeded before pruning.

Thinning

Thinning aims at increasing the stand volume of the individual trees to efficiently produce logs for timber production. The best performing trees are left with sufficient crown space to grow and achieve the desired diameter dimension as quickly as possible.

The first thinning will be done at the age 6 years. About 30% of the trees will be removed leaving the stocking at 700-800 trees per ha.

The second thinning will be done at the age 10 years leaving the stocking at 500 to 600 trees per hectare with an average yield of 21 m3 per ha.

The third and last thinning will be done at the age 14 years leaving the stocking at 350 to 450 trees per hectare which will generate commercial volume estimated at 34m^3 per hectare (Refer to table 1-yield table for *Pinus caribaea* in Uganda). This will help recover some of the costs that go into establishment and protection. *Pinus caribaea* has small conical crowns and therefore 400 to 500 trees/ha will be removed during the second thinning leaving about 300 to 400 trees per hectare. The thinning regime will have no deleterious effect on height or diameter growth on the final crop for harvesting at 25 years. The thinning schedule will be as shown in table 11.

Table 11: Thinning Schedule for Conifers

ACTIVITY	AGE (YEARS)	NUMBER REMOVED	NUMBER LEFT STANDING
First Thinning	6	250	700-800
Second Thinning	10	200	500-600
Third Thinning	14	150	350-450

During the first thinning good distribution, on ground and canopy spacing between the individual trees will be a key consideration. The objective of this thinning regime is to achieve good, straight sawlogs of average DBH of about 30-45 cm at rotation of age of 25 years.

All the activities involved in plantation establishment and their timing are shown in table 12

Table 12: Activities involved in plantation establishment, their frequency and scheduling.

YEAR	OPERATION	REMARKS
1	Survey and sub divide into compartments	Using GPS
	Clear bush and burn	Manual
	Line out and mark	
	Pit	25 to 30 cm depth and width
	Seedlings procurement	Transport seedlings using appropriate crates

YEAR	OPERATION	REMARKS
1	Pre –planting spraying	5 to 6 litres of glyphosate such as 'Mamba' or 'Round up' per hectare
	Planting	Twice a year during the rainy season.
	Spot hoeing/Strip hoeing	Three times
	Slashing/ Strip slashing	Three times
	Sprout cutting	
	Post-planting spray	4 litres of 'Mamba' or 'Round up' per hectare
2	Spot hoeing	Twice
	Slashing	Twice
	Post-planting spraying	3 litres of glyphosate such as 'Mamba' or 'Round up' per hectare
3	Slashing	Once
	Climber cutting	Once
4	Climber cutting	Twice
5-6	Climber cutting, Marking for pruning and Thinning	Pruning to 2m high of the tree height and Thin leaving 700-800 stems per Ha
10	Marking for Thinning (commercial)	Thin leaving 500-600 stems per Ha
14	Marking for Thinning (commercial)	Thin leaving 350-450 stems per Ha
1-25	Fire protection	Per year till clear felling
	Roads construction (approx. cover=3% of total area)	
	Roads maintenance	Every 5 years

Protection

Fire Protection

Fire protection will be carried out every dry season. The most severe dry season is December to March while June to August is less severe. The external boundary will be clean hoed during the dry season. Controlled burning around the plantation will be carried out at the beginning of the dry season. Funds allowing, a simple fire tower needs to be constructed at one of the highest points and has to be guarded during the dry season. People surrounding the plantation have to be sensitised about the dangers associated with fires and how to handle fires. The plantation area will be patrolled during the dry season.

Protection against vermin and domestic animals

There is normally no serious threat from wild animals except for bush bucks browsing on tender shoots of pines, which can easily be controlled. Therefore, the planted area has to be protected from grazers employing a patrol person or sensitizing the grazers.

Protection against Pests and Diseases

There are no serious threats anticipated on pines. However, NFA will work together with the National Forestry Resources Research Institute (NaFORRI) and Makerere University Kampala (MUK) to carry out monitoring and research on disease and pest problems in pines.

Harvesting

Final harvesting is expected to start after the crop has attained desired girth. On average, 100 ha. will be harvested annually. The harvested areas will be replanted the following year.

Table 13: Projected harvested volume (m3 Under bark) for North Rwenzori (2006-49)

Economic Assumptions	
Stumpage	**Amount (Ushs)**
1st Thinning	0
2nd Thinning	20,000
3rd Thinning	40,000
Final Felling	80,000

Silvicultural Assumptions		**Remarks**
	Vol (M3 10cm Top diam UB)	
1st Thinning	7.1	Thin to waste due to difficult terrain
2nd Thinning	20.6	Convert thinning to timber
3rd Thinning	34.2	
Final Felling	346	

Planting/ harvest year	**Area (ha)**	**Harvest Volume**				**Amount (Ushs)**
		1st Thinning	**2nd Thinning**	**3rd Thinning**	**Harvest year**	
2006	21.5					
2007						
2008						
2009						
2010	454.2					
2011	1,043.2					
2012	92.6	153.3				-
2013	51					0
2014	51					0

Planting/ harvest year	Area (ha)	Harvest Volume				Amount (Ushs)
		1st Thinning	2nd Thinning	3rd Thinning	Harvest year	
2015	51					0
2016	51	3,239.5				-
2017	51	7,441.2	3,165.5			63,309,070
2018	51	660.6				-
2019	51	363.8				-
2020	51	363.8	9,377.5			187,550,828
2021	50	363.8	21,540.2	736.0		460,241,877
2022		363.8	1,912.3			38,245,110
2023		363.8	1,053.1			21,061,372
2024		363.8	1,053.1	15,552.0		643,141,095
2025		363.8	1,053.1	35,722.9		1,449,976,661
2026		363.8	1,053.1	3,171.3		147,915,024
2027		356.7	1,053.1	1,746.4		90,918,981
2028		-	1,053.1	1,746.4		90,918,981
2029		-	1,053.1	1,746.4		90,918,981
2030		-	1,053.1	1,746.4		90,918,981
2031		-	1,032.4	1,746.4		90,506,013
2032				1,746.4	7,439.3	35,257,829,808
2033				1,746.4		69,857,609
2034				1,746.4		69,857,609
2035				1,712.2		68,487,852
2036					157,205.7	12,576,453,438
2037					361,101.0	28,888,076,480
2038					32,057.2	2,564,573,308
2039					17,653.7	1,412,296,430
2040					17,653.7	1,412,296,430
2041					17,653.7	1,412,296,430
2042					17,653.7	1,412,296,430
2043					17,653.7	1,412,296,430
2044					17,653.7	1,412,296,430
2045					17,653.7	1,412,296,430

Planting/ harvest year	Area (ha)	Harvest Volume				Amount (Ushs)
		1st Thinning	2nd Thinning	3rd Thinning	Harvest year	
2046					17,653.7	1,412,296,430
2047					17,307.6	1,384,604,344
2048					0	0
2049					0	0
Total	**2,048**	**14,762**	**45,452**	**70,866**	**716,340**	

6.2. Activities under the Biodiversity conservation and protection management circle

General

This will cover areas of the reserve that are wetlands or natural forests or intact woodlands. This circle is about 1,022 Ha. The following activities will be undertaken under the biodiversity conservation and protection management circle.

To maintain and where possible enhance the biological and nature conservation values

(i) Anthropogenic activities (i.e. human related non- permissible activities) shall be controlled to below 10% of baseline. First an assessment of all the human caused threats shall be made and a baseline established. Using the base line information the activities will be geared towards reduction of the threats.

(ii) Regular monitoring shall be done in all parts of the conservation area to ensure it is protected.

To retain and enhance soil and water quality the following activities shall be done:

(i) An area of natural forest stand shall be maintained and some restoration (enrichment) planting shall be done. First, an assessment of the stocking (diagnostic sampling) shall be done and species suitable and appropriate to enrich the natural wood land identified. Then the identified species shall be planted in the woodland in areas where canopy opening and gap sizes permit.

(ii) During the establishment of roads, landings, bridges and other forest earth works, care shall be taken to adhere to the guidelines for their establishment and maintenance. Heavy machine use will be restricted to what is prescribed.

To maintain forest health and protect the forest the main activities shall be to:

(i) Control the occurrence or spread and increase in populations of weeds, pests, insect and fungal attacks that are above what is expected of a natural stand.

(ii) Monitor and manage fire in cooperation with adjacent communities.

To integrate community forest needs into forest management activities by:

(i) Supporting communities to protect the natural forest from illegal activities

(ii) Working with communities to promote natural forest regeneration

(iii) Supporting livelihoods of communities through forestry activities which are in line with the National Forestry and Tree Planting Act 2003

To increase the area planted for timber production within the biodiversity conservation and protection management circle, the following are planned:

(i) All the area found suitable for enrichment (restoration) planting shall be fully planted by the 10th year of this management plan.

(ii) Timber volumes expected from the biodiversity conservation and protection management circle shall be calculated.

Establish and maintain research plots

(i) Research plot establishment and assessments within the biodiversity conservation and protection management circle shall be done.

Management of natural forests

The prime function of the natural forests will be the protection of watersheds and the prevention of the spread of fire from adjacent agricultural land into the plantation areas. At the same time a programme of enrichment planting will be undertaken to allow the possibility of sustainable broad-leaved timber supply.

Planting of hardwood will also take place along the edge of the natural forest boundary. This will have the dual effect of clarifying management boundaries and of acting as a buffer zone between natural forest and softwood areas where in the past there has been a great deal of suppression by weed invasion emanating from the natural forest.

All enrichment planting will be undertaken using 2 m striplings at a spacing of 4 x 5 m with the canopy above being opened by girdling of adjacent trees providing they are of no current commercial species. The species used in planting will be *Prunus africana*, *Cidrella ordorata*, *Entandrophragma excelsum, Newtonia buchananii,* and *Albizia corriaria* among others.

Timber production from natural forests

The natural woodland areas shall be those areas designated as natural woodland areas and mapped. To obtain a maximum sustainable yield of high quality broad-leaved saw logs, appropriate species shall be tended or planted in the diagnostically sampled areas. The area will strictly be managed as a natural buffer and no harvesting will be expected,

Watershed protection

All areas designated, as wetlands shall be marked on the ground and managed for watershed.

Biodiversity conservation

The biological biodiversity management activities are aimed at maintaining and where possible enhancing biological and nature conservation values of the natural belts and other areas sharing the delivery of biodiversity services.

New studies directed at assessing and updating the biological diversity knowledge amongst plants and other selected taxa within the forest for the natural belts and other conservation areas will be requested every June from universities, research institutions and from other suitably qualified institutions and individuals. Area of natural forest stand and some selected valley bottoms shall be maintained and where possible enhanced by restoration planting with appropriate species.

6.3. Management Activities within the community and private sector working circle

General

This will cover areas of that will involve community and private sector participation in the implementation of the management objectives. They include those areas designated as community planting and areas allocated to private tree planters.

To plant and raise trees on land allocated to communities in accordance with acceptable standards

(i) All the area classified for planting under community and private sector management circle should be fully planted by the 5th year of this management plan. This area is 200 Ha.

(ii) The communities shall be assisted to calculate and monitor the timber volumes expected from community and private sector management circle.

(iii) Timber volumes produced should be within the range expected of the area planted.

(iv) All area licensed to private businesses for timber production is planted by the 10th year of this management plan.

To promote natural forest regeneration communities will:

(i) stop grazing in CFR through enactment and enforcement of by-laws

(ii) Prevent fires by establishing fire breaks along the boundary, sensitizing the community and patrolling for fire out breaks

(iii) Reduce illegal felling of trees and saplings by conducting joint patrols

(iv) Enhance tree planting in natural forest belts through affirmative (enrichment planting) silviculture

(v) Regulate use of forest products for domestic purposes by allocating specific days and quantities for extraction

(vi) Domesticate some herbal trees and animals

(vii) Obtain licenses for extraction of forest products

(viii) Enhance public relations through exchange visits, talk shows and newsletter articles

(ix) Sensitise people so as to develop a sense of ownership for the forest

(x) Create alternative methods to reduce overuse of resources in the natural forest e.g. Improved Energy Saving Devices (IESDs), bee keeping etc

To protect natural forest from illegal activities communities will:

- avoid wildfires by making fire lines and participate in fire fighting
- initiate and promote use of improved energy saving devices
- establish private woodlots on-farm
- encourage the practice of zero-grazing
- carry out joint patrols to protect the forest
- advise forest users to get permission in form of license
- compile and submit quarterly reports on illegal activities to NFA
    - holding regular workshops with technical people on forest management
- put in place a patrol team to work hand in hand with the NFA.

To support community livelihood activities compatible with forestry, the NFA shall work with communities to:

- Sensitise the community about importance and uses of forests
- Sensitise people on government policy and legislation on forests
- Encourage women to establish on-farm herbal gardens

- Oversee inventory and monitor stocking of trees in the CFR to control community harvesting
- Sensitise people on protecting the CFR against damage, for example by fire, grazing etc
- Control movement of children and adults in the CFR to minimize unnecessary and careless damage
- Promote and construct IESDs
- Carry out selective and controlled harvesting of minor forest products like sticks, craft materials etc
- Identify watering sources and discuss with NFA officials on the best way of accessing watering points

6.4. Collaborative forest management agreements

In general, cooperation and collaboration in management of North Rwenzori Forest Reserves is vital to the successful implementation of this FMP. There are three management circles covering different areas of the reserve. There is therefore need for collaboration of everybody involved namely the community residing close to the reserves, small-scale commercial planters and NFA. Each of these has an important role to play, if the expected benefits are to be achieved.

Both the NFA and private tree planters expect to raise tree crops from which reasonable profit will be obtained at the end of the production period. This will not be possible without close cooperation and collaboration in protection against annual fires, vermin, diseases and theft. Such activities can render the investment in tree planting null, but if all cooperate, there will be mutual gain. It is prescribed that collaborative forest management negotiations be initiated with all the interested members of the community and CFM agreements be signed as the basis of this collaboration.

6.5. Research

Initial permanent sample plots shall be determined on the management plan map and marked on the ground by 31st December 2012 . Permanent sample plots (PSPs) shall be regularly measured NFA and results included in the Yield Model for the area under this management plan.

6.2. Conservation working circle (CWC)

General

This will cover areas of the reserve that are wetlands or natural forests or intact woodlands. This circle is about 1265 Ha. The following activities will be undertaken under the biodiversity conservation and protection management circle.

Objectives of the conservation working circle:

1. To maintain and where possible enhance the biodiversity values.

2. To protect soil and water quality.

3. To study ecological conditions particularly in fragile areas to promote recovery of ecosystems.

Assessment of all the human caused threats shall be made and a baseline established. Human related threats shall be controlled to below 10% of baseline. (Prescription)

Regular monitoring shall be done in all parts of the conservation area to ensure it is protected.

The prime function of the natural forests will be the protection of watersheds and the prevention of the spread of fire from adjacent agricultural land into the plantation areas. At the same time a programme of enrichment planting will be undertaken to restore ecological services.

Planting of fast growing hardwood species shall take place along the edge of the natural forest .(prescription). This will have the dual effect of clarifying management boundaries and of acting as a buffer zone between natural forest and softwood areas where in the past there has been a great deal of suppression by weed invasion emanating from the natural forest.

The recommended species for planting shall be *Prunus africana*, *Cedrella odorata*, *terminilia brownii* and *Albizia corriaria* among others.

An area of natural forest stand shall be maintained and some restoration (enrichment) planting shall be done after diagnostic sampling.

During the establishment of roads, landings, bridges and other forest earth works, care shall be taken to adhere to the guidelines for their establishment and maintenance. Heavy machine use will be restricted to what is prescribed.

Control the occurrence or spread and increase in populations of weeds, pests, insect and fungal attacks that are above what is expected of a natural stand.

All the area found suitable for enrichment (restoration) planting shall be fully planted by the 10th year of this management plan.

Research plot establishment and assessments within the conservation working circle shall be done.

The natural woodland areas shall be surveyed and mapped.

All areas designated, as wetlands shall be marked on the ground and managed for conservation.

Studies shall be promoted to assess and update biological diversity data in collaboration with other research and education institutions.

Community livelihoods working circle (CLWC)

This will cover areas surrounding the forest and those allocated to communities within the forest. Collaborative Forest Management (CFM) has been initiated with 5 groups participating. CFM agreements shall be the basis for partnership between NFA and communities.

Objectives of the working circle.

1. **To develop and implement collaborative partnerships with communities to promote conservation and livelihoods**
2. **In collaboration with other institutions support communities adjacent to forest reserve to plant trees or engage in other initiatives for income generation**

NFA shall engage communities to protect and restore the natural forest (prescription)

NFA in collaboration with other development agencies shall train communities in forestry management and forest based enterprise development (prescription)

NFA shall engage adjacent communities to Monitor and manage fire(prescription)

The 150 ha classified for planting under collaborative forest management shall be fully planted by the 5th year of this management plan. (Prescription)

NFA shall work with the District, sub county local Governments to enact and enforce relevant by-laws to support forest management

NFA shall promote community awareness and conservation education with emphasis on youth, women and other interest groups (prescription)

Tree planting is an income generating activity and this will provide a menu of livelihoods options that include employment and improved source of income. Community members shall be prioritised for contracts for most of the tree planting activities such bush clearing, lining, pitting and planting.

Communities and stakeholders shall participate in planning and decision making.

NFA shall establish mechanism for regular consultation and sharing of information with communities and related stakeholders.(prescription)

6.5. Research

Permanent sample plots shall be determined on the ground and marked on management plan map 31st December 2012 for each crop above 3 years. Permanent sample plots (PSPs) shall be regularly measured NFA and results included in the Yield Model for the area under this management plan.

Recreation Working Circle

North Rwenzori CFR is comprised of many undulating hills with a steep gradient. the valleys have natural vegetation belts which enhance the beauty and provide a home for birds and other wild life . The combination of these hills and the narrow valleys provide beautiful scenery as well as panoramic view of the surrounding low lands. The surrounding communities also have rich cultural that can offer tourism opportunities including dances,traditional sites and traditional cuisine**.**

The study shall be done within the first two years with the purpose of assessing the potential for ecotourism development.

Ecotourism attraction shall include hiking, scenery, bird viewing and cultural aspects among others.

The medium term strategy shall be to link the ecotourism site to Semuliki, Rwenzori, Queen Elizabeth National Park Network.

Tourists' camps shall be established at strategic points in collaboration with the private sector and the local communities**.**

7. MITIGATION OF ENVIRONMENTAL AND SOCIAL IMPACTS

The terrain on which this reserve occurs is very steep and therefore susceptible to soil erosion and degradation resulting into reduced productivity of the sites. Most of the hills has been subjected to annual bush burning and grazing which has contributed to loss of natural vegetation except in the valleys and the northern part of the reserve towards Semliki national park. Tree planting activities on the slopes shall be carried out along the contour to minimise soil erosion.

All the natural belts shall be conserved. The natural belts along the valleys and streams shall be conserved at a distance of at least 20m on either side of the stream.

Where no natural vegetation occurs in a valley or stream, fast growing indigenous tree species shall be planted to a distance of 20 metres on either side of each stream.

Staff of the NFA shall regularly monitor authorised activities for compliance with environmental standards.

Cattle may be allowed access to watering points within the reserve, but such watering areas shall be well managed to ensure that livestock owners adhere to established guidelines.

Use of agrochemicals such as herbicides shall strictly follow guidelines on NEMA guidelines to ensure that water sources are not polluted by such herbicides.

Community members shall be prioritised for contracts for most of the tree planting activities such bush clearing, lining, pitting and planting to strengthen partnerships and reduce conflicts.

Fire management mechanisms shall emphasise prevention through community involvement, infrastructural development and fire management equipment.

Vegetation barriers shall be established to reduce spend of run offs at specified intervals.

Exotic species shall only be introduced after establishing that they will not be invasive and any invasive species shall be timely controlled.

8. MANAGEMENT AND LOGISTICS

8.3. Organisational structure

The structure of the management of North Rwenzori management plan area will be similar to one of the NFA. The implementation of the management plan is the responsibility of the Executive Director of the NFA. In the field s/he will be represented by the various line staff concerned with the management of forest resources in general and plantations development in particular. The day-to-day activities will be managed by the field staff posted to manage the forest reserve.

8.4. Required infrastructure

The infrastructure requirements include roads and housing for staff. The road requirements are summarised in Section 6 of this management plan. Housing and staff infrastructure needs are presented in the sections below.

Staffing

Management of North Rwenzori CFRs requires 7 employees namely; 2 Transport Assistants 2 Forest supervisors, 1 Sector Manager, 1 Plantation/Range manager and 1 Accountant.

Contractors

All operational activities in the CFR will be undertaken by private contractors. The NFA staff will monitor their performance and will support them to take over more and more management tasks.

Offices and housing

There is need to establish 2 new forest stations. The old forest station at Karuguttu has grown old beyond repair. The two stations will be equipped with the necessary furniture and equipment for the smooth running of activities in the two reserves. The office at Karuguttu will be provided with a solar panel to provide electricity.

Vehicles

Two Motor vehicles and a tractor will be procured and maintained. Three motorcycles will be procured for effective patrolling of the forest reserve.

Equipment and tools

Equipments required among others include machetes, axes, planting trowels, wheel barrows, watering cans, fire protection equipment, spray pumps, hoes, pick axes, GPS, etc.

9. FINANCIAL FORECAST

9.3. Expected cost and revenues

The management has considered a period of 44 years that would enable planting up all the plantable area and harvesting and replanting harvested areas in order to ensure forest sustainability. A summary of the main costs up to 2012 is as shown in table below.

Table 14: North Rwenzori Forest Management Plan summary costs for up to 2012

	2006	2007	2008	2009	2010	2011	2012
Planning, Monitoring & Environmental Safeguards	5,500,000	1,500,000	500,000	500,000	4,730,000	43,780,300	122,380,668
Plantation maintenance	24,338,000	8,600,000	8,600,000	8,600,000	355,914,551	1,843,362,621	1,135,770,767
Salaries	15,708,000	15,708,000	15,708,000	15,708,000	103,564,560	103,564,560	107,624,560
Administrative overhead costs	2,400,000	2,400,000	2,400,000	2,400,000	25,828,000	110,309,784	51,804,922
Capital costs	8,419,760	0	0	0	22,561,488	526,858,104	263,189,714
Total Costs	**56,365,760**	**28,208,000**	**27,208,000**	**27,208,000**	**512,598,599**	**2,627,875,369**	**1,680,770,631**

9.4. Cash-flow and financing needs

The funds for the implementation of the plan for the period 2010 to 2012 have been provided by the World Bank under the Environmental Management Capacity Building Project (EMCBPII) Credit that is expected to provide about US$ 1.824 million to cover the first three years. It s assumed that NFA will provide the rest of the investment and running costs either through access of more credits or grants and or re-investing of some of the harvesting proceeds from existing mature plantations from other Central Forest Reserves. In addition, NFA intends to enter into financing agreements such as the Bio Carbon Fund of the World Bank or the Voluntary Carbon Market. This will allow reaching the harvesting period when substantial revenue will be collected to ensure replanting and continuity. It is the policy of NFA that areas under plantations must be immediately replanted as soon as they are harvested. Hence the plans envisions management of the area to periods beyond 3 rotations (60 years and above) to give assurance to financial partners that there will continuous fixation of GHG for a long time.

Financing the management plan will through the Credit allocated to Government of Uganda under the Environmental Management Capacity Building Project (EMCBPII) that has provided finance worth US $ 1.8 million to fund the establishment, infrastructure, project vehicles, boundary re-survey and marking costs as well staff training, by

NFA's own revenue some of which will be from the two reserves. Other sources of financing will be from the sale of verified emission reductions from Clean Development Mechanism (CDM) or the Voluntary Market (VCS).

Table 15: Summary of the forward cash flow and financial requirements for North Rwenzori CFR without any carbon revenues

Year	Planted area (ha)	Expenditure/ Projected Expenditure						Projected revenue (Ushs)	Net benefit (Ushs)
		Planning, Monitoring & Environmental Safeguards	Plantation maintenance	Salaries	Administrative overhead costs	Capital costs	Total costs		
2006	21.5	5,500,000	24,338,000	15,708,000	2,400,000	8,419,760	56,365,760	0	- 56,365,760
2007		1,500,000	8,600,000	15,708,000	2,400,000	8,419,760	36,627,760	0	- 36,627,760
2008		500,000	8,600,000	15,708,000	2,400,000	8,419,760	35,627,760	0	- 35,627,760
2009		500,000	8,600,000	15,708,000	2,400,000	8,419,760	35,627,760	0	- 35,627,760
2010	454.2	4,730,000	355,914,551	103,564,560	25,828,000	8,419,760	498,456,872	0	- 498,456,872
2011	1,043.2	43,780,300	1,843,362,621	103,564,560	110,309,784	8,419,760	2,109,437,025	0	- 2,109,437,025
2012	92.6	122,380,668	1,135,770,767	107,624,560	51,804,922	8,419,760	1,426,000,677	0	- 1,426,000,677
2013	51	5,000,000	708,679,223	101,354,560	70,937,200	8,419,760	894,390,743	0	- 894,390,743
2014	51	5,000,000	735,209,288	101,354,560	70,937,200	8,419,760	920,920,809	0	- 920,920,809
2015	51	5,000,000	611,592,215	101,354,560	70,937,200	8,419,760	797,303,735	0	- 797,303,735
2016	51	14,551,250	184,552,317	101,354,560	70,937,200	8,419,760	379,815,087	0	- 379,815,087
2017	51	5,000,000	175,038,251	101,354,560	70,937,200	8,419,760	360,749,771	63,309,070	- 297,440,700
2018	51	5,000,000	193,168,316	101,354,560	70,937,200	8,419,760	378,879,836	0	- 378,879,836
2019	51	5,000,000	189,298,382	101,354,560	70,937,200	8,419,760	375,009,902	0	- 375,009,902
2020	51	5,000,000	196,428,448	101,354,560	70,937,200	8,419,760	382,139,968	187,550,828	- 194,589,140
2021	50	14,551,250	213,286,708	101,354,560	70,937,200	8,419,760	408,549,478	460,241,877	51,692,399
2022		5,000,000	86,200,000	101,354,560	70,937,200	8,419,760	271,911,520	38,245,110	- 233,666,410
2023		5,000,000	65,800,000	101,354,560	70,937,200	8,419,760	251,511,520	21,061,372	- 230,450,148
2024		5,000,000	56,400,000	101,354,560	70,937,200	8,419,760	242,111,520	643,141,095	401,029,574
2025		5,000,000	25,000,000	101,354,560	70,937,200	8,419,760	210,711,520	1,449,976,661	1,239,265,141
2026		14,551,250	5,000,000	101,354,560	70,937,200	8,419,760	200,262,770	147,915,024	- 52,347,746

Year	Planted area (ha)	Expenditure/ Projected Expenditure						Projected revenue (Ushs)	Net benefit (Ushs)
		Planning, Monitoring & Environmental Safeguards	Plantation maintenance	Salaries	Administrative overhead costs	Capital costs	Total costs		
2027		5,000,000	16,000,000	101,354,560	70,937,200	8,419,760	201,711,520	90,918,981	- 110,792,539
2028		5,000,000	5,000,000	101,354,560	70,937,200	8,419,760	190,711,520	90,918,981	- 99,792,539
2029		5,000,000	5,000,000	101,354,560	70,937,200	8,419,760	190,711,520	90,918,981	- 99,792,539
2030		5,000,000	16,000,000	101,354,560	70,937,200	8,419,760	201,711,520	90,918,981	- 110,792,539
2031		14,551,250	5,000,000	101,354,560	70,937,200	8,419,760	200,262,770	90,506,013	- 109,756,757
2032		5,000,000	5,000,000	101,354,560	70,937,200	8,419,760	190,711,520	35,257,829,808	35,067,118,287
2033		5,000,000	40,328,416	101,354,560	70,937,200	8,419,760	226,039,936	69,857,609	- 156,182,326
2034		5,000,000	13,596,613	101,354,560	70,937,200	8,419,760	199,308,133	69,857,609	- 129,450,524
2035		5,000,000	13,596,613	101,354,560	70,937,200	8,419,760	199,308,133	68,487,852	- 130,820,281
2036		14,551,250	24,596,613	101,354,560	70,937,200	8,419,760	219,859,383	12,576,453,438	12,356,594,054
2037		5,000,000	534,733,017	101,354,560	70,937,200	8,419,760	720,444,537	28,888,076,480	28,167,631,942
2038		5,000,000	1,382,190,137	101,354,560	70,937,200	8,419,760	1,567,901,657	2,564,573,308	996,671,651
2039		5,000,000	726,551,997	101,354,560	70,937,200	8,419,760	912,263,517	1,412,296,430	500,032,914
2040		5,000,000	705,493,235	101,354,560	70,937,200	8,419,760	891,204,755	1,412,296,430	521,091,675
2041		14,551,250	725,893,235	101,354,560	70,937,200	8,419,760	921,156,005	1,412,296,430	491,140,425
2042		14,551,250	573,146,096	101,354,560	70,937,200	8,419,760	768,408,866	1,412,296,430	643,887,565
2043		5,000,000	160,976,132	101,354,560	70,937,200	8,419,760	346,687,652	1,412,296,430	1,065,608,778
2044		5,000,000	144,332,000	101,354,560	70,937,200	8,419,760	330,043,520	1,412,296,430	1,082,252,910
2045		5,000,000	155,332,000	101,354,560	70,937,200	8,419,760	341,043,520	1,412,296,430	1,071,252,910
2046		14,551,250	144,332,000	101,354,560	70,937,200	8,419,760	339,594,770	1,412,296,430	1,072,701,660
2047		5,000,000	144,332,000	101,354,560	70,937,200	8,419,760	330,043,520	1,384,604,344	1,054,560,823
2048		5,000,000	154,200,000	101,354,560	70,937,200	8,419,760	339,911,520	0	- 339,911,520
2049		5,000,000	86,200,000	101,354,560	70,937,200	8,419,760	271,911,520	0	- 271,911,520
Total	**2,048**								

The costs up to 2012 were covered under EMCBPII project. However, there after the funds have to be provided by NFA from other sources. Cash flows are negative until some harvesting of thinning without carbon revenues. However, Financial Analysis shows that the internal rate of return is 6.7% without carbon Revenues. This rate does not a make a substantial return on investment and is low compared to other investments. Moreover, the rate is lower than the Government of Uganda's social opportunity cost of capital of 12 percent. This justifies the reason that NFA must seek for funding under schemes like carbon sequestration schemes.

9.5. Risk analysis

Risk can be defined as the probability or likelihood of sustaining loss. Because of the long time period generally involved in this investment of a forest plantation project, risk is of relatively more concern than would be the case for an alternative investment with a shorter life-span. For example, the effect on profitability of a sustained adverse change in costs or prices will be compounded throughout the rotation and there may be little that one can do, in terms of changing management techniques or marketing strategy, to reduce the impact of such an adverse event.

On the other hand, favourable changes in costs and prices may also be captured and compounded throughout the rotation, resulting in higher levels of profitability.

Generally, a few studies have suggested that roundwood prices are essentially countercyclical, offering opportunities to reduce risk within an overall investment portfolio. Forest plantations also have the benefit that, when comparing them to other manufacturing operations, production can be altered relatively easily to take account of current market conditions (i.e. if prices are low, the trees can be left in the ground and will continue to increase in volume).

The anticipated profitability depends crucially on the cost of capital or discount rate and the twin components of risk and return. This necessitated careful identification and correct assessment of the associated risks.

Due to the quality and insufficiency of much of the existing data and information about forest plantations in Uganda, a meaningful statistical analysis of the associated risks could not be carried out and instead the risks have been explained and described in qualitative terms.

9.5.1. Operational risk

Liquidity risk is one of the most important deterrents to forest plantation establishment, particularly in the early years of establishment since one has to wait for around 12 years before any meaningful income can be made from thinnings. There is very little scope to

make money from the forest plantation in a shorter period of time due to the low level of industrialization in the country. Consequently, measures will be put in place to access other secure sources of cash that one can draw upon.

It is also envisaged that liquidity risk will slowly be overcome as the market for thinnings at age 4 and 7 develops and policy a framework that supports innovative market arrangements to overcome this risk are put in place. Examples of the latter might include legislation to support the forward sales of future cutting rights, or even the development of futures markets for roundwood and forest products including investment in value addition in wood waste including young thinnings and branches as is the case in developed countries.

9.5.2. Market risk

Market risk refers mainly to the risk that future prices, costs and market conditions will vary from those assumed when the initial financial appraisal of the forest plantation project was prepared. This includes the more obvious risk that the prices of outputs (i.e. roundwood) or inputs (e.g. tools, machinery and labour) may change. However, it also includes the risk that market factors may change (interest rates; exchange rates; and market size). Markets can collapse due to the failure of one or a number of potential buyers. Also the markets for a particular type of roundwood may shrink due to changes in product specifications, manufacturing technology or competing products

Due to the long time-horizon involved in this forest plantation project, it is quite likely that costs and prices will change during the rotation and that this might have a significant effect on profitability. Therefore, the risk associated with each cost and price figure has been evaluated by calculating the variability (i.e. variance) of each cost or price based on historical data.

9.5.3. Political and Systemic risk

Political and systemic risks are largely macro-level concepts related to the probability of large-scale political or economic changes taking place that may affect profitability. The most extreme political risks include the risk of wars, revolutions, nationalisation and major changes in political and economic regimes. Political risks are associated with policy and legislative changes that will affect the general environment for business and investment in a country.

Political risks will generally affect one or more of the following: the overall conditions for investment; market conditions; or regulations governing forest management and harvesting. Specific examples might include changes in roundwood export regulations;

harvesting regulations; taxation of forestry activities; tariff structures; capital requirements; and environmental regulations.

The most important aspect of political risk concerns the political stability of the country that could fail to favour long-term sustainable forestry development.

Systemic risk is the risk that an entire system may collapse due to the failure of one particular component. For example, one company owning all of the facilities used to process the roundwood from forest plantations may collapse or the whole production chain may break down if that company goes bankrupt. Similarly, the closure of a just a single processing plant may cause a more widespread failure at a local or regional level.

9.5.4. Ecological risks

Ecological risks are those associated with biological, climatic and site factors. These include risks of catastrophic loss from factors such as: fire; wind; hailstorm, prolonged drought; insects; pathogens; and damage by animals. They also include questions concerning the effectiveness of silvicultural treatments, seedling survival rates and yield estimates.

The catastrophic risks will be reduced by investment in fire protection measures and by diversifying investments (e.g. by planting and maintenance of different species and provenances in different locations and at different periods). In Uganda, insurance against ecological risk is unavailable and will not be necessary as in all instances, ecological risks will be minimised by effective forest management (e.g. by paying careful attention to plant storage, handling and planting, species selection and fire monitoring and control).

9.5.5. Conclusion on risk

It should be evident from the preceding discussion that risks vary throughout the duration of a forest plantation rotation. For example, the risk of poor plant survival is generally low once a forest plantation has survived the main ecological hazards present in the first few years after planting (e.g. damage by animals, drought, poor plant handling and competition from weeds). Other risks can rise or fall throughout the rotation (e.g. market risks), although these risks are sometimes predictable.

For some types of risk, it is possible to reduce risk in a number of ways (e.g. through diversification or by using other types of risk management tools). Particular attention will be paid to the assessment and management of risk. Better information and further analysis of risk-related information will be an effective way of reducing the total risk associated with this investment. One way in which market risk is will be analysed is within the context of an overall investment strategy and this is briefly discussed below.

The greatest risk to the management plan is failure to secure adequate financing for the next 9 years when planting of the remaining area will be carried out and management of existing crop. To minimise this risk, NFA use part of non tax revenue for maintenance and consider sourcing fro for sustainable funding from international funding organisations.

The other risks are associated with failure to yield a reasonable return on the investment on account of lower yield or slump on prices of stumpage. To alleviate those risks, we have used a conservative yield estimate averaging 337 m3 per Ha and prepared all the costs at their present values.

The other main risk is fire out breaks and this is administrative as it can be controlled through sensitisation and good community cooperation as well ensuring adequate risk reduction by reducing fuel loads, making fire breaks, keeping fire breaks weeded and adequate fire control preparation.

10. MONITORING AND EVALUATION

10.1. Monitoring system

The monitoring plan will identify the outcomes, strategies, activities, outputs, the actors and corresponding budget. This will answer the question of who does what, when, the indicators and with what resources.

Criteria and indicators

The criteria and indicators(C&I) for FSC and ITTO shall be used to develop indicators for monitoring activities under this forest management plan.

Supervision

Regular inspection particularly field visits to assess and ensure that planned activities are properly carried out. Supervisors shall cover their charges once every week; the sector manager shall inspect the MPA once monthly and Range/ Plantation manager once every two months. Senior staff from NFA Head office shall visit at least once a year.

Reporting Procedures

The reporting schedule shall be observed as summarised below;

- A forest supervisor shall prepare and submit a monthly report to the Sector manager
- The Sector Manager shall prepare a monthly report to the Range/ Plantation manager
- The Range manager shall prepare monthly, quarterly and annual reports to the headquarters

Situational reports to do with emergencies shall be submitted immediately to the Range/ Plantation manager and NFA Headquarters whenever such need arises.

Maps and Global Positioning Systems (GPSs)

Management maps will be updated whenever planting, harvesting of fire damage occurs. Areas will be measured using GPSs for all reporting.

Records and Record copies

Compartment records will be maintained and all activities will be recorded.

10.2. Implementation of the monitoring system

Monitoring tools for implementation of the various activities will be put in place. These will be as shown in table 17.

Table 16: Purpose and Tools for monitoring

TOOL	PURPOSE
1. Day to day management	***Smooth implementation***
Log books	Record use of equipment, consumption of fuel
Stock registration	Record amount of materials used, purchased and in stock
Book keeping systems	Record utilisation of funds for particular periods, activities or operations
Activity registration	Record Man days/ hours/ years for different activities
2. Operational management	***To monitor activity on aspects of timing, quality and quantity***
Bar charts	Assess progress of activities
Monthly or quarterly reporting	Inform supervisor of progress of activities, challenges or constraints
Technical reports	Ad hoc report on quality of work done with regard to technical aspects
Back to office reports	Report on what has been done during a field trip
3. Supervision	***Inform supervisor of whether purpose and result are being achieved***
Quarterly and annual reports	Inform supervisor of progress of activities, challenges or constraints with regard to achievement of outputs and purpose
Technical reports	Ad hoc report on quality of work done with regard to technical aspects
Mid term reviews and evaluations	Comprehensive description of activities over certain period
Accounts	Quarterly and annual reports and use of inputs
4. Integration	***To ensure existing procedures are integrated into the new monitoring system***
Meetings	All management levels to participate in the design so that it is not

TOOL	PURPOSE
	top down and is owned by all to enhance technical quality and ensure effective implementation

10.3. Monitoring and Evaluation Framework for North Rwenzori forest plantation activities

A detailed monitoring and evaluation framework is presented in table 18

Table 17: Monitoring framework for forest Plantation activities in North Rwenzori

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
1. Sustainable management and supply of Forest products and services	**1-** Set aside 2500ha for plantation development by NFA , private commercial plantations and communities	i) Demarcate and license private tree planters	Measuring tools, funds for demarcation	1-25 years	a) No. of licenses issued, size of area licensed (ha), 210ha planted annually	License and demarcate 100ha	Physical verification of licenses, survey reports and land cover maps, nursery reports	Private farmers have capacity to develop plantations according to set standards
		ii) Demarcate land for NFA planting	Measuring tools, funds for demarcation	1-25 years	b) 600ha planted annually by NFA	Demarcate 2000ha	Maps	- Required funds are available on time
		iii) Demarcate land and allocate to communities	Measuring tools, funds for demarcation	1-25 years	c) An area of 20ha planted by communities annually	Demarcate 100ha	Maps	Local communities have capacity to develop plantations according to set standards

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
	2- Establish 2070 ha of sawlog plantations by year 2021	iv) Establish and maintain tree nurseries	Seeds, Fertilizer, fungicides, soils, polythene tubes	1-10 years	d) No of seedlings raised from improved seed	Raise 1 million seedlings annually	Nursery reports and field inspection reports	- Contractors are willing and able to take up the works
		v) Ground preparation	Pangas, Axes, Herbicide and labour	1-10 years	e) Annual rate of planting of 650ha	5 litres of Herbicide per ha	Measure area with GPS and produce map	NFA, Private sector and communities having capacity to carry out the activity
		vi) Planting	Seedlings and labour	1-10 years			Maps and field progress and inspection reports	Seeds and nursery inputs are available at the right time
		vii) Weeding (Herbicide spraying)	Herbicide, spray pumps, labour	1-13 years		5 litres per ha per year, up to when crop is 2 years	Field progress and inspection reports	- Required funds are available on time
		viii) Slash weeding	Pangas, labour	1-13 years		2 times a year up to 3 years	Field progress and inspection reports	

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
		ix) Spot weeding	Hoes, labour	1-13 years		2 times a year	Field progress and inspection reports	
	3- Growth monitoring of CAI to achieve MAI of 21.5 m3 per year at rotation of 25 years	x) Assessment of PSPs	Diameter tapes, Hypsometers, technical staff and funds	Every 2 years	f) Height and diameter measurements		Growth monitoring reports, CAI and MAI of 20 m3 per year	
	4- About 400 stems per ha of at least 35cm DBH, and 400 m3 per ha at year 20	xi) Thinning	Axes, Pangas, Technical staff, labour and funds	Age 6, 10, 14 years	g) Area thinned, thinning intensity of 30% at year 5 and 10		Field progress and inspection reports	
	5- At least 8m of knot-free bottom logs	xii) Pruning	Pruning saws, labour, technical staff and funds	Age 6, 8,10, 12, 14 years	h) Area pruned, Pruning height to 2m at year 5 and to 8m at year 12		Field progress and inspection reports	

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
	6- Crop protected from fire, disease and animal damage	xiii) Establish fire lines		After planting	i) No of km established.		Area of plantations protected.	
					j) 3% of planted area covered by firelines			
		xiv) Maintain fire breaks		Beginning of every dry season	k) No of km maintained		Field progress and inspection reports	
		xv) Conduct fire patrols		During dry season	l) No of months covered.		Fire incidences, extent of fire damage	
		xvi) Presence of fire safety rules and equipment and their use		Beginning of every dry season				
		xvii) Hold community sensitization and awareness workshops		Beginning of every dry season	m) Number of community sensitization and awareness workshops held		Fire sources/causes, participation by community in fire fighting	

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
		xviii) Open access roads		1-10 years	n) m- Number of km opened		Field progress and inspection reports	
		xix) Maintain forest roads		Once a year	o) Number of km maintained		Field progress and inspection reports	
		xx) Establish block boundaries		By 2012	p) Length of blocks boundaries maintained		Demarcation Maps	
		xxi) Construct buildings (Staff houses, office, store, kitchen)		By 2012	q) Number of buildings constructed		Physical assessment	
	6- Crop protected from disease and	xxii) Monitoring crop health		1-25 years	r) Observed presence or spread and increase in populations of weeds pests and invasive			
					s) Visible signs of insect and fungal attack			

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
	7- Harvesting plan prepared and AAC established	xxiii) Carry out inventory in natural forest, Harvest and grade logs		Within 25 years	t) Volume of logs graded and sold (M3)		Field harvesting forms	- Timber dealers are willing and able to buy
		xxiv) Carry out inventory in plantations		Within 25 years	u) Inventory report of standing volume, and age classes		Field harvesting forms	
	8- Carbon sequestration	xxv) Prepare PDD and register with UNFCCC		By 2013	v) Generate and delivery 500,000 t-Co2e to the IBRD or other buyers in North Rwenzori CFR		Growth monitoring reports, CAI and MAI of 20 m3 per year	
	9- Clear felled areas replanted	xxvi) Ground preparation, planting, maintenance		Within 1 year	w) Period within which replanting is done	Not later than 1 year after harvest	Field reports	- Required funds are available on time

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
2. Integrate Local communities in Participatory Forest Management to contribute towards improvement of livelihoods	**10-** Forest management committee in place	xxvii) Hold joint Meetings		Twice a year	x) Number of meetings held		Field reports, Contract agreements, meeting minutes, attendance lists, training reports	
	Community livelihoods	xxviii) Integrate community forest needs into forest management activities		1-25 years	y) Area allocated to communities for plantation activities			

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
					z) Level of involvement of community members in the management activities of the forest			
		(xi) Carry out conservation education		1-25 years	aa) Number of pupils and communities taught		bb)	
					cc) Number of radio talk shows staged	dd)	ee)	
					ff) Number of brochures produced	gg)		
		(xii) Implement affirmative silviculture		1-10 years	hh) No. of seedlings planted	ii)		

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
					jj) Number of hectares planted	kk)		
		(xiii) Develop and implement CFM plans and agreements		1-10 years	ll) Number of CFM plans & agreements negotiated	mm)	nn)	
					oo) Number of agreements signed	pp)	qq)	
					rr) Number of households involved in CFM	ss)	tt)	
		(xiv) Census of local people employed in forestry activities		1-25 years	uu) Number of local people employed in forestry related activities	Field reports, Payment sheets		

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
		(xv) Assessment of quantities and products extracted		1-25 years	vv) Type of products and quantities extracted by local people on sustainable basis	Field reports		
					ww) Number of forest conservation sessions conducted	xx)	yy)	
	11- Non destructive activities carried out by local communities	(xvi) Low impact grazing of goats and sheep in crop above 5 years		1-25 years	zz) Impact of trees and other vegetation cover	Number of goats, sheep per ha		
3.Manage the CFRs for protection of biodiversity and ecologically fragile areas	To maintain and where possible enhance the bio-	(xvii) Anthropogenic activities controlled to below 10% of baseline		1-25 years				

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
	logical and nature conservation values							
		(xviii) Species plans for one tree species and three species of butterflies which do not occur anywhere else in Uganda's Protected Area System drawn and implemented		1-5 years				
		(xix) Regular monitoring done		1-25 years				
		(xx) One forest wide assessment of major taxa undertaken		1-5 years				
		(xxi) Indicator species measurement, flora and fauna descriptions		1-5 years				

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
3. Restore encroached and degraded areas of the CFRs to ensure sustainable supply of forest products and services.	**10-** Area recovered from encroachment	(xxii) Remove encroachers, Plant area recovered from encroachers (encroachment planting)		1-20 years	aaa) Number of encroachers removed, size of area recovered, number of ha planted	Inventory/ Survey reports, patrol reports		- There is conducive government and political support
4.	**11-** FMP revised	(xxiii) Carry out data collection exercises		Every 5 years	bbb) Number of times FMP is revised	Physical verification of revised FMPs		
					ccc) Number of data collection exercises carried out	Field reports		

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
		(xxiv) Regularize other forestry activities through e.g. post eviction sensitization meetings		1-25 years	ddd) Number of sensitization meetings held	eee)	fff)	- Communities are cooperative
		(xxv) Open forest boundaries		Once every 5 years	ggg) Length (km) of boundary opened according to guidelines	hhh)	iii)	- Boundaries are well surveyed
		(xxvi) Maintain forest boundaries		Once a year	jjj) Length of the boundary maintained	kkk)	lll)	- Required funds are available on time
					mmm) Number of cairns and trenches maintained	nnn)	ooo)	

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
					ppp) Number of live markers planted	qqq)	rrr)	
					sss) Number of spots weeded	ttt)	u	
		(xxvii) Patrol CFRs		1-25 years	vvv) Number of patrolmen contracted	www)	xxx)	
					yyy) Number of months covered	zzz)		
5. Watershed	To retain and enhance soil and water quality	(xxviii) Area of natural forest stand maintained and where possible enhanced by restoration planting		1-2 5 years				
		(xxix) Guidelines for establishing access, land-		1-25 years				

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
		ings, bridges reflecting site characteristics are adhered to						
		(xxx) Heavy machine use restricted to what is prescribed		1-25 years				
6. Profitable plantations	**13-** IRR of not less than 12%	(xxxi) Monitor discounted revenues throughout the rotation period		1-25 years	aaaa) Stumpage price per m3	Stumpage price per m3 not less than 70,000 Ug. Shs	Average bid price/ Market price	
		(xxxii) Monitor discounted costs throughout the rotation period		1-25 years	bbbb) Cost of establishment, maintenance and protection	Not exceeding 2 million	Financial reports	

Objective	Output	Activity (s)	Inputs	Time frame	Objectively verifiable indicators	Target	Means of Verification	Assumptions/Risks
7. Chain of custody	**14-** Proper documentation of transportation of forest products	(xxxiii) Issue license	License books	1-25 years	cccc) License documentation	dddd)	Routine checks on transport routes and stores	
		(xxxiv) Provide documentation for transport of forest produce	Forest Produce Movement Permit Books	1-25 years	eeee) Forest Produce movement permit	ffff)	Routine checks on transport routes and stores	
		(xxxv)Mark timber from the CFRs	Tools to mark produce	1-25 years	gggg) Mark on timber		Routine checks on transport routes and stores	
8. Research	**15**- Establishment and maintenance of Research Plots	(xxxvi) Plot assessments	Tools and equipment	1-25 years	hhhh) Technical Reports	Biannually	Distribution list	

11. APPENDICES

Appendix 1: Activity Schedule during FMP period 2012/13 – 2022/23

Main Activity	Sub-Activity	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2021/22	2022/23
Planning	Implementation of FMP	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Prepare Annual Work Plan	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Review and Revise FMP					▨					▨
Plantation establishment & management	Procure seedlings	▨	▨	▨	▨	▨	▨	▨	▨	▨	
	Planting & weeding	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Silvicultural tending			▨	▨	▨	▨	▨	▨	▨	▨
Boundaries	Surveys & demarcation	▨									
	Boundary maintenance	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Boundary patrols	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Enrichment/Gap planting		▨	▨	▨	▨	▨	▨	▨	▨	▨
Management of Natural belts	Climber cutting/tending	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
	Exploratory inventory (EI)		▨				▨				
	Diagr. Sampling (ISSMI)		▨								
Research and Growth	PSP establishment			▨	▨	▨	▨	▨	▨	▨	▨

Main Activity	**Sub-Activity**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2021/22**	**2022/23**
monitoring	PSP maintenance										
	PSP assessment										
Law Enforcement	Handling impounded produce										
	Monitor illegal activities										
CFM	Hold seminars/Workshops										
Buildings and Forest stations	Constructing new buildings										
	Building maintenance (major)										
	Maintenance of station grounds										
Tools and equipment	Procure Equipment & Tools										
Valuation	Assess total forest economic. Value										
Livelihoods	Assess off-reserve community work										

Appendix II: Historic events of North Rwenzori CFR

DATE	EVENT	SIGNIFICANCE TO FOREST MANAGEMENT
1940	Gazettement of North Rwenzori CFR	Gazettement as a Central Forest Reserve under Crown Land
1947	Subsequent gazettement	
1948	First Working Plan prepared by Dale	Prescribed forest management activities for the reserve such as early burning from top to bottom, tending of existing trial plots and inspection of boundary border cairns
1956	Destruction of Experimental Pine plot	Abandonment of Tree Planting Programme.
1961	Revision of First Working Plan	Prescribed objectives of management as to improve the vegetation and soil cover to minise soil erosion and protect water supplies, carry out research on replacing existing species trials
1998	Formulation of Statutory Instruments that contain the constitution of the reserves	Constitution of the reserves as No.63 of the Statutory Instruments; supplement No. 23 (Forest Reserves – Declaration Order)
2000	Formulation of the National Forestry and Tree Planting Act, 2003	Mandated Management of Central Forest Reserves under a responsible body; currently the National Forestry Authority that is to manage them on a business-like manner. Defined roles and responsibilities of all stakeholders and defined out the need for participatory approaches in Forest Management
2001	Establishment of the National Forestry Policy, 2001	Made a commitment to create a responsible body (National Forestry Authority), to replace the Forestry Department to improve the management of Central Forest Reserves.
2005	Establishment of 27.5Ha of plantation of *Pinus caribaea* at Karuguttu Station	Site potential of the site shows good potential of *Pinus caribaea*

Appendix III: Stakeholder consultations for North Rwenzori CFR Management planning process

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PARTICIPANTS ATTENDANCE LIST FOR THE NATIONAL STAKEHOLDERS CONSULTATION MEETING ON NORTH RWENZORI AND KASAGALA CARBON PROJECT DOCUMENTS AND MANAGEMENT PLANS
(Scheduled for 26 July 2012 at Hotel Africana)

Institution	Department or Unit	Title or Position	Name	Contacts	Signature
1. NFA	Plantations	Pltn Dev Specialist	Obed Tugumisirize	obetug@yahoo.com 0712200141 obedt@nfa.org.ug 0776211103	[illegible]
2. "	NATURAL FORESTS	RANGE MANAGER	EMMANUEL THOMAS MUTEEBA	muteebat@yahoo.com 0772641269	[illegible]
3. "	PLANNING	GIARS	RUKUNDO TOM	tomr@nfa.org.ug	Rukundo
4. Min. of Tourism Wildlife & Heritage	Wildlife Conservation	Principal Wildlife Officer	George Owoyesigire	gowoyesigire@yahoo.com gowoyesigire@mtti.go.ug	[illegible]
5. IUCN	REDD	Program Manager	Simon Peter Amunau	Simon.AMUNAU@iucn.org spamunau@gmail.com 0782312428	[illegible]
6. Min. of Water & Environment	FSSD	ACF/National REDD+ Focal Point	Margaret A. Mwebesa	margathieno@yahoo.com 0772470023	[illegible]
7. World Bank	Environment	Forestry & climate Specialist-Consultant	Paul Asiimwe	0753575014	[illegible]
8. UCB	Forestry	Forest carbon consultant	Charlie Langan	charlielangan@ugandacarbon.org	[illegible]
9. ECOTRUST	Natural forests/Envt.	Programme Coordinator	Emily M. Tumuhairwe	0775542887/0702479007	[illegible]
10. NFA	IT Department CAD	IT specialist	Ayebazibwe Lorretta	0701907776	[illegible]
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Institution	Department or Unit	Title or Position	Name	Contacts	Signature
13. NFA	PLANTATIONS (KAGO)	PLANTATION MANAGER	OBEDMOTH ALDOUS	0772-656234 obedmothaldous@yahoo.com	[illegible]
14. FSSD	FSSD	Driver	Mutekanga	0782471655	[illegible]
15. MOWE	FSSD MOWE	DRIVER	KINIMBA W.	0772558964	[illegible]
16. NFA	NF	SECTOR MANAGER	KAMUKAMA [illegible]	0772574530	[illegible]
17. MWE	MWE	K Driver	Karubanga Julius	0752812231	[illegible]
18. UNIQUE	—	CONSULTANT	GRIT TECHEL	0784 592964	Grit Techel
19. NFA	NFA	CCP	Mugume Isaac	0772854345	[illegible]
20. NFA	Corporate	Coordinator Climate Change	Mugumya Xavier	0776408396	[illegible]
21. NFA.	Finance.	Senior Accountant	Mubiru Abdul.	0782-351274.	[illegible]
22. —	Kyenjojo	L III	Andama C.	0772497211	[illegible]
23. —	KABAROLE	L3	BIGABWATUNGS		[illegible]
24. —	BUNDIBUGYO	COUNCILLOR	AKAGIZIBWE ANNET	0789731260	AAKagizibwe
25. —	Ntoroko	Councillor	Kunobere J		Kunobere J
26. —	KABAROLE	Counc/LCIII	CHEMANGEI A		[illegible]

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Appendix IV: Stakeholder interests in North Rwenzori CFR

Stakeholders	Interest	Potential Contribution
Local Community	Forest Product Sources: Firewood, timber, building poles, grazing land, water sources, land for growing crops, medicinal plants, land for tree planting Services: Employment, improved environment and environmental protection (reduced wind impact, soil erosion and protection of water sources)	Employment (labour supply) Protection against fires and illegal activities Tree planting and generally collaborative forest management
Local Government	Employment for local people Energy supply (fuel wood) Infrastructural development through road maintenance Extension services from forest staff Revenues from taxes (income to local governments)	Awareness campaigns about forestry, forestry management Partners in fighting illegal activities Popular support
Saw millers and Pit sawyers	Saw logs	Market for saw logs, income for NFA
Private tree planters	Land for tree planting Extension services from NFA staff	Increase in forest area in the sector Improved Forest Management
National Environmental Management Authority (NEMA)	Environmental protection and sustainable land use	Guidelines on land use with environmental protection concerns
Construction Companies	Supply of construction poles Firewood for brick making	Market for forest products (firewood, poles) hence income to NFA
Institutions (schools, army (UPDF 4th Division), prisons	Supply for firewood	Market for firewood and hence income to NFA
Tax bodies (URA)	Collection of taxes on forest products	Regulation of illegal activities through checks on permits for forest produce
Government of Uganda	Proper forest management, sustainable supply of high quality forestry related goods and services to the people of Uganda Poverty eradication	Making policies and laws concerning the forestry sector Supervision of National Forestry Authority Funding for the Forestry Sector

[i] Traditionally used for fevers, malaria, wound dressing, arrow poison, stomach pain, purgative, kidney disease, appetite stimulant, gonorrhoea, and insanity. An extract, pygeum, an herbal remedy prepared from the bark of *Prunus africana*, is used as an alternative medicine in patients with benign prostatic hyperplasia (BPH) though clinical trials have not yet been conducted. It has shown positive results in *in vitro* studies and mouse models of prostate cancer. The collection of mature bark for this purpose and for other medical uses has resulted in the species becoming endangered.