BUKALEBA FOREST PROJECT

Document Prepared By Busoga Forestry Co. Ltd and Green Resources

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Table of Contents

1. Project Details 4
1.1 Summary Description of the Project 4
1.2 Sectoral Scope and Project Type 5
1.3 Project Proponent 5
1.4 Other Entities Involved in the Project 6
1.5 Project Start Date 6
1.6 Project Crediting Period 6
1.7 Project Scale and Estimated GHG Emission Reductions or Removals 6
1.8 Description of the Project Activity 8
1.9 Project Location 12
1.10 Conditions Prior to Project Initiation 24
1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks 28
1.12 Ownership and Other Programs 30
1.12.1 Proof of Title 30
1.12.2 Emissions Trading Programs and Other Binding Limits 30
1.12.3 Participation under Other GHG Programs 30
1.12.4 Other Forms of Environmental Credit 30
1.12.5 Projects Rejected by Other GHG Programs 30
1.13 Additional Information Relevant to the Project 30
2 Application of Methodology 32
2.1 Title and Reference of Methodology 32
2.2 Applicability of Methodology 32
2.3 Project Boundary 35
2.4 Baseline Scenario 40
2.5 Additionality 45
2.6 Methodology Deviations 51
3 Quantification of GHG Emission Reductions and Removals 52
3.1 Baseline Emissions 52
3.2 Project Emissions 52
3.3 Leakage 56

3.4 Summary of GHG Emission Reductions and Removals 61
4 Monitoring 64
4.1 Data and Parameters Available at Validation 64
4.2 Data and Parameters Monitored 69
4.3 Description of the Monitoring Plan 73
5 Environmental Impact 79
6 Stakeholder Comments 80
7 Annex 1 – remote sensing process 83

1. PROJECT DETAILS

1.1 Summary Description of the Project

The ARR project activity of the Bukaleba Forest Project (BFP) is implemented on land within the Bukaleba Central Forest Reserve (BCFR) in the administrative district of Mayuge, Eastern Uganda. The project activity will establish and manage exotic and indigenous reforestation on approximately 2,061.6 ha of degraded shrub and grassland.

Overall objective of proposed ARR AFOLU project activity

The overall objective of the ARR project is to contribute to mitigating climate change while meeting the growing demand for quality wood products from well managed plantation forests and contributing to sustainable environmental management, community development and poverty alleviation in Uganda.

Specific objectives of the proposed ARR AFOLU project activity:

1) To establish and manage forest plantations to meet the growing demand for high quality wood products. With an annual loss of 2.2 percent in forest area, Uganda was among the ten countries globally with the highest deforestation rates between 2000 and 2005[1]. Uganda has to expand its wood resources substantially to meet the growing demand of wood products and to reduce the strong pressure on the remaining natural forests. The implementation of the proposed ARR AFOLU project activity will therefore benefit the forestry sector through an increase in the timber supply, management and overall sustainability of national resource base, and alleviating pressure on the country's natural forest.

2) To sequester carbon dioxide through forest planting, generating high quality emission reductions in greenhouse gases (GHG) that can be measured, monitored and verified. The project participants strive to demonstrate that carbon sequestration from forest plantations is a viable instrument to encourage private investment in the forestry sector, especially on degraded lands.

3) To promote environmental conservation such as soil conservation, protection of water sources and enhancement of biodiversity through the protection and management of existing indigenous flora and fauna and where possible enrichment planting with indigenous tree species.

4) To facilitate socio-economic development of the local communities through:

   - Promotion of tree planting/afforestation activities in the local communities;
   - Provision of employment opportunities;
   - Support for development initiatives for the communities through the sale of carbon credits;
   - Establishing of community woodlots in the villages around BFP on community owned land, with the objective of increasing fuel and timber supply within the communities;
   - Designating 10% of the carbon revenues generated by the project to community development initiatives in the villages surrounding BFP;

5) To develop local infrastructure including roads, health centers, water supply and communication systems.

The species to be planted are *Pinus caribaea*, *Eucalyptus grandis*, *Eucalyptus camaldulensis, Eucalyptus clones* (*grandis* and *camaldulensis* (GC) hybrids). Other species are also being planted for trial, enrichment planting and research purposes, such as *Maesopsis eminii, Gmelina arborea, Grevellia robusta,* with indigenous species such as

[1] Forest Resources Assessment, FAO of the UN. 2005

Terminalia iverensis, Mahogany (*Khaya anthoceaca*) and Melicia Excelsa trees. Approximately 79 ha of maesopsis will be planted. The total area of the other species is approximately 30 ha. The carbon benefits of these trials will not be included in the carbon estimates, and thus are not included within the ARR AFOLU project. All species have been screened against the global database of invasive species and are not invasive in Uganda.

Table 1.1: Species to be planted in the ARR project:

No.	Species selected	Type	Uses
1	*Pinus caribaea*	Exotic softwood	Timber
2	*Eucalyptus grandis*	Exotic hardwood	Poles, timber
3	*Eucalyptus camaldulensis*	Exotic hardwood	Poles, timber
4	*Eucalyptus clones (GC)*	Exotic hardwood	Poles, timber

Table 1.1.2.: Scheduled plantable areas 2004-2011

Year of planting	***Pinus Caribaea* (Ha)**	***Eucalyptus grandis, camaldulensis and clones* (Ha)**	**Total (Ha)**
2004	24.7	-	24.7
2005	123.4	-	123.4
2006	141.8	-	141.8
2007	239.4	4.8	244.2
2008	172.0	7.9	179.9
2009	381.8	30.1	411.9
2010	249.8	100.9	350.8
2011	242.2	117.1	359.2
2012	135.0	90.7	225.7
Total[2]	**1,710.1**	**351.5**	**2,061.6**

The planting schedule will be repeated following harvesting at 10 and 20 years for Eucalyptus and Pine, respectively.

The land license for BFP is for 9165 ha of which approximately 50% is eligible for reforestation and approximately 2,061.6 ha is eligible for reforestation under the VCS. Another 765 ha will be certified under ISO 14064 and is thus a separate carbon project within the same Central Forest Reserve (CFR). Busoga Forestry Co. Ltd (BFC), a subsidiary of Green Resources AS (GRAS), adheres to all national legislation and regulations as laid out by the Ministry of Water and Environment under the governance of the National Forestry Authority (NFA), which is responsible for forestry activities in Uganda.

1.2 Sectoral Scope and Project Type

The BFP is applicable to sectoral scope 14, AFOLU. The AFOLU project category is Afforestation, Reforestation and Revegetation (ARR). The project is not a grouped project.

1.3 Project Proponent

The project proponents are Busoga Forestry Co. Ltd (BFC) and Green Resources AS.

[2] Totals might not add up exactly due to rounding

BFC holds the land licence to the land within the Bukaleba Central Forest Reserve and is developing the project. Green Resources AS provides financing to BFC as well as support in project development.

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1.4 Other Entities Involved in the Project

N/A

1.5 Project Start Date

The project start date is 11th March 2004. This is when first planting began[3].

1.6 Project Crediting Period

The start date of the project is the 11th March 2004 and as such this is the start date of the crediting period. The crediting period is 42 years and thus ends on the 10th March 2046.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project	✓
Mega-project	

[3] As recorded in GRAS' Inventory and Monitoring system, Microforest

Years	Estimated GHG emission reductions or removals (tCO2e)
1	28
2	285
3	1,203
4	2,980
5	5,911
6	11,918
7	22,596
8	35,651
9	37,650
10	46,190
11	48,666
12	63,464
13	41,896
14	37,000
15	-5,016
16	-7,174
17	-2,618
18	49,453
19	50,085
20	47,587
21	16,771
22	13,001
23	-37,708
24	-26,329
25	-151,994
26	-116,929
27	-104,710
28	-16,153
29	37,219
30	45,843
31	48,423
32	63,330
33	41,905
34	36,953
35	-4,979
36	-7,146
37	-2,604
38	49,462

39	50,176
40	47,678
41	16,862
42	13,092
Total estimated ERs	499,918
Total number of crediting years	42
Average annual ERs	11,903

The long term mean has been calculated using the equation provided in the AFLOU Requirements: VCS Version 3:

$$LA = \frac{\sum_{t=0}^{n} PE_t - BE_t}{n}$$

Where:

LA = The long-term average GHG benefit

PE = The GHG emission reductions and removals generated in the project scenario (tCO2e). Project scenario emission reductions and removals shall also consider project emissions of CO2, N2O, CH4 and leakage.

BE = The GHG emission reductions and removals projected for the baseline scenario (tCO_2e)

t = Year

n = Total number of years in the established time period

There long-term average has been calculated as 266,761 tCO_2e, which is the total number of GHG credits.

Following the AFOLU Non Permanence Risk Tool, a risk buffer of 29% has been determined for the project, which will be applied each time credits are issued at verification.

1.8 Description of the Project Activity

The BFP is a commercial forest plantation project which will use carbon finance through sustainable forest management to provide a sustainable source of timber, a return to its shareholders at a rate reflecting the risk of investing in forestry in East Africa, as well as environmental and social benefits locally. The total area of the VCS ARR project is 2,061.6 ha. This is not the total area of land which BFC has land title for in the BCFR since there are a number of ineligible areas of land – ineligible due to forest remnants which were cleared less than ten years before project start through encroachment from local communities – which have been removed from the project. The total area of reforestation activities being carried out by BFC is 3,885.8 ha, of which 2,061.6 ha is eligible as an ARR project under the VCS. The 1,824.2 ha that are ineligible – mainly due to clearance of forest less than ten years before project start – consists of 1,310.6 ha of pine; 434.5 ha of eucalyptus; and 79.0 ha of maesopsis.

At BFP, modern plantation techniques for forest management and silvicultural practices will be used.

The following standards and all associated requirements will be respected:

1) Forest Stewardship Council (FSC®)[4]
2) SPGS plantation guidelines for Uganda
3) The Climate, Community and Biodiversity Standard (CCBS)[5]
4) Forest management plan for BFP
5) National Forestry & Tree Planting Act, 2003

The project cooperates and partners with a number of agencies, institutions and programs for advice pertaining to technical, ecological and social matters, including the National Forest Authority (NFA), The District Land Board, National Environment Management Authority (NEMA), The Directorate of Water Development (DWD), Makerere University Faculty of Forestry and the Soil Science Department, National Forestry Research Institute (KIFU), Public Health Institute Uganda Timber Growers Association, National Tree Seed Centre, EU Sawlog Production Grant Scheme (SPGS) and local NGOs.

Specific technologies employed during establishment, management, monitoring and verification of the plantation include:

Seed procurement

High quality seeds are obtained from the National Tree Seed Centre (NTSC). The NTSC imports seeds (only from approved sources) or collects them from within Uganda according to NFA guidelines for seedling collection[6].

Table 1.8.1: Seed origin

Species	**Origin/Provenance**
Pinus caribaea	Queensland, Australia, Brazil, and South Africa
Eucalyptus grandis	Uganda, South Africa
Eucalyptus clones	South Africa

Nursery operations

The current nursery of BFP is located at Bukaleba. The nursery covers approximately 1 hectare of land and has the potential to hold up to 1 million seedlings at any given time. The nursery operations at Bukaleba Forest Project run from January to December of each year.

Pinus Caribaea seedlings are raised in the nursery starting from May/June and Dec/Jan, for October and May planting, respectively. *Eucalyptus*, due to its faster growth rate in the nursery, is only raised from July and February, so as to ensure equal seedling height at time of planting and subsequently a uniform forest stand. The nursery is managed in a way to ensure high quality seedlings necessary for obtaining a high level of quality tree growth when they are in the field.

The operations that are conducted at the nursery include soil mixing/ sieving, pot filling, preparation of seed and transplant beds, watering, fertilizer application, weeding, root pruning and sanitary activities. Seedlings are raised in polythene tubes and the mixture comprises of 7 parts of forest top soil, 1 part cow manure, 1 part sand and 1 part mycorrhiza. Seedlings are first raised in seed beds prior to pricking out (the process of transferring germinated seedlings from seed bed to polythene tubes and transplanting beds, carried out when seedlings are 2-3 weeks old). The soil used in seedbed is a mixture of different materials similar to that used in the polythene tubes.

[4] The project achieved FSC certification in April 2011 – FSC reports and FSC certificate available to the DOE
[5] The project is expected to undergo CCBS certification in 2012
[6] For any import, permission has to be sought from the government under Ministry of Agriculture (Department of crop protection). The request has to indicate the seed type, origin and quantity. There after the request can be rejected or accepted and once accepted the order is sent. On arrival in Uganda it is cleared by the agent or by the owner.

Root pruning is carried out as necessary when the seedlings roots grow beyond the polythene tubes. This is the process of cutting lower parts of seedling roots that grow beyond the polythene tube. It is done with the purpose of hardening off and initiating self establishment of seedlings. This is done when seedlings are about to be transplanted in the field, with the main purpose of hardening off and initiating self establishment. The seedlings are watered twice a day so as to ensure survival and good growth. Water is easily obtained from a nearby stream using a diesel-powered water pump and a large storage tank of 5,000 liter capacity.

Plantation Operations

Plantation operations comprise a number of activities from land preparation to harvesting of the forest products.

Site preparation

Pitting and slashing are the only type of site preparation that takes place. Prior to transplanting, planting spots are marked out in the field where holes of diameter 20-30 cm and depth 30-40 cm are dug at a spacing of 3 x 3 m for both pine and eucalyptus. The activity is carried out manually. At BFP beating up is done 2-4 weeks after planting by replanting seedlings which died or are in a weak state.

Weeding

Both manual and chemical weeding is done at BFP as a way to control weeds. Spot weeding is done manually by clearing the area in a 1 meter radius immediately surrounding the seedling. One of the plantation operations at BFP is slashing of tall grasses. Slashing is done manually at BFP using bush knife where tall grasses and other herbaceous weeds compete with the seedlings.

Chemical weeding is used to a minimal extent, usually with roundup (Glyphosate) by spraying in the plantation site. The chemical is highly effective as it completely kills all weeds/grasses leaving the site void of weeds for a whole season. Slashing is done both in land preparation and as part of weed control.

Pruning

Pruning will be carried out at BFP with the aim of improving the quality of poles by inhibiting the growth of knots and to reduce fire risk and damage. Pruning also improves access in the plantation. Pruning is done for pine, eucalyptus and maesopsis in accordance with the following pruning schedule:

Table 1.8.2: Pruning schedule for Pines, Eucalyptus and Maesopsis

Regime	Age		No. of trees pruned/ ha	Mean dominant height	Pruning height (m)
1	Pine	Eucalyptus			
2	4	3	All	4.5	2
3	8	6	750	9	4.5
4	11	8	500	12	6

Thinning

This is an important silvicultural operation done mainly to remove non-desirable trees so as to improve the growth rate of the remaining trees. Trees which are removed include those which are diseased and those with poor growth. However, thinning is principally done for the purpose of reducing tree density in order to enhance the form and growth of the remaining trees. Table A.5.4.3 shows the thinning schedule to be used – the specifications are based on NFA/ SPGS guidelines.

Table 1.8.2 Thinning and harvesting schedule

Species	No. stems per ha	Non-commercial thinning		1st Commercial thinning		2nd commercial thinning		Harvesting
		Age	Remaining	Age	Remaining	Age	Remaining	Age

			stems per ha		stems per ha		stems per ha	
Pine	1,111	4	900	8	550	12	385	20
Eucalyptus	1,111	-	-	4	800	-	-	10

Survival assessment

This is carried out to determine the survival rate during the planting season. At BFP this task is scheduled to take place two weeks after planting so that beating-up can be carried out the same planting season where necessary. A further survival assessment is carried out 6-9 months following this, with replanting taking place if stands have a survival rate lower than 70%.

Fire control

Fire has been assessed to be one of the threats to BFP, but there are established strategies for preventing fire and fighting fire. These measures include the establishment of fire towers – one in the eastern and one in the western block - used for detection of fire; a standby fire crew during the main dry season and a general patrol team trained in fire measures all year round, to take care of any occurrence of fire within or outside project boundaries; and fire lines in place to stop the out of and within the plantation. Internal fire lines around planted areas are 6 m wide whereas the external fire line around the edge of the property is 6-10 m.

Conservation areas

At the BFP a significant area of the total project has been set aside for conservation purposes. Within the project site these largely comprise of areas around wetlands, pockets of forest areas and scattered indigenous tree species. These have been set aside to meet the project conservation objectives, CCBA, FSC and other requirements under Ugandan law. The project also ensures the conservation of rare threatened and endangered tree species within the project area by educating local communities on the importance of conserving them.

Application of GIS:

In the proposed ARR AFOLU project activity, GIS is an essential tool for data management and informing decision-making. GIS will be employed in the planning, verification and monitoring of project implementation.

Transfer of technology/know-how

A know-how transfer to the host party is not foreseen by the project. However, capacity building is expected to occur on the following activities:

The majority of field workers at the project are from the local community. Training is provided to staff to enable them to carry out their role at the plantation. Below is a list of the areas of training conducted at BFP that demonstrate transfer of technology/technology know-how:

1. **Training of local community on nursery and silvicultural operations for establishing exotic and indigenous tree species**

Plantation workers and local communities have been trained to ensure they have the necessary knowledge and skills on nursery and silvicultural operations. It was conducted by the project manager who divided the training into parts, namely nursery and silvicultural operations.

(a) Training on Nursery operations:
This aimed at providing nursery workers the necessary techniques on nursery operations such as seed sowing, pricking out, watering, weeding, pot mixing, root pruning, etc.

(b) Training on silvicultural operations:

This is always done for all new plantation employees for the company to help them understand the way to perform different silvilcultural operations such as planting, weeding, pruning, thinning, and other forest operations carried out up to harvesting. Many of the workers are expected to demonstrate technology transfer by using knowledge learnt through BFP back in their villages, establishing and managing their own woodlots with greater success.

2. Training workshop on monitoring, prevention and control of out-break of diseases and pests as recommended by research institutions.

A specialist from Makerere University visited BFP in July 2009 to provide training on out-break of disease and pests. Training is planned moving forward for once a year. Plantation workers were trained on the signs, prevention and control of diseases and pests outbreak. Over 10 people attended the training. Topics covered during the training included:

- **Diseases and pest signs**

Description of different disease and pest signs were made by displaying the common signs of diseases through the use of pictures of affected trees. This aimed to create awareness to plantation workers on disease signs at the plantation so as to report to the project manager to prevent further spread and treatment.

- **Diseases and pest control**

Methods used in controlling pests and diseases when they occur were described in detail in the training session. The workers acquire much information on ways of controlling pests and disease breakout and spread.

Due to the training, greater awareness has been created among local people and workers making them effective in detecting and reporting signs of diseases or pests immediately they are discovered. It has placed them in better position to be able to understand different diseases and pest that can affect their own trees in woodlots as well.

3. Training of stand-by fire fighters.

Training on fire fighting has been conducted by SPGS through workshops taking place at various sites around Uganda since 2004. Fire fighter employees have attended such workshops, which typically lasted 2-3 days. SPGS' workshops are an on-going capacity building initiative which BFP intends to use in the future (the latest fire training workshop took place on the 17th and 18th December 2009)

Two approaches were used in the SPGS training:

1. Theoretical knowledge: workers were trained on issues including the effect of forest and buildings fires, types of forest fires, fire protective gears, etc
2. Practical implementation: workers were trained on forest and building fire suppression using modern technology and other items used in fire fighting. During the training, practical demonstrations to show the ways to attack forest fires were done. Training on the use of other fire fighting equipments was also carried out at the same time

4. Training of workers on management of fertilizer

Education on the management of fertilizers was conducted by NFA and SPGS for nursery workers at BFP. As fertilizer application in the field is not common practice, it is only necessary for nursery workers to be trained on this. Plantation supervisors were also trained by SPGS the spraying precautions.

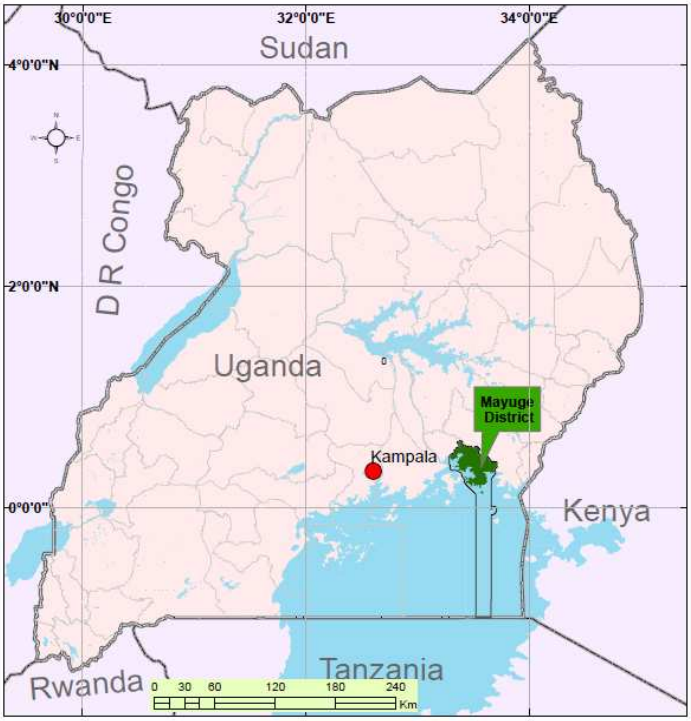
All nursery workers were taught good handling of fertilizers by showing appropriate containers for the handling of fertilizers, safety gear for handling fertilizers and other agro-chemicals.

1.9 Project Location

The proposed VCS ARR AFOLU project activity is located in East Africa, in the Republic of Uganda. The project is located within the Bukaleba Central Forest Reserve (BCFR) in the administrative district and county of Mayuge and the sub-county of Bukaleba. The project area is 2,061.6 ha.

The BCFR, and thus project area, lies between 33° 18' and 33° 32 E, and 0° 11' and 0° 15' S, and is between altitudes 1130m to 1370 m above sea level. It was first gazette in 1948 as a Central Forest Reserve (CFR).

Figure 1.9.1. Map showing location of Mayuge district in Uganda



- BCFR has 4 settlement villages within it, which surround the VCS ARR project area. BCFR is further surrounded by eleven villages located in the three parishes: Bukaleba, Mbirabira, Lwanika.
- The project participant's main headquarter is in the town of Jinja, PO Box 1900

The total VCS ARR project area is 2,061.6 ha. As shown in 1.12.1, BFC holds two licences for land development through tree planting covering the total project area. The whole area of the VCS ARR project is therefore under control of the project proponent.

The maps shown in Figure 1.9.2 shows the project area as found in 2011, including features surrounding the project area, such as villages and conservation area (wetlands and natural forest). Figure 1.9.3 shows just the VCS ARR project area, which is the eligible area to generate carbon credits under the VCS.

The project boundary, geographical location and polygons of the discrete land parcels of the ARR project activity are indicated below in Figure 1.9.4.a. and Figure 1.9.4.b, as well as Table 1.9.1.

Figure 1.9.2. Project location and surrounding area

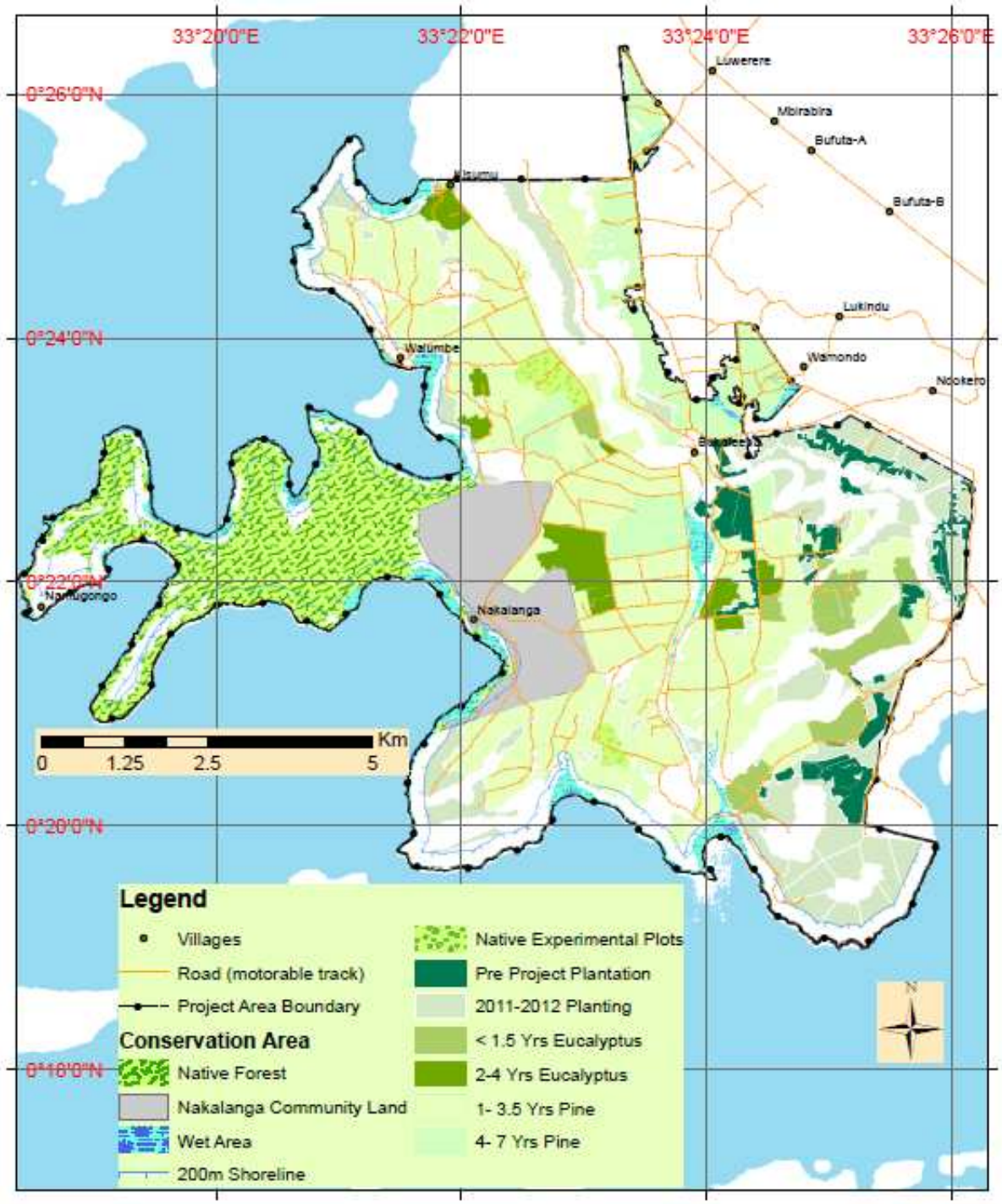


Figure 1.9.3. VCS eligible area

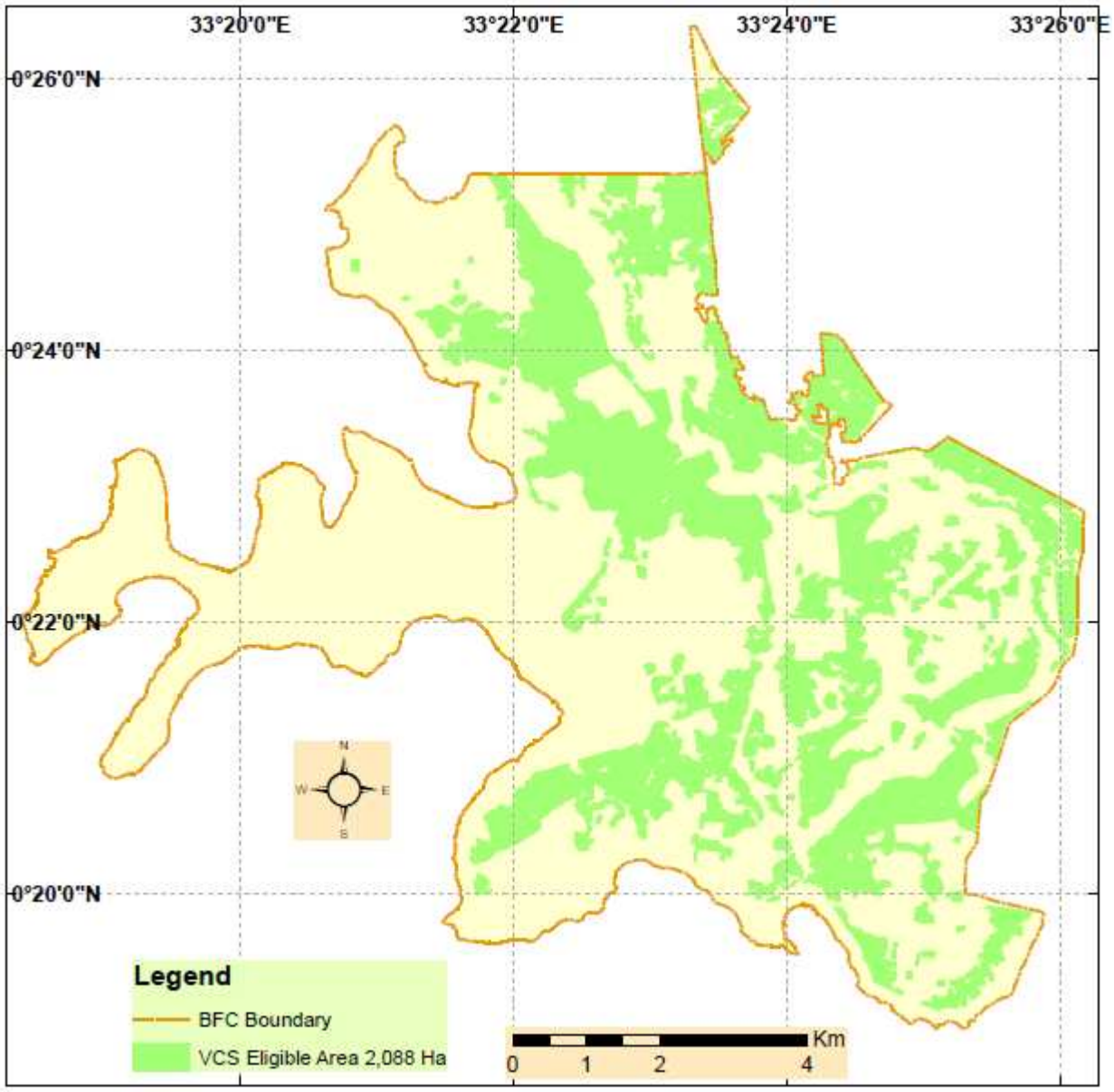
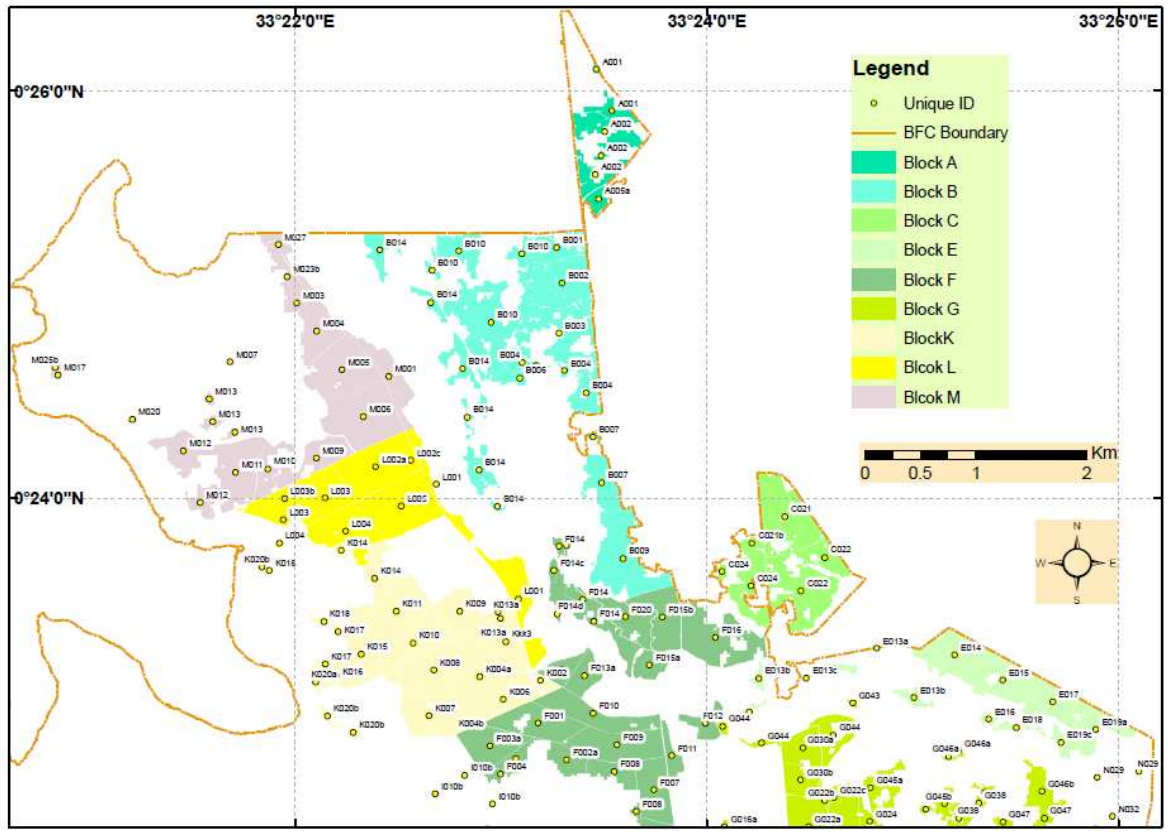


Figure 1.9.4 a and b. Maps showing the unique identification of all polygons of the project area



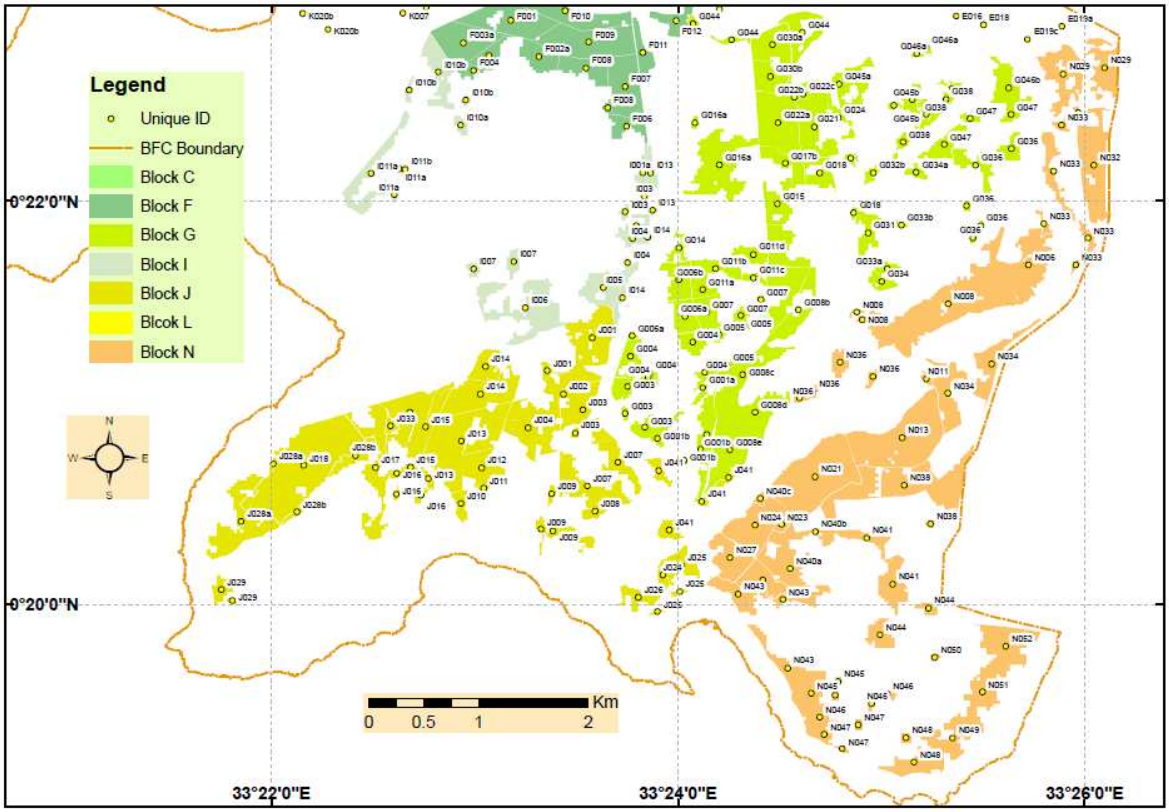


Table 1.9.1. Unique identification of the polygons for the BFP

Block	Species	ID	Area, Ha	Planting year	Eastings	Northings
A	Pcar	A001	4.184642	2004	543652.8	47715.4
A	Pcar	A001	0.429474	2004	543511.5	48091
A	Pcar	A002	0.549882	2004	543555.9	47307.11
A	Pcar	A002	5.800825	2004	543501.5	47137.59
A	Pcar	A002	10.53264	2004	543591	47528.49
A	Pcar	A005a	3.61961	2004	543532.9	46917.79
B	Pcar	B001	9.544484	2005	543154.1	46476.37
B	Pcar	B002	19.19583	2005	543203.9	46156.04
B	Pcar	B003	24.01757	2005	543175.8	45704.42
B	Pcar	B004	7.553691	2005	543420.4	45160.74
B	Pcar	B004	0.562364	2005	543226.6	45365.36
B	Pcar	B004	0.666278	2005	542972.8	45412.48
B	Pcar	B004	0.385294	2005	542843.7	45436.91
B	Pcar	B006	1.121688	2006	542823.3	45297.6
B	Pcar	B007	11.26847	2006	543562.4	44348.95
B	Pcar	B007	0.652711	2006	543482	44764.53
B	Pcar	B009	28.5326	2006	543753	43664.4
B	Pcar	B010	39.92578	2010	542565.2	45801.42
B	Pcar	B010	0.696146	2010	542031	46273.53
B	Pcar	B010	3.332386	2010	542839.6	46421.04
B	Pcar	B010	11.27385	2010	542274.3	46445.88
B	Pcar	B014	0.580478	2012	542620.3	44137.84
B	Pcar	B014	5.997953	2012	542454.6	44466.61
B	Pcar	B014	1.05342	2012	542349.5	44942.85
B	Pcar	B014	6.917623	2012	542309.4	45382.31
B	Pcar	B014	2.419391	2012	542019.5	45980.15
B	Pcar	B014	6.096694	2012	541561.5	46456.62
C	Pcar	C021	25.50846	2006	545209.6	44044.45
C	Pcar	C021b	1.87195	2006	544915.3	43802.62
C	Pcar	C022	23.46422	2006	545357.5	43373.54
C	Pcar	C022	7.67144	2006	545569.2	43673.68
C	Pcar	C024	1.019889	2006	544645.5	43547.9
C	Pcar	C024	12.59829	2006	544904.2	43417.05
E	Ecln	E013a	0.350394	2011	546039.9	42851.3
E	Ecln	E013b	1.32213	2012	544888.8	42275.77
E	Ecln	E013b	1.510107	2012	544977.7	42578.73
E	Pcar	E013b	2.668274	2011	546374.9	42406.44
E	Pcar	E013b	2.424744	2011	545659.7	42664.89
E	Ecln	E013c	0.36808	2012	545405.4	42583.63
E	Ecln	E014	19.66903	2011	546742.2	42792.29

E	Ecln	E015	14.80091	2011	547175.6	42564.28
E	Ecln	E016	1.018554	2012	547050.4	42212.63
E	Ecln	E017	14.84898	2011	547624.2	42365.59
E	Ecln	E018	1.852527	2012	547297.9	42134.38
E	Ecln	E019a	11.60345	2011	548013.4	42118.02
E	Ecln	E019c	2.542203	2012	547701.4	42000.6
F	Pcar	F001	16.66331	2008	542987.5	42176.22
F	Pcar	F002a	6.857687	2008	543243.4	41842.94
F	Pcar	F002a	4.425326	2008	542786.9	41851.18
F	Pcar	F003a	15.95725	2008	542556.4	41968.72
F	Pcar	F004	1.20161	2008	542649.2	41715.32
F	Pcar	F006	4.379938	2006	544042.9	41207.32
F	Pcar	F007	15.47338	2006	544031.3	41569.5
F	Pcar	F008	0.697085	2006	543871.2	41376.45
F	Pcar	F008	7.585424	2006	543673.8	41736.82
F	Pcar	F009	21.07926	2008	543700.7	41977.92
F	Pcar	F010	17.1251	2008	543483.2	42262.51
F	Pcar	F011	4.498156	2009	544190.2	41880.38
F	Pcar	F012	5.748372	2009	544494.6	42172.32
F	Pcar	F013a	7.361182	2008	543403.7	42605.39
F	Pcar	F013b	5.644755	2008	543203.4	42662.42
F	Pcar	F014	3.411906	2009	543388.2	43293.18
F	Pcar	F014	11.37979	2009	543489.1	43095.44
F	Pcar	F014	1.148202	2009	543175.6	43776.67
F	Pcar	F014b	0.492815	2011	543243.6	43782.97
F	Pcar	F014c	1.496379	2011	543129.5	43558.18
F	Pcar	F014d	0.375632	2011	543161.8	43161.29
F	Pcar	F015a	5.971447	2005	543989.8	42700.47
F	Pcar	F015b	15.76405	2005	544107.3	43132.99
F	Pcar	F016	24.50841	2005	544586.8	42949.7
F	Pcar	F020	13.39773	2012	543774.6	43136.91
G	Pcar	G001a	1.541463	2009	544424.3	38490.28
G	Pcar	G001a	7.142117	2009	544772.5	38388.6
G	Pcar	G001a	1.858681	2009	544740.8	38817.64
G	Pcar	G001b	0.333022	2010	544567	38156.46
G	Pcar	G001b	1.443496	2010	544720.2	38254.96
G	Pcar	G001b	1.349748	2010	544326.8	38355.78
G	Pcar	G003	3.056391	2009	544210.8	38457.58
G	Pcar	G003	0.538151	2009	544032.2	38584.33
G	Pcar	G003	4.255199	2009	544053.3	38827.73
G	Pcar	G004	0.479792	2009	544242.7	38909.8
G	Pcar	G004	0.718762	2009	544253.5	38957.87

G	Pcar	G004	0.87845	2009	544756.6	38959.53
G	Pcar	G004	4.563073	2009	544079.2	39103.76
G	Pcar	G004	4.114819	2009	544648.3	39234.65
G	Pcar	G005	1.076949	2009	544959.5	39027.2
G	Pcar	G005	1.125612	2009	544883.7	39301.73
G	Pcar	G005	0.410808	2009	545119.4	39383.7
G	Pcar	G006a	0.394215	2009	544093.7	39293.62
G	Pcar	G006a	5.882593	2009	544577.9	39467.59
G	Pcar	G006b	7.159001	2009	544519.1	39803.94
G	Pcar	G007	1.68562	2009	545087.9	39476.61
G	Pcar	G007	0.338666	2009	545268	39623.13
G	Pcar	G007	5.363959	2009	544772.3	39510.05
G	Pcar	G008a	12.60338	2009	545462.7	39689.7
G	Pcar	G008b	7.368021	2009	545610.1	39530.54
G	Pcar	G008c	14.61527	2009	545103.9	38939.5
G	Pcar	G008d	12.83303	2009	545214.4	38593.74
G	Pcar	G008e	16.24026	2009	544988.1	38249.33
G	Ecln	G010a	8.602368	2009	545466	40093.86
G	Pcar	G011a	2.80213	2010	544739.2	39715.38
G	Egra	G011b	7.183104	2008	544855	39906.52
G	Pcar	G011c	1.128859	2009	545200.8	39821.74
G	Pcar	G011d	3.951441	2010	545199.4	40035.8
G	Ecln	G014	2.437381	2009	544520.7	40095.65
G	Ecln	G015	6.887185	2009	545419.2	40498.57
G	Pcar	G016a	20.41624	2009	544888.9	40853.68
G	Pcar	G016a	0.605198	2009	544668.6	41239.34
G	Pcar	G017b	6.120784	2009	545491.7	40868.23
G	Pcar	G018	0.41659	2009	546116.3	40418.59
G	Pcar	G018	5.204089	2009	545803.5	40779.24
G	Pcar	G021	14.71385	2009	545756.7	41201.81
G	Pcar	G022a	18.75525	2009	545425.9	41238.58
G	Pcar	G022b	0.52043	2009	545571.4	41473.34
G	Pcar	G022c	0.885237	2009	545654.5	41500.8
G	Pcar	G023b	0.654405	2009	546090.8	40913.92
G	Pcar	G024	2.897866	2009	545976.9	41284.12
G	Pcar	G030a	9.873516	2005	545374.7	41950.97
G	Pcar	G030b	7.955622	2005	545355.2	41661.37
G	Ecln	G031	6.279963	2010	546245.4	40232.21
G	Pcar	G032b	1.455561	2010	546292.1	40781.76
G	Ecln	G033a	1.703486	2010	546422	39905.08
G	Ecln	G033b	0.352604	2010	546549.3	40304.34
G	Pcar	G034	2.763505	2010	546370.2	39786.34

G	Pcar	G034a	1.641533	2010	546683.6	40787.59
G	Pcar	G036	0.442575	2010	547203.4	40186
G	Pcar	G036	0.358747	2010	547274.1	40299.49
G	Pcar	G036	0.54	2010	547146.7	40479.33
G	Pcar	G036	5.561381	2010	547226.5	40851.03
G	Pcar	G036	3.686884	2010	547551.8	41003.24
G	Pcar	G038	1.799049	2010	546565	41062.97
G	Pcar	G038	3.63794	2010	546780	41313.6
G	Pcar	G038	0.546085	2010	546956.8	41451.91
G	Pcar	G043	0.415954	2012	545824.1	42355.68
G	Pcar	G044	1.35775	2012	545002.7	41996.2
G	Pcar	G044	0.985586	2012	544651.8	42144.65
G	Pcar	G044	8.598445	2012	545646.9	42066.62
G	Pcar	G045a	11.4733	2011	545984.1	41590.63
G	Pcar	G045b	0.596026	2012	546480.4	41396.52
G	Pcar	G045b	2.823829	2012	546649.9	41447.25
G	Pcar	G045b	1.271656	2012	547014.2	41549.74
G	Pcar	G046a	0.436677	2012	546689.9	41872.05
G	Pcar	G046a	0.706289	2012	546775.2	41921.99
G	Pcar	G046b	9.076871	2012	547527.3	41558.52
G	Pcar	G047	5.410403	2012	546942.2	41039.84
G	Pcar	G047	1.104472	2012	547177	41279.68
G	Pcar	G047	1.764205	2012	547549.4	41312.89
I	Pcar	I001a	2.013601	2008	544190.4	40783.25
I	Pcar	I003	2.560028	2008	544131	40297.86
I	Pcar	I003	0.99	2008	544030.8	40427.52
I	Pcar	I003	0.485122	2008	544202.1	40563.12
I	Pcar	I004	0.495482	2008	544052.8	39959.25
I	Pcar	I004	1.997256	2008	544097.2	40177.65
I	Pcar	I005	8.695703	2008	543831.7	39733.46
I	Pcar	I006	19.94306	2009	543118.7	39548.46
I	Pcar	I007	1.173076	2008	542648	39903.77
I	Pcar	I007	2.574294	2008	543015.3	39970.47
I	Egra	I010a	1.62	2008	542531.7	41217.67
I	Ecln	I010b	0.54	2012	542576.7	41444.33
I	Ecln	I010b	0.849684	2012	542059.2	41535.01
I	Ecln	I010b	9.990445	2012	542327.6	41702.65
I	Pcar	I011a	0.717704	2012	541924.5	40583.54
I	Pcar	I011a	0.304187	2012	541968.2	40818.91
I	Pcar	I011a	10.16232	2012	541713.6	40775.99
I	Pcar	I011b	0.42918	2012	542021.7	40812.98
I	Pcar	I013	0.381101	2010	544281.3	40439.2

I	Pcar	I013	2.728222	2010	544262.1	40779.78
I	Pcar	I014	3.08306	2010	544004.8	39641.21
I	Pcar	I014	0.63953	2010	544234.9	40191.7
J	Pcar	J001	1.237981	2010	543321	38975
J	Pcar	J001	15.9307	2010	543731.2	39273.07
J	Pcar	J002	9.991133	2009	543465.8	38758.24
J	Pcar	J003	0.529597	2009	543575.8	38403.51
J	Pcar	J003	13.21626	2009	543645	38614.74
J	Pcar	J004	13.23235	2010	543144.6	38451.74
J	Pcar	J007	12.88479	2010	543685.5	37919.61
J	Pcar	J007	6.175955	2010	543967	38135.69
J	Pcar	J008	3.072178	2010	543581	37454.92
J	Pcar	J008	2.290421	2010	543756	37690.8
J	Pcar	J009	0.994494	2010	543373.2	37509.08
J	Pcar	J009	1.299964	2010	543264.3	37524.13
J	Pcar	J009	0.920857	2010	543361.2	37849.59
J	Pcar	J010	2.836956	2010	542534.3	37759.53
J	Pcar	J011	0.650074	2009	542741.1	37901.54
J	Pcar	J012	8.795835	2009	542722.1	38086.88
J	Pcar	J013	1.103735	2010	542235.7	37989.35
J	Pcar	J013	29.14529	2010	542537.3	38329.11
J	Pcar	J014	16.3024	2010	542710.5	38758.33
J	Pcar	J014	5.283444	2010	542755.2	39010.59
J	Pcar	J015	0.606331	2010	542072.2	38091.7
J	Pcar	J015	8.282317	2010	542210	38461.29
J	Pcar	J016	0.875604	2010	542166.7	37836.82
J	Pcar	J016	0.442815	2010	541945.4	37845.76
J	Pcar	J016	0.833147	2010	541948.1	38035.76
J	Pcar	J016	11.88598	2010	542067.9	38595.19
J	Pcar	J017	14.55208	2010	541752.2	38088.91
J	Pcar	J018	46.36914	2010	541100.2	38107.2
J	Pcar	J024	2.127972	2010	544375.5	37109.93
J	Pcar	J025	0.536935	2010	544530.8	36953.54
J	Pcar	J025	5.619768	2010	544545.6	37197.74
J	Pcar	J026	0.377409	2010	544325.7	36772.1
J	Pcar	J026	4.022277	2010	544150.9	36906.14
J	Pcar	J028a	17.65703	2011	540529.4	37595.89
J	Pcar	J028a	0.38645	2011	540822.1	38120.5
J	Pcar	J028b	1.258442	2012	541037.3	37685.02
J	Pcar	J028b	4.664446	2012	541571.3	38199.77
J	Pcar	J029	0.33175	2012	540446.9	36874.53
J	Pcar	J029	2.756507	2012	540346	36973.12

J	Pcar	J033	0.96578	2011	541891.8	38470.61
J	Pcar	J041	2.903726	2012	544432.8	37519.11
J	Pcar	J041	0.536341	2012	544730.8	37778.72
J	Pcar	J041	1.057683	2012	544972.9	37997.51
J	Pcar	J041	2.170598	2012	544338.5	38062.02
K	Egra	K002	2.459582	2007	543010.6	42561.93
K	Pcar	K004a	28.07775	2009	542462.1	42595.68
K	Pcar	K004b	1.476603	2009	542218.1	42290.21
K	Pcar	K005	2.827569	2009	542898.8	42455.15
K	Pcar	K006	6.89375	2007	542675	42392.51
K	Pcar	K007	16.85215	2007	542004.6	42241.23
K	Pcar	K008	20.72673	2007	542048	42654.83
K	Pcar	K009	12.02265	2007	542281.6	43187.22
K	Pcar	K010	18.00603	2007	541861.5	42898.97
K	Pcar	K011	21.84273	2008	541709.4	43188.39
K	Pcar	K013a	1.953315	2011	542649.6	43122.75
K	Pcar	K013a	1.133275	2011	542628.6	43181.08
K	Pcar	K014	1.138066	2008	541213.8	43739.11
K	Pcar	K014	11.80684	2008	541515.2	43484.32
K	Pcar	K015	13.68264	2008	541393.5	42798.6
K	Pcar	K016	5.044574	2008	541171.4	42603.99
K	Ecln	K017	1.439796	2008	541071.4	42712.07
K	Ecln	K017	0.380287	2008	541186.4	43004.06
K	Pcar	K018	0.891288	2008	541056.4	43093.08
K	Pcar	K018	0.445698	2008	540565.8	43557.11
K	Pcar	K020a	0.83227	2011	540982	42543.63
K	Pcar	K020b	0.64329	2012	541322.1	42089.87
K	Pcar	K020b	0.972401	2012	541088.3	42237.93
K	Pcar	K020b	0.441013	2012	540500.1	43589.38
K	Egra	Kkk3	12.19186	2009	542697.1	42911.69
L	Pcar	L001	16.42579	2008	542809.2	43297.72
L	Pcar	L001	6.259284	2008	542070.7	44336.24
L	Pcar	L002a	25.85962	2007	541525.2	44495.35
L	Pcar	L002c	1.21621	2009	541842.1	44553.6
L	Pcar	L003	1.12734	2007	540691.5	44014.31
L	Pcar	L003	12.84516	2007	541066.8	44211.99
L	Pcar	L003b	13.33518	2011	540703.4	44207.32
L	Pcar	L004	0.371245	2007	540655.3	43800.38
L	Pcar	L004	18.60108	2007	541254	43910.46
L	Pcar	L005	27.65826	2007	541754	44139.25
M	Pcar	M001	11.93321	2008	541643.9	45310.85
M	Pcar	M002	1.480249	2007	540956.8	46067.58

M	Pcar	M003	2.114033	2012	540814.7	45975.98
M	Pcar	M004	13.51246	2007	540992.4	45722.25
M	Pcar	M005	23.81689	2007	541221.4	45370.11
M	Pcar	M006	29.39405	2007	541411.6	44948.5
M	Pcar	M007	0.310182	2010	540212.8	45442.39
M	Pcar	M009	12.17339	2007	540989.4	44571.25
M	Pcar	M010	7.462626	2009	540552.4	44473.41
M	Pcar	M011	22.1247	2009	540261.3	44443.84
M	Pcar	M012	3.55711	2009	539940.9	44171.64
M	Pcar	M012	11.78763	2009	539790.7	44637.21
M	Pcar	M013	1.097192	2009	540254.5	44807.28
M	Pcar	M013	1.771151	2009	540055.7	44902.84
M	Pcar	M013	0.809999	2009	540025	45109.33
M	Pcar	M017	0.3394	2009	538660.6	45325.97
M	Pcar	M020	0.352779	2009	539330.4	44924.07
M	Pcar	M023b	6.7754	2012	540725.2	46215.65
M	Pcar	M025b	0.849874	2012	538634.5	45392.49
M	Ecln	M027	2.814047	2012	540646.5	46504.82
N	Pcar	N006	16.10987	2010	547709.8	39941.37
N	Egra	N008	0.49016	2010	546191.6	39440.93
N	Egra	N008	0.385766	2010	546142.9	39508.98
N	Egra	N008	45.9153	2010	546975.6	39582.63
N	Pcar	N011	0.68937	2010	546779.9	38899.18
N	Ecln	N013	33.90866	2010	546555.5	38362.65
N	Pcar	N021	34.88065	2010	545764.9	38006.08
N	Egra	N023	1.224892	2010	545455.5	37569.25
N	Egra	N024	15.45926	2010	545214.7	37562.56
N	Egra	N027	9.932771	2010	544987.6	37264.42
N	Egra	N028	7.407799	2010	545288.2	37060.63
N	Pcar	N029	12.99927	2012	548026.6	41682.67
N	Pcar	N029	9.691496	2012	548403.9	41739.04
N	Pcar	N032	19.64116	2012	548304.7	40849.36
N	Pcar	N032	0.392385	2012	548163.9	41332.83
N	Pcar	N033	0.530874	2012	548140.7	39939.51
N	Pcar	N033	1.805008	2012	548250.9	40185.15
N	Pcar	N033	0.981851	2012	547849.1	40315.81
N	Pcar	N033	6.184668	2012	547939	40796.96
N	Pcar	N033	1.066624	2012	548011.4	41216.19
N	Pcar	N034	10.23615	2012	546973.9	38768.62
N	Pcar	N034	8.926749	2012	547375	39034.74
N	Pcar	N036	0.711702	2012	545623.1	38722.61
N	Pcar	N036	0.81	2012	545745	38782.67

N	Pcar	N036	1.273388	2012	546291.1	38918.74
N	Pcar	N036	3.33	2012	545993.3	39052.31
N	Ecln	N038	0.351847	2012	546816.4	37574.61
N	Ecln	N038	30.1214	2012	546574.3	37925.17
N	Pcar	N040a	15.73514	2011	545536.1	37166.32
N	Pcar	N040b	4.885585	2012	545766.9	37502.18
N	Pcar	N040c	0.698643	2012	545262.4	37806.49
N	Ecln	N041	8.333224	2012	546471.1	37024.44
N	Ecln	N041	4.074544	2012	546232.9	37444.81
N	Pcar	N043	8.536515	2012	545513.5	36257.29
N	Pcar	N043	1.083497	2012	545468.2	36882.88
N	Pcar	N043	7.085297	2012	545061.7	36933.29
N	Ecln	N044	4.59	2012	546354.6	36559.33
N	Ecln	N044	1.696735	2012	546797.5	36805.86
N	Ecln	N045	0.54	2012	545946.7	36009.33
N	Ecln	N045	0.45	2012	545973.7	36135.33
N	Ecln	N045	5.817131	2012	545728.7	36027.52
N	Ecln	N046	5.619704	2012	545803.2	35809.17
N	Ecln	N046	0.63	2012	546278.8	35932.19
N	Ecln	N046	1.038165	2012	546421	36020.11
N	Ecln	N047	0.405846	2012	546012.6	35518.76
N	Ecln	N047	2.299739	2012	545845.2	35650.68
N	Ecln	N047	0.54	2012	546156.7	35739.33
N	Ecln	N048	7.269352	2012	546666.2	35398.72
N	Ecln	N048	0.809999	2012	546591.7	35619.33
N	Ecln	N049	10.34896	2012	547017	35618.05
N	Ecln	N050	0.45	2012	546855.7	36357.33
N	Ecln	N051	8.484436	2012	547288.6	36040.15
N	Ecln	N052	15.13588	2012	547503.6	36456.17

1.10 Conditions Prior to Project Initiation

In 1974, over 5,000 ha of the reserve were given to the veterinary department to raise cattle and almost all of this area fell within the eastern part of the reserve – this was known as the Bukaleba Beef Scheme. Under this scheme the area was fenced and large trees removed by bulldozers. Some beef cattle were introduced and the area had infrastructure such as piped water supply from Lake Victoria, and five modern house built (however, these became dilapidated). The reserve under the beef scheme was cleared of most natural trees leaving only *Imperata cylindrical* (elephant grass) and some *Comretum mole* on ridge tops[7].

In the area of the reserve which had remained under management of Forest Department (now NFA), attempts were made to plant pine in 1976 and 1977 but only 30 ha were planted. Between 1990 and 1993 an additional 80 ha of pine, mostly *Pinus caribaea*, were planted.

[7] SGS FSC assessment report

Since the 1970s there has been intensive encroachment of the BCFR from local communities through charcoal burning and agriculture. These activities are illegal within the reserve; however, the law has not been enforced. This has led to succession of degradation within the reserve with most natural trees destroyed.

Busoga Forestry Co. Ltd began planting in the Bukaleba Central Forest Reserve in 1996 with the objective of mitigating climate change and developing Uganda's forestry sector. Early developments in carbon markets around this time – the first carbon offsets being piloted and the development of the Kyoto Protocol – were key to Green Resources beginning its projects. The initial planting from 1996 – 1999, however, was deemed ineligible for carbon certification under the CDM due to such an early start date, and under the VCS, the early planting had to have had an independent third party verifier assess its baseline and potential carbon benefits to be eligible – at the time, Green Resources had such an assessment carried out for its Tanzanian project which started at a similar time but not for its Bukaleba project.

The planting continued from 1996 until 1999 with the expectation that carbon market developments would have started to come to fruition by this point in time; however, with this turning out to not be the case, the project halted all planting. Planting was resumed later in 2004 once confidence returned that the business model of timber and carbon could be realised, making the project financially attractive to equity investors.

With the development of new rules and procedures at a much later stage, the early area of land therefore did not meet the eligibility requirements, although there is clear evidence, including auditor proposals, that carbon had always been an intention from the start.

The Bukaleba VCS ARR project is therefore the second component of BFC's forest plantation within the BCFR.

In line with the VCS AFOLU project requirements, PPs must show that no activities have converted native ecosystems to generate GHG credits or that any such clearing or conversion took place 10 years prior to the proposed project start date. Since the BFP start date is 11th March 2004, an assessment of vegetation ten years before was carried out to demonstrate that at this point in time the whole VCS eligible area included in the project was already cleared of forest – see figure 1.10.

Figure 1.10.1. 1994 Classification of the BCFR based on Landsat imagery

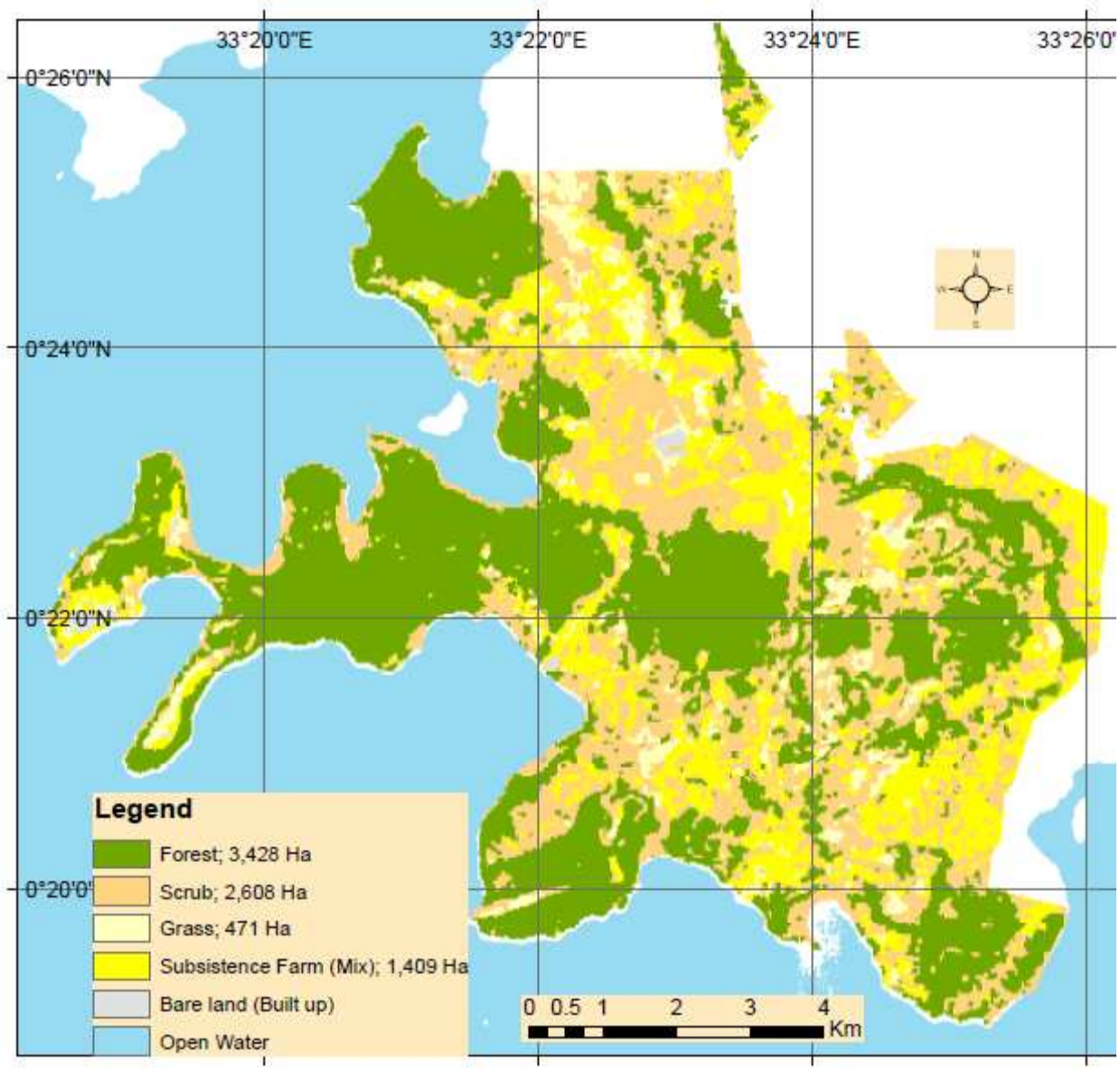
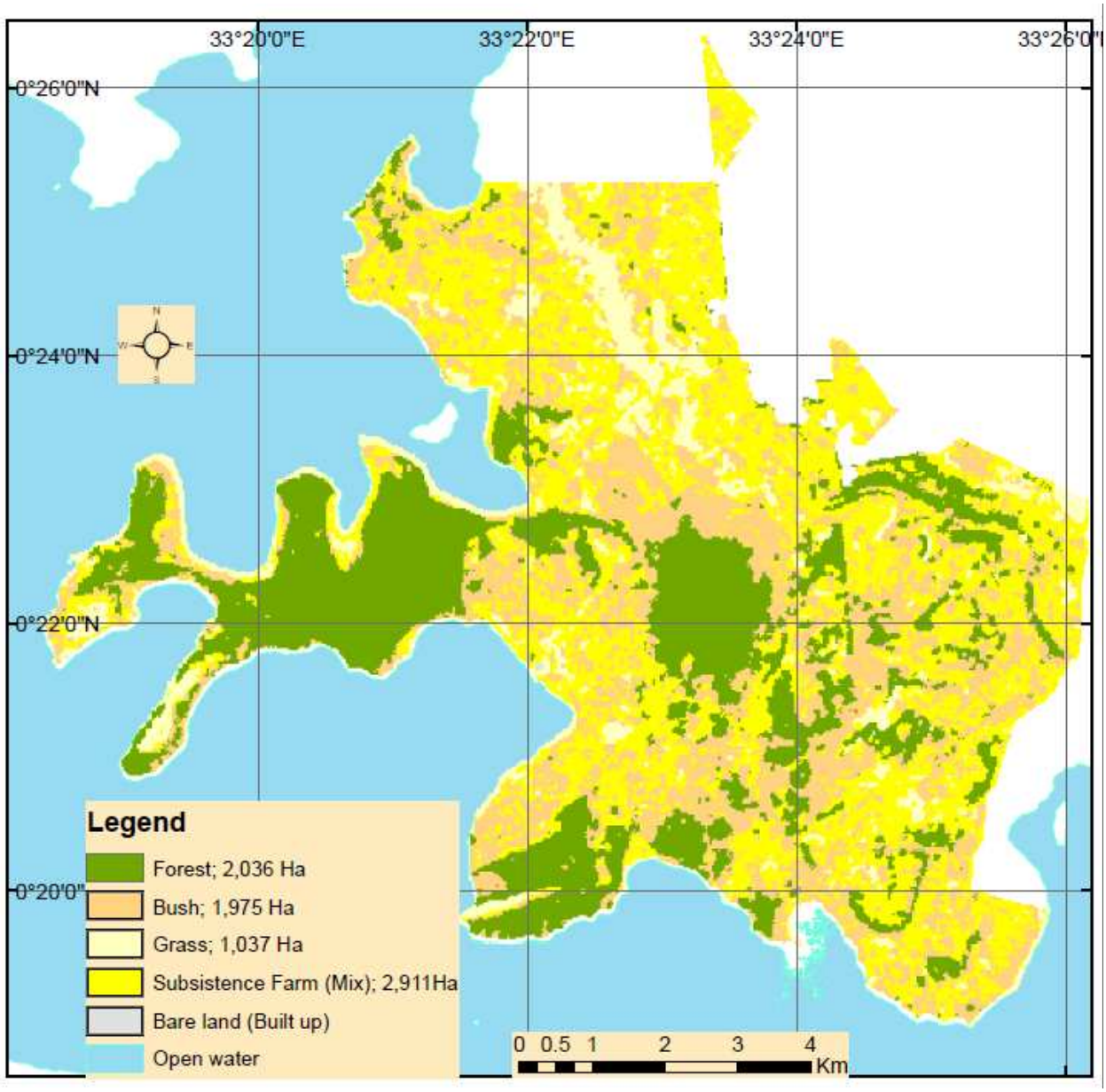


Figure 1.10.2 shows the project area just before the project start date. This has been included to demonstrate the successive pattern of degradation in the without project scenario as well as show the land class of the project area just before project start.

Figure 1.10.2. 2004 Classification of the BCFR based on Landsat imagery



1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

Below is a list of all relevant national and local laws and regulations in Uganda that the project will comply with, along with examples of how the project these will be ensured.

1. The Uganda Gazette
2. The National Environment (management of Ozone Depleting Substances and Products) regulations, 2001
3. The National Environment (Minimum standards for management of soil quality) regulations, 2001
4. The National Environment (waste management) regulations
5. The National Environment Management Policy for Uganda, 1994
6. The Land Act
7. The Water Act, 1995
8. National Forestry Plan 2001, 2002
9. Private Forest Sector in Uganda – Opportunities for greater involvement
10. National Forestry & Tree Planting Act, 2003
11. National Environment (Riverbanks, Lakeshores & Wetlands) Regulation, 2000
12. The Uganda Wildlife Statute, 1996
13. Value Added Tax Statute 1996 and Amendments (2002-2008)
14. Workers' Compensation Act, 2000
15. The Employment Act, 2006
16. Trade Union Act, 2000
17. Labour Unions Act, 2006
18. The National Social Security Fund Act
19. The Labour Disputes (Arbitration & Settlement) Act, 2006
20. The Occupational Safety & Health Act, 2006
21. The Constitution of The Republic of Uganda, 2006
22. The Local Governments Act, 1997 and Amendment (1997-2008)

The National Environment Management Policy (1994) gives the overall policy framework, which calls for sustainable development that maintains and enhances environmental quality and resources productivity to meet human needs of the present generation without compromising ability of future generations to meet their own needs (commitment to social economic development of projects). The policy sets a guiding principle that an Environmental Impact Assessment (EIA) should be required for any activities which may cause significant impact on the environment. It also fosters integration of environmental concerns into development policies, plans and projects at national, district and local level, which is achieved mainly using the EIA tool.

For BFP, the project has carried out EIA and it has been approved by NEMA, in accordance with the policy.

The National Forestry Policy (2001) as a management instrument emphasizes the importance of protection and sustainable management of Uganda's forests. The instrument encourages private sector investment in forest development for purposes of improving people's livelihoods, contributing to poverty eradication, and providing biodiversity and environmental services through effective forest conservation strategies such as, promoting profitable and productive forestry plantation businesses; conservation and management of Uganda's biodiversity in support of local and national socio-economic development and international obligations and establishment, rehabilitation and conservation of watershed protection forests.

BFC's management objectives for the project address those strategies in their totality through modernized silviculture and protection of sensitive ecosystems. BFC has set aside natural forest and areas that are rich in biodiversity (e.g. wetlands) for protection and conservation purposes. Around wetlands, a buffer of 60 meters (30 meters each side). For natural forest and high conservation value forest the buffer is 10 meters.

The National Forestry Plan (2001, 2002) was developed to put the Uganda Forestry Policy into practice. It sets out priority strategies for the sector and a new institutional framework linking the central government and local governments, recognizing the decentralization policy embraced in the Constitution of Uganda 1995 and the local government's Act 1997 as amended. The plan recognizes the importance, role and encourages private sector investment in the forest sector.

The National Wetland Conservation and Management Policy (1995), outlines the importance of the Environmental Impact Assessment and Audit procedures is a requirement for all activities to be carried out that will have an impact on wetlands. Furthermore, the policy aims at maintaining an optimum diversity of uses and users and consideration for other stakeholders when using a wetland. Mechanisms that have been recommended in the ecological survey also includes planting grass strips to stop silting of water bodies, enforcing laws and by-laws, sensitization of the people and formation of beach management units (BMUs) so as to avoid any conflict over open access natural resources. In addition, BFP collects soil and water samples every 3 years to detect any changes, both positive and negative, that might have impacted the conserved area (or other areas) as a result of the project activities.

The National Water Policy (1999) promotes an integrated approach to manage the water resources in ways that are sustainable and most beneficial to the people of Uganda. It stipulates that the quality of drainage water shall be such as not to pollute the receiving water or ground water and that all measures must be taken by the users to prevent increase in salinity levels in receiving waters, to prevent the accumulation of dangerous or toxic compounds in the subsoil, capable of contaminating groundwater aquifer.

The Poverty Eradication Action Plan (PEAP) and Plan for Modernization of Agriculture (PMA) recognizes sustainable natural resource management including forests as one of the key strategic intervention areas to achieve PEAP and PMA objectives.

BFP has one of its strategies to introduce modern farming practices to project adjacent villages as a way of contributing to poverty alleviation within the project area including the broader objectives of these two policy documents.

The National Forestry and Tree planting Act (2003) is the principle legal instrument for forest management in Uganda. Just as the mother policy, the Act stresses the importance of protection and sustainable management of Uganda's forests. It promotes private sector investment in forest development for purposes of improving people's livelihoods, contributing to poverty eradication, providing biodiversity and environmental services.

BFC aims to improve rural communities' livelihood by sustainable forest management. BFP provides employment to both men and women inside or adjacent to the project zone, as well as contribute to the community by supporting construction of a health centre, roads/infrastructure, improved access to clean water (spring protection and borehole rehabilitation), free seedlings and training on how to establish a woodlot etc. The communities, with support from BFC, also participate in a HIV/Aids sensitization and control project. The villagers get a second income by working at the plantation as well as on their own cropland. This leads to poverty alleviation and environmental awareness around deforestation, climate change and the importance of conserving natural and indigenous species.

The main objective of the Uganda Wildlife Act, (Cap.200:2000) is to protect wildlife resources and enable derivation of benefits. Need for sustainable management is recognized within the framework of effective planning and stakeholder participation. The Act allows local community involvement and opens up wildlife management to the non-governmental/private sector by making it possible for the private sector to manage protected areas/wildlife and provide services. The Uganda Wildlife Act provides for, inter alia, the sustainable management of wildlife, and establishes the Uganda Wildlife Authority (UWA) as the body mandated with the co-ordination, monitoring and supervision of wildlife management. It does so in partnership with neighbouring communities and stakeholders.

The Water Act (1997) is an act to provide for the use, protection and management of water resources and supply. BFP supports the communities in protecting springs to secure safe water for domestic use and rehabilitation of boreholes for a sustained access to safe water supply.

BFC will comply with the above listed local, national and international laws, regulations and agreements.

1.12 Ownership and Other Programs

1.12.1 Proof of Title

The Reserve, and thus the project area, is formally owned by the government under Article 237 (2) (b) of the Constitution of the Republic of Uganda. BFC has acquired two land licenses: No. 670 and No.814 from the National Forestry Authority (NFA). The licences grant a 50 year-contract for land development through tree planting in the Bukaleba Central Forest Reserve. Licence No. 670 was acquired from Deutch Forest Consult (Germany Company). Although a limited contract of 50 years is in place, the land license can be renewed, offering the potential of even longer-term project activities.

1.12.2 Emissions Trading Programs and Other Binding Limits

All net GHG emission reductions generated by the project will be sold in the voluntary market.

1.12.3 Participation under Other GHG Programs

The project has not been registered, or is seeking registration under any other GHG programs.

1.12.4 Other Forms of Environmental Credit

As mentioned in section 1.12.3, the project is not seeking registration under any other GHG program, and as such is not going to generate any other form of GHG-related environmental credit emission reductions or removals under the VCS program. There is a small portion of land in the reserve which has been developed to ISO 14064. This area of forest plantation, however, is not part of the ARR VCS project.

1.12.5 Projects Rejected by Other GHG Programs

The project has not been rejected by any other GHG programs.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

N/A since the project is not a grouped project.

Leakage Management

BFC is in the process of developing a collaborative forest management plan with the local communities so that sustainable livelihoods can be practiced. The objective of this is to reduce pressure on the peninsula forest, which in the baseline scenario would have been deforested as well as reduce encroachment of activities which are deemed

illegal within the BCFR. Initiatives which are being explored include intensive apiculture, growing of commercially known medicinal plants, growing of tree crops in agroforestry and ecotourism[8].

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Further Information

Ecology[9]:

The average temperature is 30 ℃ with an average mi nimum of 25.5℃ and absolute maximum of 32℃. Wind runs during the rainy season stands at 1-4m/sec, compared to the dry season run of 4-8m/sec.

The average annual rainfall lies between 1000-1250mm in the two rain season patterns of March - May and September - November; with the heavy rains coming in March-May season. There are two marked dry seasons July-September, and December-February being the driest. Evaporation is moderate which means that soils retain moisture for periods of the year during rainy seasons.

The original vegetation of Bukaleba Forestry is characterised by scattered patches of phragmites Mauritania and Cyprous latifolious along the lake shore and Milicia excelsa, Ficus sur, Antiaris toxicaria, Markhamia lutea, Ficus natalensis, Albizia coriaria, and Maesopsis eminii found in forest wood land. Other species found in Bukaleba forest reserve include herbaceous species like Cyperus rotundus, Scleria melanomphala, Desmodium salicifolium, Digitaria abyssinica, Imperata cylindrica, Leersia hexandra etc. Within the plantation there are patches of natural vegetation which can be observed along river valley bottoms, water ways and steep slopes. These have been left intact to improve biodiversity and to protect the areas from erosion by rainwater, and also to protect the rivers and streams. The Imanyiro Peninsula area is still intact and contains the high conservation value forest. The rest of the Bukaleba Forest Reserve did not receive the protection that was intended and is now largely disturbed by subsistence farming. It is this disturbed land that is replanted with plantations, while the areas that has still forest left receive enrichment planting treatment where indigenous trees are used to replant.

Soils[10]:

The reserve is made up of pre-cambrian rocks with bare granitic rocks at several places. The ridge is heavily eroded with several bare surfaces. The lower slopes and flat areas have alluvial soils ending up into sandy clay soils. The Elephant grass (*Pennisetum purperium*) on northern slopes are indicating fairly deep fertile soils while *Cympopogon afronardus* and *Imperata cylindica* indicate infertile soils towards the lake and *Themeda triandra* is underlain by rocky base on very thin soil. The reserve is characterized by a central ridge running almost parallel to the lakeshore in south-east to north-west direction. Although the ridge has more rounded tops, the highest peak is 1,384m above sea level. The ridge is generally rugged and rocky and slopes on either side to form flat lands into Lake Victoria to the south and cultivated lands to the north. The ridge area has shallow soils and is not suitable for commercial forestry.

Past land use[7]:

The past management of the BFCR was based on providing Mvule logs for sawmill in Kityerera. The rest of the species which include Albizia, Maesopsis, Alstonia, Terminlia and a rage of other species were not harvested. In 1974, over 5000 ha of the reserve were given to the veterinary Department to raise beef cattle and almost all of this area falls within the Eastern part of the reserve. This was known as Bukaleba Beef Scheme. Under this scheme the area was fenced and large trees removed by bulldozers. Some beef cattle were introduced and the area had infrastructure such as piped water supply from Lake Victoria, and five modern houses some of which are still standing on the Western side but in a sorry state.

The reserve which was under the beef scheme was cleared of most natural trees leaving only *Imperata cylindrica* (elephant grass) and some *Combretum mole* on ridge tops.

[8] See page 26 of the Collaborative Forest Management Programme for Bukaleba Central Forest Reserve, Draft 1
[9] See FSC report by SGS
[10] See FSC report by SGS

In the area of the reserve which had remained under the management of Forest Department now NFA, attempts were made to plant pine in 1976 - 1977 some 30 ha were planted and again in 1990 - 1993 an additional 80 ha of pine mostly *Pinus caribaea* were planted. However, no tending operations were carried out in both the old crop and the young crop until of late when a private contractor was hired by the NFA to carry out thinning in this part of the plantation. As a result of this, stocking is low and the trees have very poor form.

In the rest of the area, there has been intensive encroachment of the reserve and most important natural trees in the reserve destroyed by illegal charcoal burning.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Consolidated afforestation and reforestation baseline and monitoring methodology AR-ACM0001, "Afforestation and reforestation of degraded land" (Version 05.2.0).

The methodology also refers to the latest approved versions of the following tools, procedures, guidelines and guidance:

- Procedures to demonstrate the eligibility of lands for afforestation and reforestation, Version 01.0
- Guidance on application of the definition of the project boundary to A/R CDM project activities, Version 01.0
- Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks, Version 02.0
- Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities, Version 01.0
- Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, Version 01.0
- Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity", Version 04.0.0
- Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity, Version 01.0
- Tool for estimation of change in soil organic carbon stocks due to the implementation of A/R CDM project activities, Version 01.1.0
- Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities, Version 02.1.0
- Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities, Version 01.1.0

2.2 Applicability of Methodology

The methodology AR-ACM0001, Version 05.2.0, has the following applicability conditions:

(a) The A/R CDM project activity is implemented on degraded lands, which are expected to remain degraded or to continue to degrade in the absence of the project, hence the land cannot be expected to revert to a non-degraded state without human intervention;

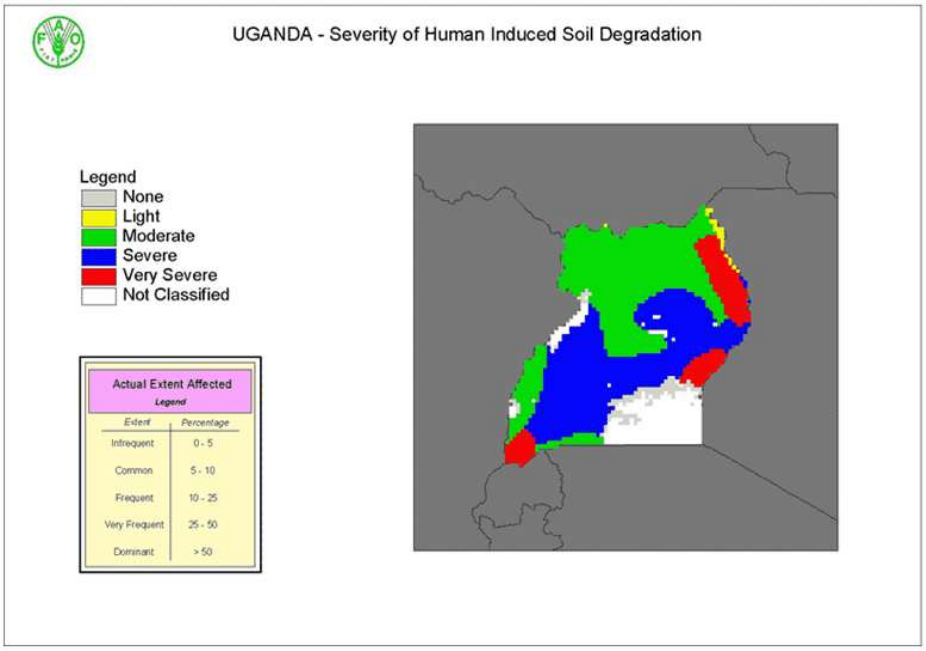
The "tool for the identification of degraded or degrading lands for consideration in implementing A/R CDM project activities, version 1" has been applied to demonstrate that the lands are degraded or degrading.

Stage 1 of the tool requires the PP to screen the lands of the project to determine whether the area has been classified as "degraded" under any verifiable local, regional, national or international land classification system or credible study produced within the last ten years. For BFP, the FAO (2008) National Soil Degradation Maps were used to show the land was classified as degraded; however, since the soil degradation assessments used to compile the map were obtained in the 1980s, it had to be shown that the drivers and pressures that led to the land becoming degraded are still present, and there are no or insufficient management interventions to reverse degradation. The drivers and pressures of land degradation in the region have been from charcoal and fuelwood production, as well as agriculture. These drivers are still present as can be seen from field evidence as well as the EIA and FSC assessment reports.

Further evidence that the anthropogenic degradation drivers and pressures that led to the land becoming "degraded" are still present (procedure (a) (i)) was provided by direct visual field evidence of selected indicators of land degradation. Land is classed as degraded and/ or degrading if a reduction in plant cover due to overgrazing or other land management practices is shown. As shown in the land classifications from 1994 and 2004, shown in section 1.10, there has clearly been a loss of forest vegetation in this time period, which demonstrates that the land is degrading.

Figure 2.2.1, shown below, shows the national soil degradation map for Uganda[11]. Overlaying this image in Google Earth, it can be seen that the BFCR has severe soil degradation[12].

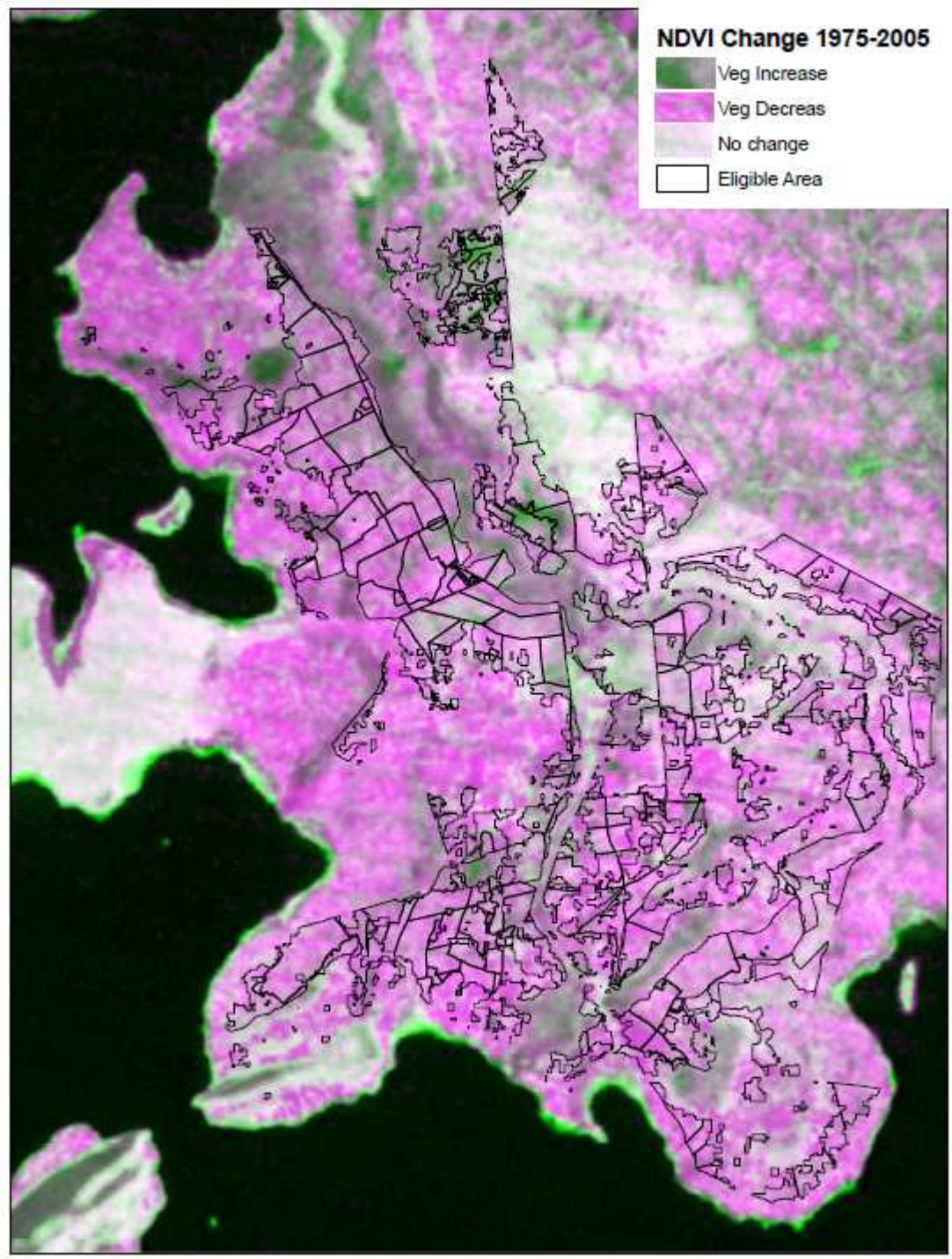
Figure 2.2.1. National Soil Degradation Map for Uganda



In addition to the FAO soil degradation map and the land classifications shown in section 1.10, a time series analysis from 1975-2005 using Landsat imagery further substantiates the successive pattern of degradation, as can be seen in Figure 2.2.2.

[11] FAO (2008) National Soil Degradation Maps http://www.fao.org/landandwater/agll/glasod/glasodmaps.jsp
[12] KMZ file available to substantiate

Figure 2.2.2. Time series analysis showing vegetation change in the BCFR between 1975 and 2005[13]



This multi-temporal change image highlights vegetation change in the area – magenta shows decreases in vegetation and green showing vegetation increase. It can clearly be seen that almost the whole of the BCFR has experienced a vegetation decrease between 1975 and 2005.

[13] The time series analysis is publically available from the ESRI website: http://changematters.esri.com/compare

(b) If at least a part of the project activity is implemented on organic soils, drainage of these soils is not allowed and not more than 10% of their area may be disturbed as result of soil preparation for planting;

The project is not taking place on any organic soils. As mentioned in 1.13, Additional Information, the soils in the BCFR are alluvial soils ending up into sandy clay soils.

(c) The land does not fall into wetland[14] category

No wetlands will be planted and the PP has a SOP, Procedure 20, "Detecting and demarcating wetlands", which is followed to delineate and exclude any such areas from the project area.

The project proponent is not choosing to account for changes in carbon stock in soil organic carbon (SOC) pool in the project scenario, and thus, consequently applicability conditions (d) and (e) from the methodology do not apply.

The combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, has the following applicability conditions:

- Forestation of the land within the proposed project boundary performed with or without being registered as the A/R CDM project activity shall not lead to violation of any applicable law even if the law is not enforced

This is applicable to the BFP – as the project is taking place in a central forest reserve, forestation is the only activity which can legally take place within the reserve.

- The tool is not applicable to small – scale afforestation and reforestation project activities

This is met since the BFP is not a small-scale project.

2.3 Project Boundary

The project boundary is only the eligible areas of planting, as shown in Figure 1.9.3 in section 1.9. The project boundary delineates the reforestation project activity under the control of the BFC and meets the CDM "Guidance on application of the definition of the project boundary to A/R CDM project activities" since the total area (2,061.6 ha) is under control and is substantiated through proof of title.

Following the "Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities", the project meets step 1(a), "demonstrate that the land at the moment the project starts does not contain forest...", as demonstrated by figure 1.10.2. However, for step 1 (b), "demonstrate that the activity is a reforestation or afforestation project activity", the project does not meet the stated requirements under the CDM for reforestation since there is a conflict between the CDM and VCS rules on how reforestation is defined – under the CDM the land is not forest since 1989; under the VCS it's the direct human-induced conversion of non-forested land to forested land through planting, seeding and/ or the human-induced promotion of natural seed sources on land that was once forested but has been converted to non-forested land. The project does, however, meet the VCS' land eligibility criteria as shown in section 1.10.

Figure 2.3.1 shows the *ex ante* stratification of actual new GHG removals by sinks, representing the different species planted in the eligible areas according to the planting plan.

[14] "Wetlands", "settlements", "cropland" and "grassland" are land categories as defined in the *Good Practice Guidance for Land Use, Land-use Change and Forestry* (IPCC, 2003)

Figure 2.3.1. *Ex ante* stratification of actual net GHG removals by sinks

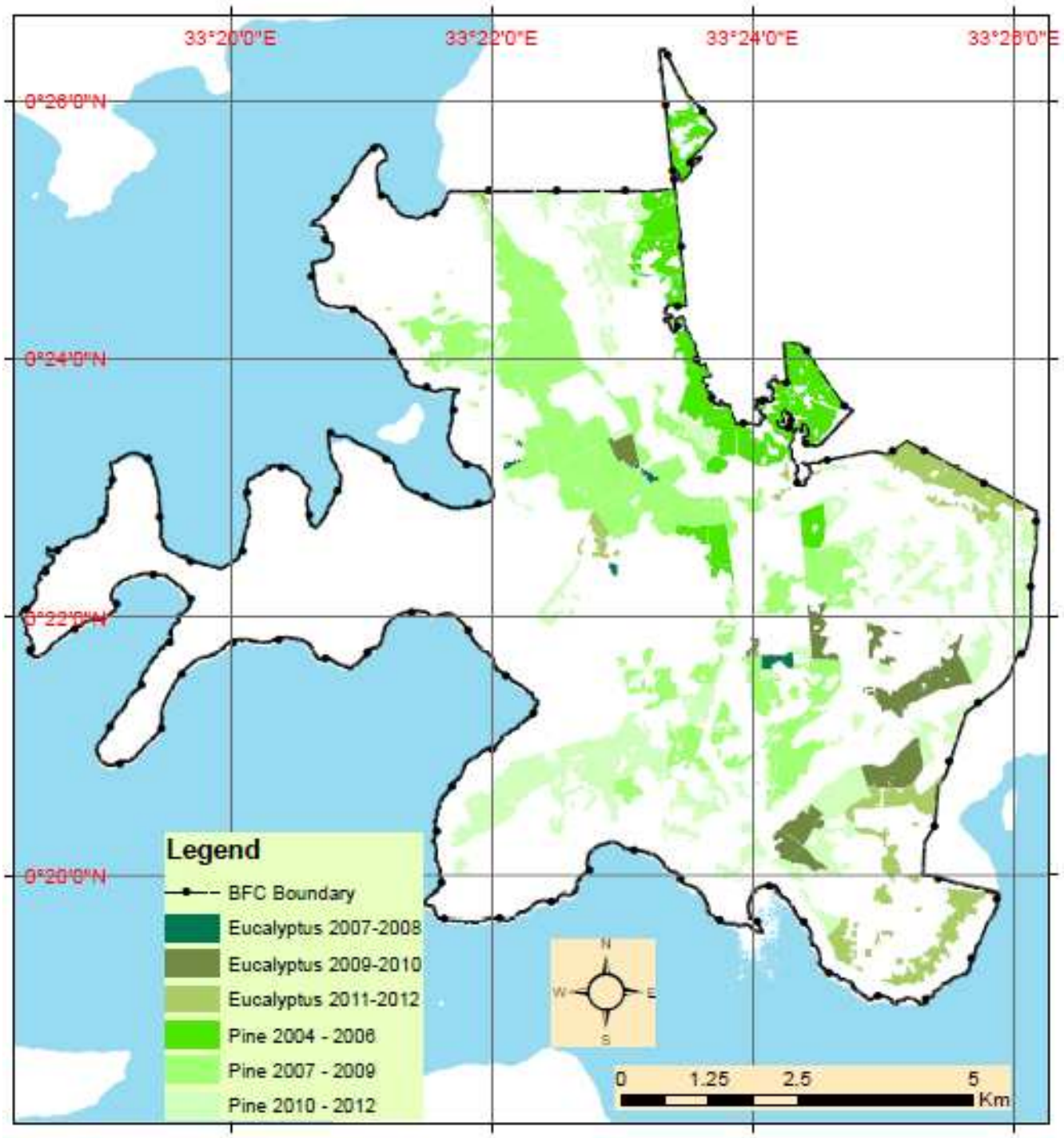


Table 2.3.1. Carbon Pools, Sources and Sinks

Carbon pools	Accounted for	Justification/Explanation
Above-ground biomass	Yes	Major carbon pool subjected to project activity
Below-ground biomass	Yes	Below-ground biomass stock is expected to increase due to the implementation of the A/R CDM project activity
Dead wood	No	Under the applicability conditions of this methodology, carbon stock in this pool is likely to increase in the project compared to the baseline. However, the methodology also provides the conservative choice of not accounting for changes in carbon stock in the pool. This pool has been excluded due to carbon stocks in deadwood in the baseline scenario are expected to decrease more relative to the project scenario. This is expected since there is clear evidence that the land within the BCFR has been degrading due to the clearance of natural vegetation – as shown in Figures 1.10.1 and 1.10.2 as well as 2.2.2. In addition, the EIA makes reference to the clearance of vegetation in the baseline. Deadwood has been removed by local communities for fuelwood and has now reached a point where there is little more deadwood remaining. In the project scenario, although communities will still be able to collect deadwood from the project – offcuttings etc – there is expected to be enough of a surplus that will mean that the deadwood pool can accumulate.
Litter	No	Under the applicability conditions of this methodology, carbon stock in this pool is likely to increase in the project compared to the baseline. However, the methodology also provides the conservative choice of not accounting for changes in carbon stock in the pool. This pool has been excluded due to carbon stocks in litter in the baseline scenario are expected to decrease more relative to the project scenario. Similarly to the deadwood pool, the succession of degradation that has been witnessed in the baseline at the BCFR has meant that the litter pool has been continually reduced. The project scenario is expected to provide a significant amount of litter from offcuts and pruning.
Soil organic carbon (SOC)	No	Under the applicability conditions of this methodology, carbon stock in this pool is likely to increase in project compared to the baseline. However, the methodology also provides the conservative choice of not accounting for changes in carbon stock in the pool.

Sink/ Source		Gas	Included?	Justification/Explanation
Baseline	Removals by sinks	CO_2	Excluded	Following "guidance on conditions under which the change in carbon stocks in existing live woody vegetation are insignificant" from the CDM EB (EB 46 Report, Annex 16), the carbon stocks of sinks in the baseline are not considered.
		CH_4	N/A	N/A
		N_2O	N/A	N/A
		Other	N/A	N/A
Project	Burning of woody biomass	CO_2	Excluded	Carbon stock decreases due to burning are accounted as a change in carbon stock.
		CH_4	Included	Burning of woody biomass for the purpose of site preparation or as part of forest management can lead to significant levels of emissions of methane. These emissions are estimated following the CDM A/R methodological tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
		N_2O	Included	Burning of woody biomass for the purpose of site preparation or as part of forest management can lead to significant levels of emissions of nitrous oxide. These emissions are estimated following the CDM A/R methodological tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
		Other	N/A	N/A
	Removals by sinks	CO_2	Included	Measured in the carbon pools shown in Table 2.3.1
		CH_4	N/A	N/A

Sink/ Source		Gas	Included?	Justification/Explanation
		N_2O	N/A	N/A
		Other	N/A	N/A
	Harvesting	CO_2	Included	Carbon stock decreases due to harvesting are accounted as a change in carbon stock.
		CH_4	Excluded	Emissions from harvesting assumed to be only CO_2
		N_2O	Excluded	Emissions from harvesting assumed to be only CO_2
		Other	N/A	N/A
Leakage	Emissions from pre-project agricultural activities	CO_2	Included	Emissions from displacement of agricultural activities are calculated following the CDM tool: "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity".
		CH_4	Excluded	Emissions from displacement of agricultural activities are calculated following the CDM tool, which is only based on the changes in carbon stocks of only the pools required by the methodology – the pools shown in Table 2.3.1.
		N_2O	Excluded	Emissions from displacement of agricultural activities are calculated following the CDM tool, which is only based on the changes in carbon stocks of only the pools required by the methodology – the pools shown in Table 2.3.1.
		Other	N/A	N/A

2.4 Baseline Scenario

Historical and existing land-use/land-cover changes in the context of the socio-economic conditions prevailing within the boundary of the proposed A/R CDM project activity and key factors that influence the land-use/land-cover changes over time

The baseline scenario has been developed using the CDM's "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities". Section 2.4 of the PD describes the baseline section of the tool, and section 2.5 covers the additionality section.

STEP 0. Preliminary screening based on the starting date of the A/R project activity

The project start date is the 11th March 2004. Since the VCS ARR project's start date is after the 31st December 1999 but before the date of its registration, evidence is provided to show:

- The start date of the ARR VCS project activity was after 31st December 1999, and
- The incentive from the planned sale of VCUs was seriously considered in the decision to proceed with the project activity.

As shown in section 1.5, the project start date is substantiated through GRAS' inventory and monitoring system, Microforest.

Evidence that the incentive from the planned sale of VCUs was seriously considered in the decision to proceed with the project activity is shown through a "Carbon Offset Verification" drawn up by SGS in 1998. Busoga Forestry Company engaged with SGS to assess the potential benefits from the project, in terms of GHG removals. Furthermore, board minutes from 1999 and 2000 substantiate that the company's objective was to develop carbon forestry projects. From 1999 onwards, GRAS' attempts to raise investment for the project were impacted by the lack of developments in carbon markets, which were expected to have made significantly more progress in light of the introduction of the Kyoto Protocol in 1997. Following the UNFCCC's COP 9 in 2003, however, the rules for AR project activities were decided, which brought back further confidence to forest carbon project developers to reinvest in such activities. In 2004, with renewed confidence of carbon market opportunities, Busoga Forestry Company began planting of the VCS eligible area[15].

STEP 1. Identification of alternative land use scenarios to the proposed ARR VCS project activity

Sub-step 1a. Identify credible alternative land use scenarios to the proposed ARR VCS project activity

Historical and existing land-use/land-cover changes in the context of the socio-economic conditions prevailing within the boundary of the proposed A/R CDM project activity and key factors that influence the land-use/land-cover changes over time

As shown in the FAO's Global Forest Resources Assessment 2005, since 1990 Uganda's forests and wooded lands have decreased from approximately 6.3 million to 4.7 million hectares, which represents one of the highest deforestation rates in the world over the last decade[16]. Furthermore, records from NEMA indicate that back in 1890 approximately

[15] Microforest planting data from 1996 - 2010
[16] FAO, Global Forest Resources Assessment 2005

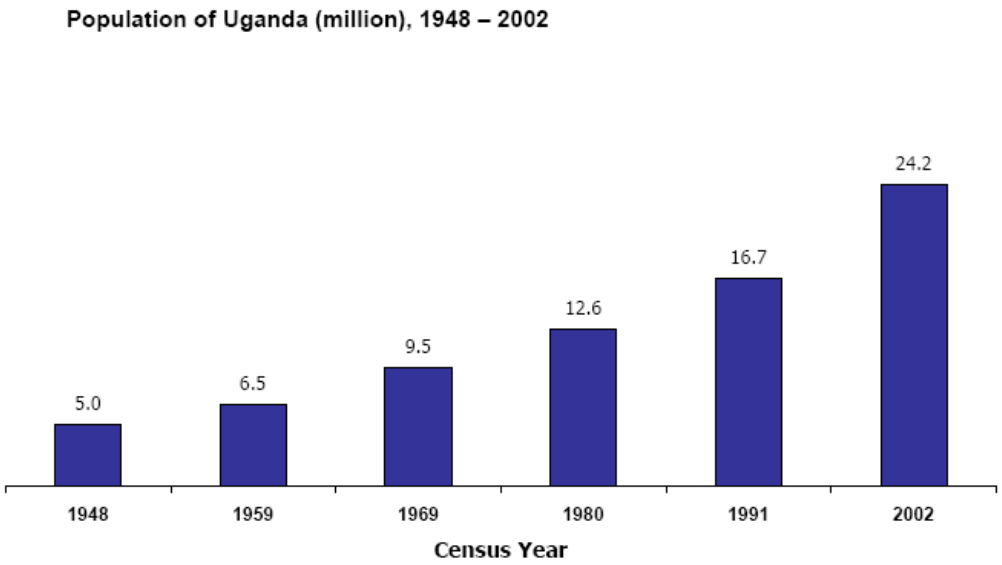
10.8 million hectares, equivalent to 45% of Uganda's land area, was forest and woodland[17]. In light of this, it is not surprising that deforestation has been present at BFP over the last century, principally due to the prevailing land-use of subsistence agriculture, fuel-wood collection, charcoal production and grazing activities. Key policies, regulations and events have acted as precursors to this land-use change and thus driven the extent of the land-cover change.

Uganda experienced a period of instability during the 1970s with the dictatorship of Idi Amin; a time characterized by political repression, corruption and human rights abuses, and culminating in the Liberation War between Uganda and Tanzania at the end of the decade. Further insecurities proceeded into the early 1980s after the return to power of Milton Obote, which led to an insurgency causing widespread conflict. This era of Uganda's history had strong repercussions for almost all aspects of the country's economy - including the land-use and forestry sector - and meant that people were forced to meet immediate livelihood needs as oppose to long-term needs.

In the early 1970s, the Government of Uganda encouraged the growing of agricultural crops in Central Forest Reserves (CFRs) in a campaign to increase agricultural output. Inevitably this resulted in mass encroachment of CFRs, and successive governments have struggled to reverse this action. This was also the first time that illegal logging by pit-sawing became common practice; another activity which became difficult to control.

Another important factor pertaining to the increased pressure on the land has been the rapid population increase, which almost doubled between 1980 and 2002 (see figure 2.4.1 below). This vastly increased the demand of food and employment which could not be met by equivalent supply. Such a disparity meant many local communities had no other option but to resort to subsistence living in an unsustainable manner. Thickets and forests became degraded as people exerted them for firewood, charcoal production, timber and clearing virgin land for cultivation and grazing.

Figure 2.4.1 Uganda population change[18]



[17] Working Paper 3, *natural Resource Management and Policy in Uganda: Overview* Paper, Economic Policy Research Centre, February 2000, ftp://ftp.fao.org/agl/agll/kageradocs/08case_studies/ug_nrm_overview_paper.pdf

[18] Projections of demographic trends in Uganda 2007-2017, Uganda Bureau of Statistics, December 2007

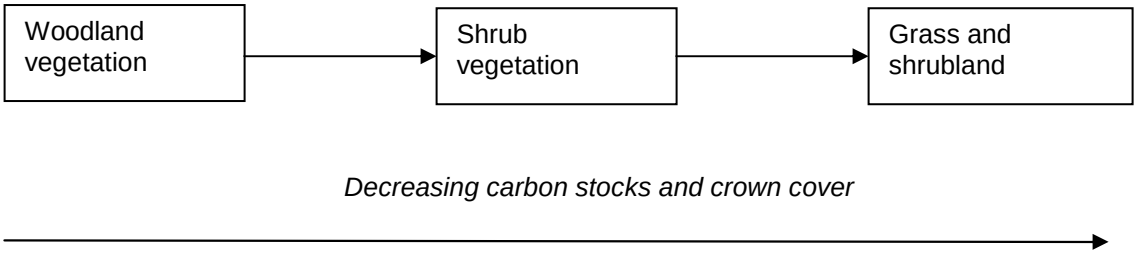
Privately owned land has also continued to decrease since the 1980s due to the increasing population, owing to fragmentation and further subdivision among children of the next generation. Further exacerbation of the state of the land occurred when the forest department was taken over by the NFA in 1995. This transitional restructuring led to relaxed enforcement of forest law and regulations, which resulted in an increase of people using the reserve illegally. The reserve was subject to increased anthropogenic pressures compared to adjacent private and community land, the forest reserve has seen far worse anthropogenic pressures to private and community lands, as the clear tenure of individuals' lands means there's no ambiguity for encroachment.

Uganda's economy has developed steadily since 2000, showing how far the country has come since the troubled economic times of the 1970s. It is now one of the fastest growing economies in Africa[19], but, conversely, social indicators still point to an array of problems which are firmly rooted in that of a poor nation: low life expectancy, one of the highest population growth rates in the world etc. Such social problems are prevalent in the communities around the ARR VCS project activity and limit individuals' outlook perspectives to short term needs. Furthermore, the limited availability of jobs in local trading centres and restricted access to loans means that work is hard to find and implementing private initiatives, such as tree planting, is not a viable option currently. The maintenance of a short-term income stream from land use practices which lead to degradation has thus been imperative, even if unsustainable.

Historical and current land-use/ land-cover change has led to progressive degradation of the land over time including a decrease or steady state at a reduced level of the carbon stocks in the carbon pools

The high prevailing rate of deforestation seen in Uganda over the last century has meant that many areas have been left in a state of degradation. This is highlighted in the work carried out by the FAO to map out the severity of human induced soil degradation (Figure 2.2.1), which shows that the majority of Uganda's soils are either moderate or severe in degradation. As indicated by the map, BFP is in an area of severe soil degradation. The results from the Ecological Survey support a problem with the soil, identifying the main concern with them at BFP as being of "poor chemical properties" leading to soil infertility.
Degradation is also evidenced by comparison of the NFA maps of the reserve from 1995 and 2005, changing from predominantly woodland vegetation below the forest definition to bush vegetation and a significant area of subsistence farmland over this ten year period. Moreover, the current land-use and stratification map that was produced from ground truthing the project area showed that the land was of a grass and shrubland classification.

Figure 2.4.2. Schematic of land-class change



[19] http://web.worldbank.org viewed 10/06/11

National, local and sectoral land-use policies or regulations

Local Government Act, 1997:

The Local Government Act was a key policy influencing land-use in Uganda as it effectively devolved management functions from central government to districts and lower-level councils[20]. However, district councils took advantage of their new powers of control, which led to exploitation of the forest reserves.

Forest Reserves (Declaration) Order, 1998:

In response to concerns relating to the unsustainable management of the reserves due to the consequences of the Local Government Act, the government introduced the Forest Reserves (Declaration) Order (1998), which reversed decentralization of forest management for forests of 100 ha or more[21].

- Plan for Modernization of Agriculture, 2000:

As part of the Poverty Eradication Action Programme (PEAP, 1997), the Plan for Modernization of Agriculture (PMA, 2000) provides a framework for eradicating poverty through helping subsistence farmers move towards becoming commercial farmers. Forestry is promoted as one such activity, along with agriculture, fisheries and livestock. Though the Plan seems like a positive step towards encouraging sustainable development, the emphasis of the strategy is on key reforms to legal and regulatory frameworks – such as decentralisation to lower levels of local government, removing direct government in commercial aspects of agriculture – and thus assumes the intended reforms will be achievable with just this[22]. In the region of BFP, this policy instrument has not been affective as the local communities have remained without financial resources to develop such activities. Nevertheless, such a credit scheme would be insufficient in establishing a reforestation project due to the large investment costs.

- The National Forestry Policy, March 2001:

As the main policy instrument for forest management in Uganda, it emphasises the importance of protection and sustainable management of Uganda's forests, along with identifying stakeholders that can help promote the development of forestry – including the private sector. However, the policy alone does not have the necessary instruments to develop the forest sector in the desired way, instead it attempts to create a more enabling environment for forestry development.

Other post-11 November 2001 policies/ regulations:

- The National Forest Plan, 2002:

[20] http://www.fao.org/docrep/005/Y7584E/Y7584E11.htm
[21] Competing jurisdictions: settling land claims in Africa, Sandra Evers, Marja Spierenburg and Harry Wels; can be viewed at: http://books.google.com/books?id=6iEFRNxiDtIC&pg=PA272&lpg=PA272&dq=The+Forest+Reserves+(Declaration)+Order&source=bl&ots=nKdlCzox6W&sig=I6vQKcy0OegJFFBnNRWEtqatnKw&hl=en&ei=s-n7SvD4NYad4Qbp8vDcAw&sa=X&oi=book_result&ct=result&resnum=3&ved=0CA4Q6AEwAg#v=onepage&q=The%20Forest%20Reserves%20(Declaration)%20Order&f=false
[22] Will the Plan for Modernization of Agriculture Deliver? Samuel Bagabo: http://www.irdiuganda.org/pdf/pma.pdf

Despite this policy being beyond the time frame of interest as specified in the CDM's "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities", it provides evidence that the National Forestry Policy required strengthening to meet its objectives, as it was developed to implement the National Forestry Policy through establishing strategies addressing the policy statements.

- The National Forestry and Tree Planting Act, 2003 (NFTPA)

As the main principle legal instrument for forest management in Uganda, the NFTPA made reforms to accelerate the development of the sector. Key aspects of the Act include: introduction of the National Forestry Authority (NFA) replacing the Forest Department (FD); district forest offices established by district councils; and management and environmental safeguards put in place through requirements of forest management plans and EIAs for projects significantly impacting forests.

The policies adopted before 11 November 2001 do not influence the areas of the A/R AFOLU project

The following are credible alternative land use scenarios to the proposed ARR VCS project activity:

1. Maintaining the current land-use without the ARR VCS Project
2. Establishment of forest plantations without the use of carbon finance
3. Commercial agriculture

Sub-step 1b. Consistency of credible alternative land use scenarios with enforced mandatory applicable laws and regulations

Since the BFP is being developed in a Central Forest Reserve (BCFR), the only permitted activity is tree planting. Therefore scenario 3, commercial agriculture, is not consistent with enforced mandatory applicable laws and regulations.

Maintaining of the current land-use of further degradation of the land due to encroachment activities, such as slash and burn agriculture and charcoal production, is not in compliance with all applicable legislation and regulations as encroachment of forest reserves for activities other than tree planting is illegal. However, the scenario is valid because of the systematic lack of enforcement of applicable laws and regulations, as described below:
In a Forest Reserve, settlements or activities such as charcoal making or pasture are not permitted. Only dry or dead wood may, in reasonable quantities, be cut and taken free of any charge by members of local communities (National Forest and Tree Planting Act Section 33, August 2003). Illegal encroachment for various small-scale land-uses has been a continuous practice of local communities until the start of the project activity, as the NFA has been without the resources to implement patrols or other methods to enforce these laws (NFA has just two officers for its administrative district unit). In light of this, continuations of the pre-project land use is not in compliance with applicable laws and regulation, but as the illegal activities have taken place on more than 30% of the Reserve, as an administrative unit, this is still in line with the A/R CDM methodology, unless it is specifically required by a permit holder paying fees etc.

The scenario of establishing forest plantations without the use of carbon finance would be consistent with enforced mandatory and applicable laws and regulations and are thus credible alternative land use scenarios.

The following is a list of plausible alternative land use scenarios to the ARR VCS project activity that are in compliance with mandatory legislation and regulations taking into account their enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations:

1. Maintaining the current land-use without the ARR VCS project

2. Establishment of plantations without the use of carbon finance

The next steps of the "Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities" are covered in section 2.5, Additionality, shown below, since these steps are specifically in relation to additionality.

2.5 Additionality

STEP 2. Barrier analysis

Sub-step 2a. Identification of barriers that would prevent the implementation of at least one alternative land use scenario

The land use scenario, establishment of plantations without the use of carbon finance, identified in Step 1b, is prevented by an investment barrier - insufficient financial returns. However, following the combined tool to identify the baseline scenario and demonstrate additionality, this barrier must be demonstrated by carrying out investment analysis.

Sub-step 2b. Elimination of land use scenarios that are prevents by the identified barriers

The following is a list of land use scenarios that are not prevented by any barrier:

1. Maintaining the current land-use without the ARR VCS project

2. Establishment of private plantations without the use of carbon finance

Sub-step 2c. Determination of baseline scenario (if allowed by the barrier analysis)

Following the decision tree from the tool, since forestation without being registered as an A/R CDM project activity is included in the list of land use scenarios that are not prevented by any barrier, and the list does not contain only one land use scenario, the tool must be continued with Step 3: Investment Analysis.

STEP 3. Investment analysis

Sub-step 3a. Determine appropriate analysis method

Benchmark analysis (Option III) is applied as the project generates revenues not just from the sale of VCUs – which rules out applying simple cost analysis. Investment comparison analysis is not applicable to the project since the alternative land use scenario requires no investment at all. Benchmark analysis is therefore the appropriate analysis.

Sub-step 3b. – Option III Apply benchmark analysis

The equity Internal Rate of Return (IRR) has been applied as the financial indicator for the ARR VCS project since there is only one potential project developer.

In line with the Additionality Tool, the benchmark is to represent standard returns in the market, considering the specific risk of the project type, but not linked to the subjective profitability expectation or risk profile of a particular project developer.

The benchmark has been derived from a company internal benchmark since there is only one potential project developer. This is based on GRAS' equity investors' requirements to proceed with investment in BFP due to its potential to provide an expected total return of 25% in the long term[23]. This benchmark has been consistently applied in the past to other projects developed by GRAS; for example, the A/R CDM Kachung Forest Project, which is registered under the CDM. The benchmark is further substantiated by the standard return on equity by IbbotsonAssociates' 2003 Cost of Capital report, which is in line with the second approach for deriving the benchmark.

The ideal method to obtain such a benchmark would be to analyze IRR expectations for private forestry operations in Uganda. However, this was not possible due to the very limited development of the sector, particularly for private investments on a scale similar to that of the ARR VCS project.

Although data for required returns on capital was not available for forestry within Uganda, it was possible to look more generally at equity investments within the country. IbbotsonAssociates (www.ibbotson.com), a leading provider of independent investment research in major international markets, annually determine the required return of capital for investments in 173 countries from the perspectives of foreign investors. The statistics represent the IRR-return that an investor would expect to receive if investing in a particular country. The report looks at perspectives from six different countries (UK, France, Germany, Canada, Japan and Australia) and applies both a linear and logarithmic scale of the Country Risk Rating Model to determine the according IRRs. In total, 12 IRR-values are provided covering all six countries and the two different model scales.

For 2003 investments in Uganda, the analysis shows a range of required IRRs of 24.38 – 33.64 %, with an average of 29.74% for all country perspectives with both models (IbbotsonAssociates, 2003[24]).

Benchmark = 25%

Sub-step 3c. – Option III Apply benchmark analysis

The financial model to determine the IRR at BFP was developed using justified plantation assumptions and costs – the majority of which were substantiated through contract examples or government documentation that were available at the point of the investment decision being made. The investment analysis covers the total area under the control of BFC since this is what was considered from the investors' perspective when looking at the financial viability of the project – therefore the VCS project area is included along with the ineligible areas and the early stands planted between 1996 and 1999. However, for the early stands only 40% of the value of the timber is assumed due to a significant amount of the timber not being suitable for the market due to knots and bent trees which have resulted from the lack of early silvicultural management that occurred between 1999 and 2004. The pole and timber markets in Uganda demand a high quality of wood and as such trees with knots and bends are unable to be sold. Only pine and eucalyptus species are included in the VCS ARR project; however, since maesopsis is also planted, this costs and revenues from these trees is also included in the financial model. The costs were on a per hectare basis and linked to the planting schedule which scaled the costs up to the total project area. Beating up (replanting) for 10% of the plantable areas was conservatively assumed to account for any mortality that may occur. For second rotations, it was assumed that the eucalyptus stands will be coppiced (thus, no establishment costs – just maintenance costs assumed) and the pine and maesopsis stands would be replanted, assuming the same establishment and maintenance costs as initial planting.

[23] Further evidence of the benchmark is provided by private equity investors – documentation available to DOE
[24] IbbotsonAssociates, 2003: International Cost of Capital Perspectives Report 2003. The report has been submitted to the DOE but cannot be published due to copyright constraints

The cost inputs to the financial model are shown below**:**

Table 2.5.1. Cost input parameters

Parameter	**Cost**	**Source**
Annual land rent per ha planted	9,900 Ush per ha planted	NFA land licence
Seedlings	275 – 400 Ush per seedling	NFA price lists
Land preparation and planting activities	15,000 – 40,000 Ush per ha	BFC contract rates from pre-project start activities
Crop management	20,000 – 25,000 Ush per ha	Contract rates from pre-project start activities
Chemical costs: Pesticide Herbicide NPK Fertilizer	 0.02 USD per seedling 20 USD per ha 0.03 USD per seedling	BFC contract rates from pre-project start activities
Chemical application labour	25,000 per ha	BFC contract rates from pre-project start activities
Fire protection	34,000 Ush per ha per year	BFC contract rates from pre-project start activities
Road costs Construction Maintenance	 1,310 USD per km 432 USD per km	BFC road construction contracts
Exchange rate	1,90 Ush to 1 USD	www.onda.com

Revenues from each timber species, the sale of VCUs and SPGS funding were accounted for in the model. Harvested timber volumes were inputted from the carbon model, which used the merchantable timber yield models by Alder (2004) for pine and eucalyptus, and Buchholz (2003) for maesopsis to determine the amount of timber that will be available at the planned commercial thinning and harvesting years according to the schedule presented in Table 1.8.2. The assumed wood prices were as follows:

Table 2.5.2 Assumed stumpage prices in IRR calculation

Species and timber type	**Price, Ush**
Pine	
First thinning	39,910,[26]
Second thinning	59,865[27]
Harvest	79,820[28]
Eucalyptus	
Thinning	25,1205[30]
Harvest	50,240[32]
Maesopsis[29]	
First thinning	39,910
Second thinning	59,865
Harvest	79,820

[26] All first thinnings, including the thinning for Eucalyptus, assumed to be half the harvesting price
[27] All second thinnings assumed to be three quarters of harvested price
[28] Calculated as a weighted average of NFA harvesting license prices from the NFA website: http://www.nfa.org.ug/content.php?submenu_id=5
[29] For Maesopsis, it was assumed that the same price per m^3 as pine would be achieved

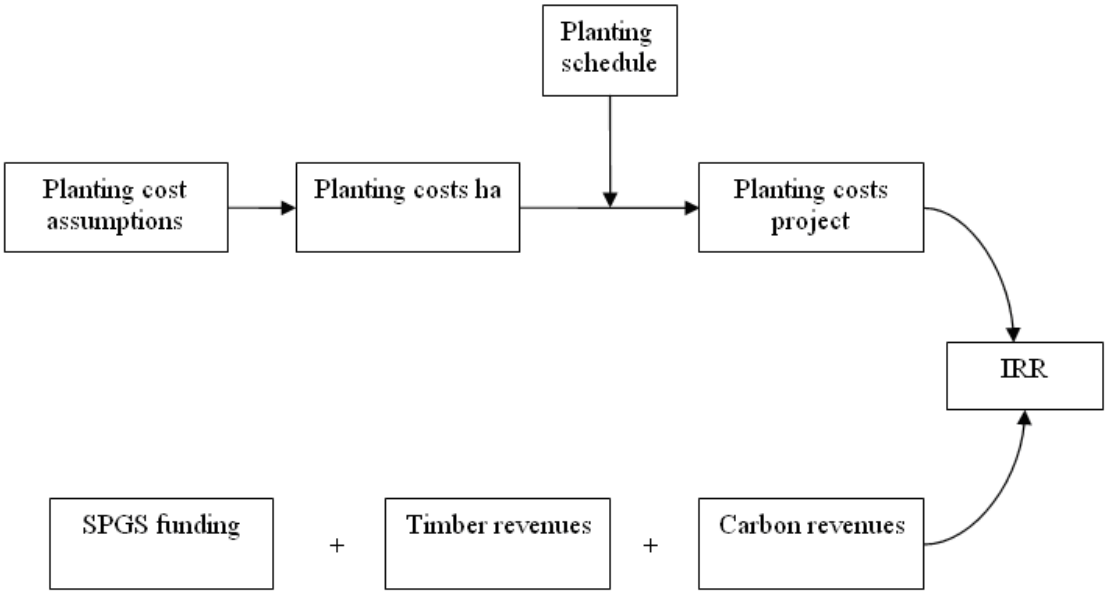
A wood price increment of 2% for all wood prices was assumed for the first 10 years of the project. This is to factor in the increases in timber/ wood prices that have occurred recently in East Africa.[30] Wood prices have not been assumed to increase beyond 10 years due to the uncertainty linked to forecasting so far in the future and also due to the likely stabilisation of regional wood prices with global prices.

Table 2.5.3. Assumed carbon prices in IRR calculations

VCU price range[31]
$2.93
$6.44

A corporate tax rate of 30% is assumed in the model, which is based on what the corporate tax rate was at the start of the project[32]. Figure 2.5.1, shown below, outlines the structure of the financial model as presented in Excel. The timeframe of the model is from 2004 to 2031. This period is from first planting to final harvesting of the first rotation of pine – the longest rotation species being planted at BFP. Although the timeframe of the investment analysis was from 2004 to 2031.

Figure 2.5.1. Schematic of financial model components



The IRR based on the above assumptions, without the sale of VCUs, has been calculated as 13.1%. The A/R CDM project activity has a less favourable indicator than the benchmark of 25% and is therefore not considered financially attractive without the benefits from the sale of VCUs. The project would therefore not have been viable without the potential of carbon financing. Without carbon revenues but including SPGS funding, the IRR is significantly higher than just the timber revenues scenario; however, including SPGS revenues but without carbon does still, however, show that the project would not reach the required benchmark.

[30] GRAS Annual Report 2008, page 11
[31] Based on carbon price indications from State and Trends of the Carbon Market 2003, PCF *plus* Research and World Bank, December 1, 2003
[32] http://data.worldbank.org/indicator/GB.TAX.CMAR.ZS

Project scenario	IRR
Solely timber revenues	13.1%
Timber revenues + SPGS funding	17.4%
Timber revenues + SPGS funding + VCUs (price $3)	20.3%
Timber revenues + SPGS funding + VCUs (price $7.15)	25.4%

Sub-step 3c. – Sensitivity analysis

Sensitivity analysis was carried out to test whether the financial attractiveness was robust to reasonable variations in key parameters. The critical parameters were identified as timber prices, capex, growth yield, SPGS inclusion of Phase 2 and site indexes. A price increase and decrease of 10% was assumed for each of these parameters; for SPGS the maximum eligible area for phase 2 was included and for the site indexes the maximum sites were selected.

Table 2.5.4. Sensitivity analysis of financial analysis

Parameter change	IRR, without VCUs sale	IRR, without VCUs sale but with SPGS	IRR, with VCUs sale (price $3)	IRR, with VCUs sale (price $7.15)
Standard assumptions	13.1%	17.4%	20.3%	25.4%
10% increase in timber prices	13.8%	18.2%	21.3%	26.4%
10% decrease in timber prices	12.3%	16.4%	19.4%	24.4%
10% increase in Capex	13.0%	17.1%	20.0%	24.9%
10% decrease in Capex	13.3%	17.6%	20.7%	26.0%
10% increase in yield	13.8%	18.3%	21.3%	26.4%
10% decrease in yield	12.3%	16.4%	19.4%	24.4%
SPGS Phase 2 included	13.1%	19.0%	22.6%	28.7%
Pine SI 16, Euc SI 34	15.5%	20.4%	23.6%	28.8%
SPGS Phase 2 and Pine SI 16, Euc SI 34	15.5%	22.1%	25.8%	31.9%

In addition to varying the timber prices, capex and growth yields by ± 10%, each of these parameters was adjusted to the point in which the benchmark in the non-carbon scenarios was met. The likelihood of each parameter being at such a point was then justified.

Increased timber price:

The scenario without carbon but with SPGS funding for the whole area requires an increase in timber price of 30% to reach the investment benchmark. The scenario without carbon and without SPGS requires a 180% increase.

Decreased capex:

Decreasing the capex completely (by 100%) for the without carbon and SPGS scenario still does not give an IRR which meets the benchmark. For the without carbon but with SPGS scenario a reduction of 80% of the capex is required, which would be unfeasible to implement the project.

Increased yield:

The scenario without carbon but with SPGS funding requires an increase in yield volume of 110% (for pine, eucalyptus and maesopsis) to reach the investment benchmark. The scenario without carbon and without SPGS requires a 305% increase (for pine, eucalyptus and maesopsis). Such increases are unlikely to be achieved at the BCFR site – even with the species at the highest site indexes found in the yield models (pine site index 20, eucalyptus site index 34 and maesopsis site index 30), which are far higher than the estimated site indexes, the IRR without carbon revenues and SPGS is still below the benchmark (at 24.2%).

Increase in SPGS area

The inclusion of SPGS phase 2 (an additional 2,500 ha of planted area from 2009 – 2012) shows that the IRR is still significantly below the benchmark at 19%. Even when the total plantable area is included for SPGS funding, the IRR remains below the benchmark at 20.1%.

As shown in Table 2.5.4, the sensitivity analysis demonstrates that the IRR of the ARR VCS project is robust to reasonable variations in the critical assumptions, remaining financially unattractive without revenues from the sale of VCUs.

STEP 4. Common practice

Forestry plantations are rare in Uganda with private sector plantations even more so. No similar forestry activities have been implemented or are currently underway without the support of carbon financing, as although some government plantations were established in the central area of the reserve, these were on a much smaller scale to the ARR VCS project. Small scale plantation forestry has also been done on small private forestland and as a means of protection against erosion in larger tea and coffee plantations, but similarly this doesn't class as the same activity.

The lack of private sector forest plantations in Uganda is shown in the SPGS report "Forestry Investment in Uganda: Opportunities and Challenges"[33]. The report, produced in 2007, emphasises the expected wood shortfall in Uganda in the coming years due to a lack of plantations to support the increasing demand. The report estimates current plantations in 2007 at 14,000 Ha, of which 70% were under four years old. This means that 9,800 Ha were planted between 2002 and 2006 (it's assumed that the report is not including anything planted in 2007 – this is deemed reasonable due to the study period probably starting a few months before June 2007 and also because any young plantation of just a few months would probably have not have been verified). The report talks about the NFA having "invested heavily in commercial plantations in its first two years but financial constraints have since caused the organisation to cease planting". The NFA was formed in 2003[34], which means that the majority of its planting would have taken place in the following years after this; therefore, a significant amount of the 9,800 Ha of "young" standing plantations referred to in the report would have been done by the NFA.

The NFA website states that a total of 2,132 Ha were established for the financial year of 2004/2005[35]. Assuming that the same area of land was established in the other financial year that the NFA "planted heavily", the total planted area by the organisation would be 4,264 Ha. This means that of the estimated 9,800 Ha planted between 2002 and 2006, approximately 5,500 Ha was not planted by the government, and thus could be attributable to private and NGO/ ODA funded plantations. The rate of non-government plantation establishment for this period can therefore be estimated at 1,375 Ha per year by taking an average. Considering this is a forest plantation rate for the whole country and that some of this would be private small-holders as well as NGO/ ODA development, it is clear that private large scale forest plantations had not been developed at this point in time.

The NFA keeps records of how much planting has occurred in Central Forest Reserves across the country and this data has been analysed as part of the common practice assessment. Of the 106 Central Forest Reserves, eight of these were deemed to have projects being implemented that are of a similar scale to the BFP – that is they are more than 2,000 ha and have been planted since 31st December 1989. No similar projects in scale have been implemented in Central Forest Reserves prior to this. Of these eight reserves, the Kachung Central Forest Reserve is another project developed by Green Resources AS, and is registered under the UNFCCC's CDM EB. In addition, the Rwoho Central Forest Reserve contains a number of AR CDM projects developed by the NFA with the World Bank of which

[33] Forestry Investment in Uganda: Opportunities and Challenges, A Briefing Note Prepared June 2007 (v.2) by SPGS
[34] http://www.nfa.org.ug/content.php?submenu_id=7
[35] http://www.nfa.org.ug/content.php?submenu_id=4#plant

two are registered so far. The New Forests Company is developing an AR CDM project in the Namwasa Central Forest Reserve which is in the validation stage of the CDM process. The New Forests Company is also developing a project in the Luwunga Central Forest Reserve (http://www.newforests.net/index.php/our-people/uganda-team - see plantation manager at Luwunga); however, this project is not yet in the validation process of any carbon standard yet and thus cannot be substantiated due to the lack of information on this. Another similar project being developed is in the Kikonda Central Forest Reserve; here the project has been developed using the voluntary carbon standard, Carbon Fix.

As demonstrated above, since 2006 there has been an increasing development in private forest plantations within Uganda due to the incentive of carbon markets. The inclusion of carbon revenues has meant that such projects now offer an attractive enough return for private investment. These are the only significant large scale plantations that are taking place in Uganda.

Below is a list of carbon A/R projects currently being implemented:

Project	**Standard - status**
Nile Basin Reforestation Projects	CDM – registered
Kikonda Forest Reserve	Carbon Fix – registered
Trees for Global Benefits	Plan Vivo - registered

With step 4 being satisfied, the proposed ARR VCS project activity is considered additional.

2.6 Methodology Deviations

The project is deviating from the A/R CDM methodology on precision requirements. The A/R CDM methodology requires PPs to have a maximum allowable relative margin of error of the mean for estimation of tree biomass of ± 10% at 90% confidence interval. However, the VCS Version 3 Standard requires PPs to have ± 15% at 95% confidence interval. The project is, therefore, applying the VCS precision requirement instead of that specified in the A/R CDM methodology.

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

Following "guidance on conditions under which the change in carbon stocks in existing live woody vegetation are insignificant" from the CDM EB (EB 46 Report, Annex 16), the project's baseline emission reductions are assumed to be zero.

The procedure in the guidance is that the change in carbon stocks of existing woody vegetation sinks may be accounted as zero for an area of land within the project boundary if one of the conditions in the guidance is met.

Condition (v) in the guidance is: "harvesting/grazing of foliage, or harvesting/coppicing of live wood, commonly occurs at levels sufficient to result in static or declining biomass in the existing woody vegetation"

Condition (v) is met in the BCFR as this has been the principle driver resulting in the successive land degradation that is shown in the time series and maps shown in Figures X, Y and Z. Furthermore, the EIA clearly describes the on-going activities ("no-action alternative") as "cutting down of trees and wood plants in favour of crop cultivation, degradation of wetlands...."[36])

Based on the satisfaction of condition (v), the baseline carbon stock changes/ removals are conservatively assumed to be zero.

3.2 Project Emissions

Actual net GHG removals by sinks shall be calculated following equation 3 from the methodology:

$$\Delta C_{ACTUAL} = \Delta C_P - GHG_E$$

Where:

ΔC_{ACTUAL}	Actual net GHG removals by sinks; t CO_2-e
ΔC_P	Sum of the changes of the carbon stock in the selected carbon pools within the project boundary; t CO_2-e
GHG_E	Increase in non-CO_2 GHG emissions within the project boundary as a result of the implementation of the A/R CDM project activity; t CO_2-e

Non-CO_2 GHG emissions:

Removal of biomass in the process of land preparation does not have to be accounted for. As stated in section 3.3.1 of the EIA, land preparation of the project area will be done using hand tools and herbicides. Since no burning is used to clear land for planting, no emissions from land preparation are assumed.

Non-CO_2 GHG emissions from forest fires will be monitored throughout the project and accounted for following the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity,

[36] See page 38 of the EIA

Version 04.0.0". In line with the applicability conditions, emissions resulting from any occurrence of fire within the project boundary shall be accounted for each incidence of fire which affects an area greater than the minimum threshold area reported by the host Party for the purposes of defining forest, provided that the accumulated area affected by such fires in a given year is ≥ 5% of the project area.

The non-CO_2 emissions from forest fires will calculated following equation 7 of the tool:

$$GHG_{FF\_TREE,t} = 0.001 * \sum_{i=1}^{M} A_{BURN,i,t} * b_{TREE,i,t_L} * COMF_i * \left(EF_{CH4,i} * GWP_{CH4} + EF_{N2O,i} * GWP_{N2O}\right)$$

where:

$GHG_{FF\_TREE,t}$	Emission of non-CO_2 gases resulting from the loss of aboveground biomass of trees due to fire, in year t; t CO_2-e
$A_{BURN,i,t}$	Area burnt in stratum i in year t; ha
b_{TREE,i,t_L}	Mean aboveground tree biomass per hectare in stratum i in year t_L which is the year in which last verification was carried out before occurrence of the fire; t d.m. ha^{-1} Where aboveground biomass of living trees is not burnt by fire, b_{TREE,i,t_L} may be set equal to zero
$COMF_i$	Combustion factor for stratum i; dimensionless
$EF_{CH4,i}$	Emission factor for CH_4 in stratum i; g CH_4 (kg dry matter burnt)$^{-1}$
GWP_{CH4}	Global warming potential for CH_4; dimensionless Default value of 21 is used
$EF_{N2O,i}$	Emission factor for N_2O in stratum i; g N_2O (kg dry matter burnt)$^{-1}$
GWP_{N2O}	Global warming potential for N_2O; dimensionless Default value of 310 is used
I	1, 2, 3 … M strata
T	1, 2, 3, … years elapsed since the start of the project activity

Changes in carbon stock in the selected carbon pools:

The *ex ante* carbon stock changes in the project scenario were calculated using equation 4 and 5 from the methodology. Since the project is only selecting the tree biomass carbon pool, equation 5 is simplified to the following:

$$\Delta C_t = \Delta C_{TREE_{PROJ},t}$$

ΔC_t	Change in carbon stock in all selected carbon pools in the project scenario, in year t; tCO_2-e

$\Delta C_{TREE\_PROJ,t}$	Change in carbon stock in tree biomass in project, in year *t*, as estimated in the tool "estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities"; tCO_2-e

The stock change method from the tool was applied and an estimation of tree biomass was calculated using the *BEF* method, equation 1, as follows:

$$B_{TREE,j,p,i,t} = V_{TREE,j,p,i,t} * D_j * BEF_{2,j} * (1 + R_j)$$

$B_{TREE,\ j,\ p,\ i,\ t}$	Biomass of trees of species *j* in sample plot *p* of stratum *i* at a point of time in year *t*; t d.m.
$V_{TREE,\ j,\ p,\ i,\ t}$	Stem volume of trees of species *j* in sample plot *p* of stratum *i* at a point of time in year *t*, estimated by using the tree dimension(s) as entry data into a volume table or volume equation; m^3
D_j	Basic wood density of tree species *j*; t d.m. m^{-3}
BEF_2	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass, for tree speices *j*; dimensionless
R_j	Root-shoot ratio for tree species *j*; dimensionless
j	*1, 2, 3, …* tree speices in plot *p*
p	*1, 2, 3, …*sample plots in stratum *i*
i	*1, 2, 3, …*tree biomass estimation strata within the project boundary
t	*1, 2, 3, …*years counted from the start of the A/R CDM project activity

In the absence of the project and regional specific parameters during PDD preparation for the biomass expansion factors (BEF), wood density (D), carbon fraction (CF) and root-to-shoot ratio, the project participants have used default values from the GPG LULUCF 2003 (Table 3A.1.10). The "Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks, Version 2" have been followed in selecting the default values. The following is a summary of the sources and relevant procedure, in line with the guidance, for the conservative choice of default data.

Parameter	**Source and conservative choice**
Wood density:	
Eucalyptus:	Species-specific (eucalyptus grandis) data from a national forest inventory for the same ecological zone has been used since the methodology does not provide a default value nor are there local peer-reviewed studies. A conservative choice of default data is ensured by taking the mean value from the two different water content values provided – 50% and 12%.
Pine:	Species-specific (pinus caribaea) data from a study carried out in Uganda is used.

Biomass Expansion Factor (BEF)

Eucalyptus: No species-specific data was available thus data was taken from the IPCC GPG LULUCF literature for the same climatic zone. Since the data available was not from the same genus, its conservative value was determined by assuming the range represents the upper and lower 95% confidence limits of a normally distributed dataset. The conservative value was taken as the value which fell half way between the mean and the limit of the range.

Pine: No species-specific data was available thus data was taken from the IPCC GPG LULUCF literature for the same genus. However, since the data was available for the same conditions that are similar to the project (ecological zone),its conservative value was determined by assuming the range represents the upper and lower 95% confidence limits of a normally distributed dataset. The conservative value was taken as the value which fell half way between the mean and the limit of the range.

Root-shoot ratio

Eucalyptus: Since no species-specific data was available, the equation from the A/R Methodological Tool, "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in the baseline and project scenarios of an A/R CDM project activity" was applied:

$R = exp\ [-1.085 + 0.9256 * ln(A)] / A$, where A is above-ground biomass content (t d.m. ha^{-1}). A was calculated as the average above-ground biomass over the first rotation.

Pine: No species-specific data was available thus the same equation that was used for eucalyptus was applied.

The resulting conservative default data is given in Table 3.2.1:

Table 3.2.1. Wood density, BEF and Root-Shoot ratio for species used

Tree species	Wood Density (tonnes d.m.m-3)	BEF	Root-Shoot ratio
Eucalyptus	0.392[37]	2.70[38]	0.25
Pine	0.424[39]	1.25[40]	0.26

The growth data from "*Yield of Eucalyptus and Caribbean pine in Uganda, D. Alder et al. 2003"* is used to project the merchantable timber volume and thus the biomass growth of the project. During *ex-post* calculations, the growth data (standing volume per hectare) will be collected and converted into biomass through Wood Density (WD) and Biomass Expansion Factors (BEF) and root-shoot ratio (R) using equations and steps described in the methodology.

[37] Taken from the book "Uganda Timber" by C.h. Tack, published by the Ministry of Agriculture and Forestry, Forestry Department and adjusted for water content

[38] Taken from Table 3A.1.10 of the GPG LULUCF 2003, BEF_2 (overbark) for Tropical Broadleaf

[39] Taken from "Basic density and strength properties of pines in Uganda", R.C. Ishengoma et al, Tanzania Journal of Forestry and Nature Conservation, Volume 76: http://www.ajol.info/index.php/tjfnc/article/viewFile/40718/60558

[40] Taken from Table 3A.1.10 of the GPG LULUCF 2003, BEF_2 (overbark) for Pines

The project participants consider that any changes due to thinning have been taken into consideration in the growth figures that were used; however, the trend shall be monitored. The impact of disturbances, e.g. losses from fire and pests, are considered to be small and are a result of natural events. Losses due to commercial harvests and thinnings during the crediting period shall be captured in the calculations using equation 21.

3.3 Leakage

Following the methodology, the leakage types that can occur are GHG emissions due to activity displacement, the activity displaced being agricultural activities. Leakage is estimated as follows:

$$LK = \sum_{t=1}^{t^*} LK_{AGRIC,t}$$

where:

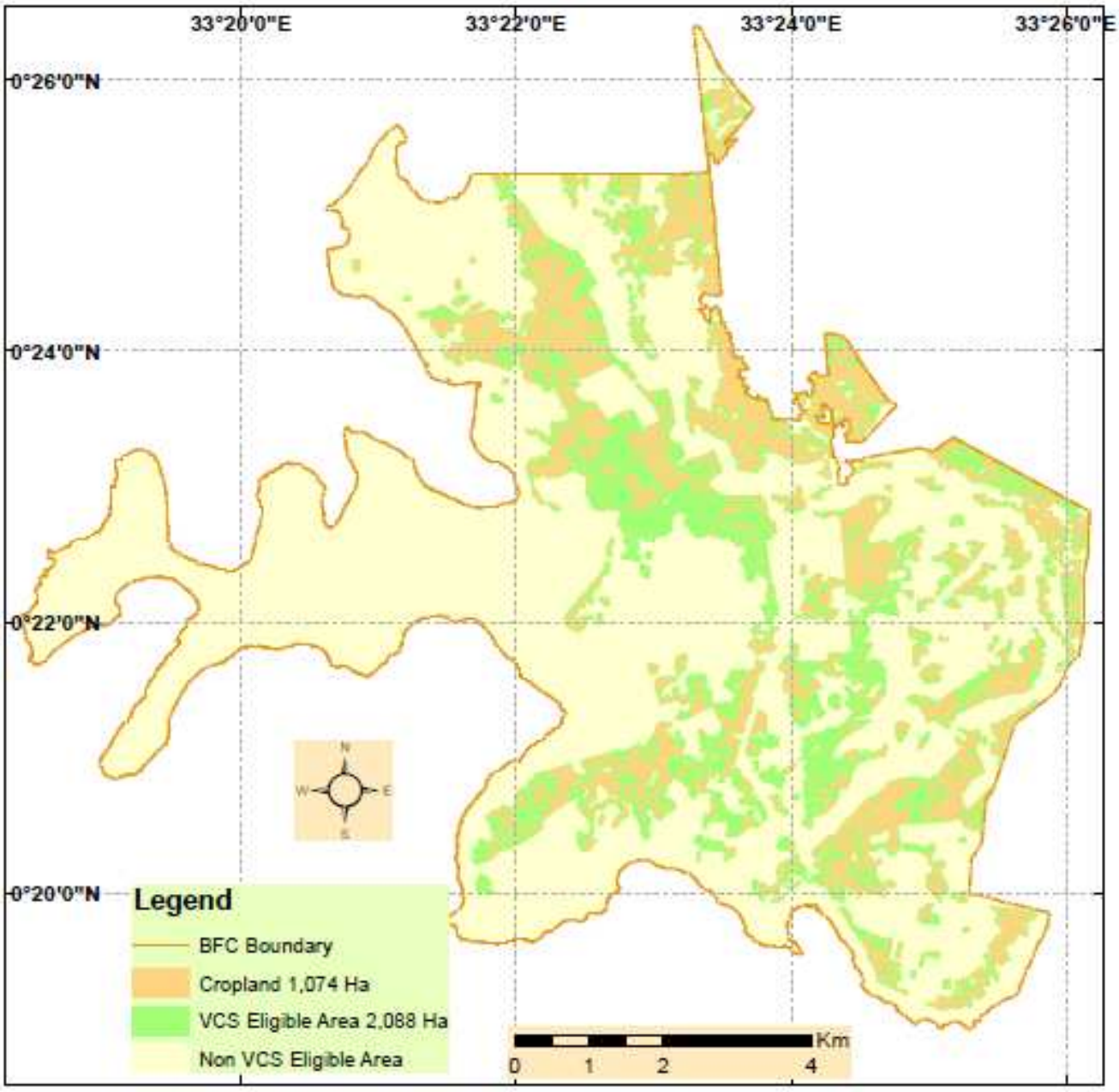
LK	Total emissions due to leakage; tCO_2-e
$LK_{AGRIC,t}$	Leakage due to the displacement of agricultural activities in year t, as calculated in the tool "Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities in A/R CDM project activity"; tCO_2-e

The following is the application of the A/R CDM tool as referenced by the methodology to determine $LK_{AGRIC,t}$.

Step 1: Estimate the area subject to pre-project agricultural activities that is expected to be afforested/reforested (therefore the activities to be displaced) during year t since the start of the A/R project activity (Ad_t).

The area, Ad_t, has been directly estimated from a classification of a satellite image (LandSat) from before project start. Figure X, shown above in section 3.1, shows the total area of land that was classed as agricultural land prior to project start. This is 2,911 ha. However, this area is deemed conservative since it also includes land which was used for agricultural purposes but was left fallow – using Landsat imagery it is difficult to differentiate between such strata.

Figure 3.3.1. Map showing area of pre-project agricultural land taking place within the project area



The following was then calculated:

$$D_{t^*} = \frac{\sum_{t=1}^{t^*} Ad_t}{A}$$

where:

D_t	Fraction of the total area of A/R CDM project activity subject to displacement of agricultural activities in year *t*; dimensionless

A	Total area of A/R CDM project activity
Ad_t	Area subject to pre-project agricultural activities that are displaced during year t since the start of the A/R project activity; ha
t	*1, 2, 3, ...t^** years elapsed since the start of the A/R CDM project activity

This gave a total fraction of the total area of A/R CDM project activity subject to displacement of agricultural activities as follows:

t	1	2	3	4	5	6	7	8	9	....t
Ad_t	17.6	93.4	91.4	123.9	47.3	189.1	180.6	110.2	220.5	0
A	2061.6 ha									
D_t	0.009	0.054	0.098	0.158	0.181	0.273	0.361	0.414	0.521	0.521

Step 2: Take ΔC_t – annual change in carbon stock in all selected carbon pools for year t; t C yr^{-1}, as calculated following requirements of the baseline and monitoring A/R CDM methodology within which this tool is used.

For the planned (*ex ante*) or actual (*ex post*) verifications calculate:

$$\Delta C_{t=t_{ver}} = \sum_{t=1}^{t_{ver}} \Delta C_t * 1year$$

where:

$\Delta C_{t=tver}$	Sum of annual changes in carbon stock in all selected carbon pools since the start of the A/R CDM project activity to the year of verification t_{ver}; tC
ΔC_t	Annual change in carbon stock in all selected carbon pools for year t.
t_{ver}	Year of verification event; yr

$\Delta C_{t=tver}$ has been calculated as 12,311 tC for the planned 2011 verification.

Step 3: For each year t take D_t and select t_{ver} which occurs immediately after the year t in order to calculate:

$$\Delta CD_{t^*} = D_{t^*} * \Delta C_{t=t_{ver}}$$

where:

ΔCd_{t^*}	Sum of annual changes in carbon stock in all selected carbon pools since the start of the A/R CDM project activity to the year of verification t_{ver} attributable to the area subject to pre-project agricultural activities that are displaced during year t^* since the start of the A/R project activity

$\Delta C_{t=tver}$ Sum of annual changes in the carbon stock in all selected carbon pools since the start of the A/R CDM project activity to the year of verification t_{ver}; t C

D_{t^*} Fraction of the total area of A/R CDM project activity subject to displacement of agricultural activities in year t^*; dimensionless

t_{ver} Year of verification event; yr

t *1, 2, 3, ...* t^* years elapsed since the start of the A/R CDM project activity

Applying this equation, ΔCd_{t^*} was calculated as shown in Table 3.3.1. (this table just shows it for the first verification)

Table 3.3.1. Sum of annual changes in carbon stocks for first verification

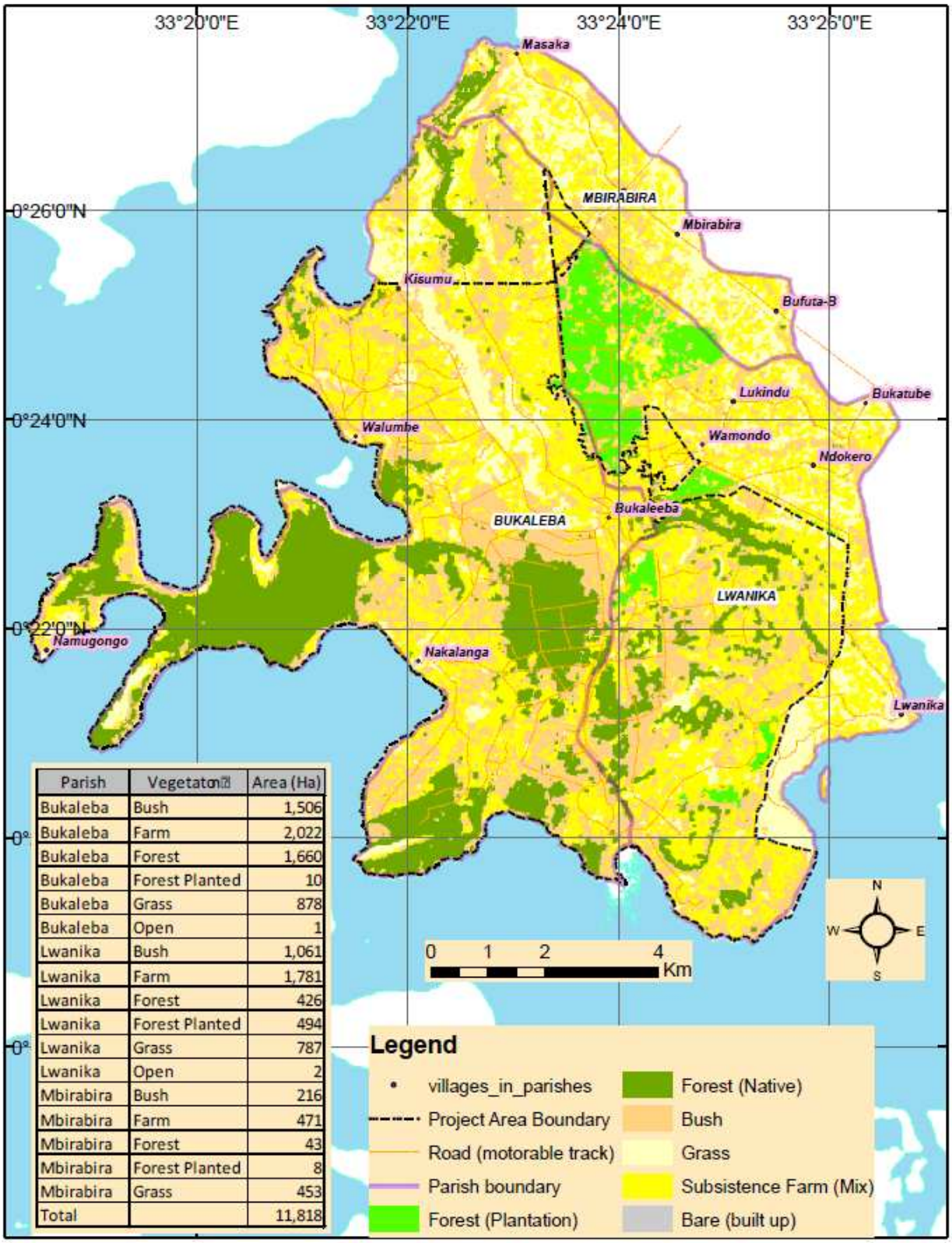
	2004	2005	2006	2007	2008	2009	2010	2011
ΔCd_t	105	663	1,209	1,949	2,231	3,360	4,439	5,097

Step 4: Estimate the factor, *f,* as the fraction of land covered by forest (according to the national definition of forest) in region containing the A/R CDM project activity. The region shall be the smallest territorial administrative division/s encompassing all areas of land included in the A/R CDM project activity for which data on forest cover are publically available.

Figure 3.3.2, below, shows land class classification of the three parishes which are contained within the ARR VCS project boundary. These are the parishes of Bukaleba, Lwanika and Mbirabira. The land class of each parish has been determined through a supervised classification of Landsat imagery from 2004. Since more than one territorial administrative division is involved then *f* has been calculated as a weighted average of the individual divisions' fraction of land covered by forest using area as a weight.

f was calculated as 0.180 based on the results shown in figure 3.3.2 for the parishes Bukaleba, Lwanika and Mbirabira.

Figure 3.3.2. Map showing different land classes by parishes covered by the BCFR to determine *f*



Parish	Vegetation	Area (Ha)
Bukaleba	Bush	1,506
Bukaleba	Farm	2,022
Bukaleba	Forest	1,660
Bukaleba	Forest Planted	10
Bukaleba	Grass	878
Bukaleba	Open	1
Lwanika	Bush	1,061
Lwanika	Farm	1,781
Lwanika	Forest	426
Lwanika	Forest Planted	494
Lwanika	Grass	787
Lwanika	Open	2
Mbirabira	Bush	216
Mbirabira	Farm	471
Mbirabira	Forest	43
Mbirabira	Forest Planted	8
Mbirabira	Grass	453
Total		11,818

Step 5: Calculate average leakage due to displacement of agricultural activities in year *t**:

$$LK_{Agric,t^*} = \frac{44}{12} * \frac{f}{T_{cred}} * \Delta Cd_{t^*}$$

Applying the equation from step 5, leakage was calculated as follows for the first verification:

Year	1	2	3	4	5	6	7	8
$LK_{Agric,t}$	2	10	19	31	35	53	70	80

3.4 Summary of GHG Emission Reductions and Removals

Following section 7 from the methodology, the net anthropogenic GHG removals by sinks is the actual net GHG removals by sinks minus the baseline net GHG removals by sinks minus leakage. This is represented by the following equation (equation 8 from the methodology):

$$C_{AR-CDM} = \Delta C_{ACTUAL} - \Delta C_{BSL} - LK$$

Where:

C_{AR-CDM}	Net anthropogenic GHG removals by sinks; t CO_2-e
ΔC_{ACTUAL}	Actual net GHG removals by sinks; t CO_2-e
ΔC_{BSL}	Baseline net GHG removals by sinks; t CO_2-e
LK	Total GHG emissions due to leakage; t CO_2-e

Years	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
1	0	29	2	28
2	0	295	10	285
3	0	1,222	19	1,203
4	0	3,010	31	2,980
5	0	5,946	35	5,911
6	0	11,971	53	11,918
7	0	22,666	70	22,596
8	0	35,731	80	35,651
9	0	37,831	181	37,650
10	0	46,455	265	46,190
11	0	49,035	369	48,666
12	0	63,942	479	63,464
13	0	42,518	621	41,896
14	0	37,717	716	37,000
15	0	-4,215	801	-5,016
16	0	-6,382	791	-7,174
17	0	-1,841	777	-2,618
18	0	50,226	773	49,453
19	0	51,266	1,180	50,085
20	0	48,768	1,180	47,587
21	0	17,951	1,180	16,771
22	0	14,181	1,180	13,001
23	0	-36,528	1,180	-37,708
24	0	-26,122	207	-26,329
25	0	-151,787	207	-151,994
26	0	-116,722	207	-116,929
27	0	-104,503	207	-104,710
28	0	-15,946	207	-16,153
29	0	37,831	612	37,219
30	0	46,455	612	45,843
31	0	49,035	612	48,423
32	0	63,942	612	63,330
33	0	42,518	612	41,905
34	0	37,717	764	36,953
35	0	-4,215	764	-4,979
36	0	-6,382	764	-7,146
37	0	-1,841	764	-2,604
38	0	50,226	764	49,462

39	0	51,266	1,090	50,176
40	0	48,768	1,090	47,678
41	0	17,951	1,090	16,862
42	0	14,181	1,090	13,092
Total	0	524,165	24,247	499,918

The long term mean has been calculated as 266,761 tCO_2e - as shown in section 1.7. Further information on the intermediate steps in the carbon calculations can be found in Annex 2, “Emission Reduction Calculations”, of the PDD.

4 MONITORING

4.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$D_{eucalyptus}$
Data unit:	t d.m. m^{-3}
Description:	Basic wood density for eucalyptus
Source of data:	Taken from the book "Uganda Timber" by C.h. Tack, published by the Ministry of Agriculture and Forestry, Forestry Department
Value applied:	0.392
Justification of choice of data or description of measurement methods and procedures applied:	National data
Any comment:	

Data Unit / Parameter:	D_{pine}
Data unit:	t d.m. m^{-3}
Description:	Basic wood density for pine
Source of data:	Taken from "Basic density and strength properties of pines in Uganda", R.C. Ishengoma et al, Tanzania Journal of Forestry and Nature Conservation, Volume 76: http://www.ajol.info/index.php/tjfnc/article/viewFile/40718/60558
Value applied:	0.424
Justification of choice of data or description of measurement methods and procedures applied:	Default data used due to lack of national data
Any comment:	

Data Unit / Parameter:	$BEF_{2,eucalyptus}$
Data unit:	Dimensionless
Description:	Biomass expansion factor for conversion of stem biomass to above-ground biomass for eucalyptus
Source of data:	Taken from Table 3A.1.10 of the GPG LULUCF 2003, BEF_2 (overbark) for Tropical Broadleaf
Value applied:	2.70
Justification of choice of data or description of measurement methods and procedures	Default data used due to lack of national data

applied:	
Any comment:	Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks, Version 2 applied.

Data Unit / Parameter:	$BEF_{2,pine}$
Data unit:	Dimensionless
Description:	Biomass expansion factor for conversion of stem biomass to above-ground biomass for pine
Source of data:	Taken from Table 3A.1.10 of the GPG LULUCF 2003, BEF_2 (overbark) for Pines
Value applied:	1.25
Justification of choice of data or description of measurement methods and procedures applied:	Default data used due to lack of national data
Any comment:	Guidelines on conservative choice and application of default data in estimation of the net anthropogenic GHG removals by sinks, Version 2 applied.

Data Unit / Parameter:	$R_{eucalyptus}$
Data unit:	Dimensionless
Description:	Root-shoot ratio for eucalyptus
Source of data:	Equation from the A/R Methodological Tool, "Estimation of carbon stocks and change in carbon stocks of trees and shrubs in the baseline and project scenarios of an A/R CDM project activity" was applied to determine the root-shoot ratio.
Value applied:	0.25
Justification of choice of data or description of measurement methods and procedures applied:	Default equation applied due to lack of national data
Any comment:	

Data Unit / Parameter:	R_{pine}
Data unit:	Dimensionless
Description:	Root-shoot ratio for pine
Source of data:	Equation from the A/R Methodological Tool,

	"Estimation of carbon stocks and change in carbon stocks of trees and shrubs in the baseline and project scenarios of an A/R CDM project activity" was applied to determine the root-shoot ratio.
Value applied:	0.26
Justification of choice of data or description of measurement methods and procedures applied:	Default equation applied due to lack of national data
Any comment:	

Data Unit / Parameter:	$V_{TREE,\ eucalyptus}$
Data unit:	m^3
Description:	Stem volume of eucalyptus trees for trees of given age/diameter/height
Source of data:	Alder yield model
Value applied:	The volume equation for eucalyptus is: $V = 0.489 \times (B \times H)^{\wedge} 0.942$ Where: V = Volume B = Basal area H = Height
Justification of choice of data or description of measurement methods and procedures applied:	Yield model is based on data from Uganda on same species.
Any comment:	

Data Unit / Parameter:	$V_{TREE,\ pine}$
Data unit:	m^3
Description:	Stem volume of pinr trees for trees of given age/diameter/height
Source of data:	Alder yield model
Value applied:	The volume equation for pine is: $V = ((4.534 \times 10^{-5} \times DBH)^{\wedge} 1.8875) \times H^{\wedge} 1.0304 \times N$ Where: V = volume DBH = Diameter at Breast Height H = Height

	N = Number of trees per ha
Justification of choice of data or description of measurement methods and procedures applied:	Yield model is based on data from Uganda for pinus caribaea.
Any comment:	

Data Unit / Parameter:	$COMF_i$
Data unit:	Dimensionless
Description:	Combustion factor for stratum *I*
Source of data:	Default data from the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
Value applied:	The following default values will be applied:

Forest type	Mean age (years)	Default value
Tropical forest	3- 5	0.46
	6 -10	0.67
	11 -17	0.50
	18 and above	0.32

Purpose of the data:	Used in equation 7 of the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
Any comment:	

Data Unit / Parameter:	EF_{CH4}
Data unit:	g kg^{-1} dry matter burnt
Description:	Emission factor for CH_4 in stratum *i*
Source of data:	Default data from the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
Value applied:	6.8 (for tropical forest)
Purpose of the data:	Used in equation 7 of the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".

Any comment:	

Data Unit / Parameter:	EF_{N20}
Data unit:	g kg^{-1} dry matter burnt
Description:	Emission factor for N_2O in stratum *i*
Source of data:	Default data from the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
Value applied:	0.20 (for tropical forest)
Purpose of the data:	Used in equation 7 of the tool: "Estimation of non-CO_2 GHG emissions resulting from burning of biomass attributable to an A/R CDM project activity".
Any comment:	

Data Unit / Parameter:	t_{VAL}
Data unit:	dimensionless
Description:	Two-sided Student's *t*-value, at infinite degrees of freedom in the first iteration and at degrees of freedom equal to (n-1) in subsequent iterations, for the required confidence level;
Source of data:	Student's t-distribution table.
Value applied:	1.96
Justification of choice of data or description of measurement methods and procedures applied:	This is at the 95% confidence level in line with the VCS Standard requirements.
Any comment:	

Data Unit / Parameter:	***E***
Data unit:	t d.m. (or t d.m. ha^{-1})
Description:	Acceptable margin of error (i.e. one-half the confidence interval) in estimation of biomass stock within the project boundary; in units used for s_i
Source of data:	Set in the VCS Standard
Value applied:	15%
Justification of choice of data or description of measurement methods and procedures	

applied:	
Any comment:	

4.2 Data and Parameters Monitored

Data Unit / Parameter:	A_i
Data unit:	Ha
Description:	Area of tree biomass stratum i
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Initial measurement is carried out in accordance with the SOP: Boundary Measurement and Survival Checking.
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	*Ex ante* stratum areas are as follows:
Monitoring equipment:	GPS for field assessment along with ArcGis for the area calculation and remote sensing QA/QC.
QA/QC procedures to be applied:	Further analysis for QA/ QC is carried out through remote sensing of high resolution imagery when satellite images are available.
Calculation method:	The area is calculated in ArcGis.

Stratum	**Area, Ha**
Pine 2004	24.7
Pine 2005	123.4
Pine 2006	141.8
Pine 2007	239.4
Pine 2008	172.0
Pine 2009	381.8
Pine 2010	249.8
Pine 2011	242.2
Pine 2012	135.0
Euc 2007	4.8
Euc 2008	7.9
Euc 2009	30.1
Euc 2010	100.9
Euc 2011	117.1
Euc 2012	90.7

Any comment:	

Data Unit / Parameter:	$A_{p,i}$
Data unit:	Ha
Description:	Area of sample plots in tree biomass stratum *i*
Source of data:	Measured and calculated
Description of measurement methods and procedures to be applied:	The radius of each plot is measured from the centre of the plot following the GRAS Inventory Guidelines. All the plots are registered in ArcGis to produce a map of the location of all the plots. The data from the plots is used in excel (as well as being backed up) to calculate the total plot area.
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	Radius = 11.38 m, which is equivalent to 0.04 ha
Monitoring equipment:	The radius of each plot will be measured using a tape measure.
QA/QC procedures to be applied:	10% of all plots are remeasured
Calculation method:	The area of a plot is calculated by squaring the radius and multiplying it by π. The sum of all the plots within the stratum, *i*, is taken to give the total area of sample plots.
Any comment:	Sample plot location is registered with a GPS and marked on the project map

Data Unit / Parameter:	DBH_i
Data unit:	cm
Description:	Tree diameter at breast height
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Measured following GRAS' Inventory Guidelines
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	10.6 cm – average taken from yield model
Monitoring equipment:	Haglöfs calipers
QA/QC procedures to be applied:	10% of all plots are remeasured
Calculation method:	N/a
Any comment:	

Data Unit / Parameter:	H_i
Data unit:	m
Description:	Tree height (dominant height)
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Measured following GRAS' Inventory Guidelines. The dominant height is determined through measuring the height of the trees with the largest dbh. Trees with height defects (fox tails for example) are not included in height measurements.
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	14.2 m – average taken from yield model
Monitoring equipment:	Vertex or Suunto
QA/QC procedures to be applied:	10% of all plots are remeasured
Calculation method:	The average of the four height measurements is calculated
Any comment:	

Data Unit / Parameter:	T
Data unit:	Year
Description:	Time period elapsed between two successive estimations of carbon stock in trees and shrubs
Source of data:	Recorded time
Description of measurement methods and procedures to be applied:	N/A
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	N/A
Any comment:	If the two successive estimations of carbon stock in trees are carried out at different points of time in year t_2 and t_1, (e.g. in the month of April in year t_1 and in the month of September in year t_2), then a fractional value is assigned to T.

Data Unit / Parameter:	***N***
Data unit:	Dimensionless
Description:	Total number of possible sample plots within the project boundary (the sampling space or the population); dimensionless
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	The total project area is calculated in Arc GIS.
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	N/A
Monitoring equipment:	Arc GIS
QA/QC procedures to be applied:	N/A
Calculation method:	*N* is equal to project area divided by the size of the sample plot
Any comment:	

Data Unit / Parameter:	w_i
Data unit:	Dimensionless
Description:	Relative weight of the area of stratum *i*; dimensionless
Source of data:	Calculated
Description of measurement methods and procedures to be applied:	
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	The relative weight of the area of a stratum *i* is equal to the area of the stratum *i* divided by the project area
Any comment:	

Data Unit / Parameter:	s_i
Data unit:	t d.m.
Description:	Estimated standard deviation of biomass stock in stratum *i*. Standard deviation of biomass stock per unit area (in t d.m. ha^{-1}) may also be used for this purpose

Source of data:	Either from data obtained from the plantation or from other similar plantations
Description of measurement methods and procedures to be applied:	Approximate value of the standard deviation of biomass stock in each stratum is either known form existing data related to the project area or existing data related to a similar area, or is estimated from a preliminary sample
Frequency of monitoring/recording:	Measured at each verification event
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	The relative weight of the area of a stratum *i* is equal to the area of the stratum *i* divided by the project area
Any comment:	

Data Unit / Parameter:	$A_{BURN,\,i,\,t}$
Data unit:	ha
Description:	Area burnt in stratum *i* in year *t*
Source of data:	Measured
Description of measurement methods and procedures to be applied:	Measured following GRAS' Inventory Guidelines – see "Fire Damage Assessment"
Frequency of monitoring/recording:	Measured after any forest fire
Value applied:	N/A
Monitoring equipment:	N/A
QA/QC procedures to be applied:	N/A
Calculation method:	The area burnt from all forest fires in each particular year is summed
Any comment:	

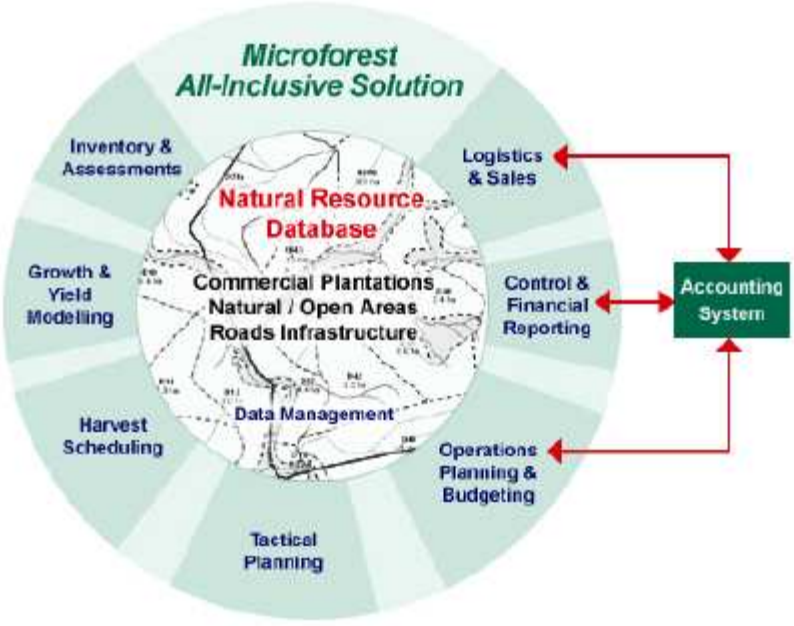
4.3 Description of the Monitoring Plan

Microforest

Green Resources has a monitoring and inventory system called Microforest, which is the company's principle archiving platform. Microforest is an integrated plantation and natural resource management system[41]. It encompasses the entire life cycle of forestry operations and includes modules that manage inventory, modelling, planning, scheduling,

[41] See Microforest factsheet

operations, logistics and financials. An organisational diagram for project monitoring is shown at the of this section in Figure 4.3.2. This details the responsibilities, information flows and levels of control.



Project boundary

Field surveys and remote sensing are used to determine the actual boundary of the ARR VCS project activity and that of the actual reforestation activity that has occurred compartment by compartment, species by species and by the year planted. In the case where the actual boundary deviates from the description of the boundary in the PD, additional information will be provided and projections will be adjusted ex-post.

The geographical coordinates (latitude and longitude) of each corner of polygon sites are determined using GPS, collected and exported to the GIS software (ArcView 9) and processed to generate monitoring maps of the actual project boundary and that of the actual reforestation activity for each compartment, including variables of the compartment i.e. compartment ID, species and year planted. Alternatively or in addition boundaries will be checked using remotely sensed data processed in GIS. All of this data is recorded in the company's internal monitoring and inventory system, Microforest.

The area planted within the project boundary will be monitored periodically throughout the crediting period. If changes to the planted area occur during the crediting period, the specific areas will be identified and mapped out to be confirmed at the next verification. This includes those areas where the planting has failed to recover and in case of areas affected by fire and/or disease outbreak.

Project establishment

To ensure forest establishment is carried out in line with the management plan the following will be monitored and recorded in Microforest:

- Site preparation: Ensure site preparation is implemented based on practice documented in section 1

- Information on the number of species planted, area of stratum, and planting layout as per the management plan shall be prepared

Forest management

To ensure that the forest management practices described in section 1 are implemented, the following parameters will be monitored and recorded in Microforest:

- Planting: date, location, area, tree species, thinning intensity, volumes or biomass removed
- Thinning: date, location, area, tree species, thinning intensity, volumes or biomass removed
- Harvesting: date, location, area, tree species, volumes, or biomass removed
- Coppicing: date, location, area, tree species, volumes or biomass removed
- Checking and confirming that harvested lands are re-planted as planned
- Monitoring of disturbances: date, location, area (GPS coordinates and remote sensing, as applicable), tree species, type of disturbance, biomass lost, implemented corrective measures,change in the boundary of strata and stands

Quality control and Quality Assurance (QC/QA)

The methodology requires uncertainty assessment and procedures to reduce uncertainties.

To ensure the net anthropogenic GHG removals by sinks to be measured and monitored precisely, credibly, verifiably and transparently, a quality assurance and quality control (QA/Q) procedure shall be implemented, including (1) collection of reliable field measurements; (2) verification of methods used to collect field data; (3) verification of data entry and analysis techniques; and (4) data maintenance and archiving. If after implementing the QA/QC plan it is found that the targeted precision level is not met, then additional field measurements need to be conducted until the targeted precision level is achieved.

(1) Reliable field measurements

The methodology emphasises the importance of collecting reliable field measurement data as an important step in the quality assurance plan. Persons involved in the field measurement work should be fully trained in the field data collection and data analysis. Standard Operating Procedures (SOPs) for each step of the field measurements shall be developed and adhered to at all times. These SOPs should detail all the phases of the field measurements and contain provisions for documentation for verification purposes, so that measurements are comparable over time and can be checked and repeated in a consistent fashion. To ensure the collection of reliable field data:

- Field-team members shall be fully aware of all procedures and the importance of collecting data as accurately as possible;
- Field teams shall install test plots if needed in the field and measure all pertinent components using the SOPs;
- Field measurements shall be checked by a qualified person to correct any errors in techniques;
- A document that shows that these steps have been followed shall be presented as a part of the project documents. The document will list all names of the field team and the project leader will certify that the team is trained
- Any new staff are adequately trained

(2) Verification of field data collection

To verify that plots have been installed and the measurements taken correctly, 10-20% of plots shall be randomly selected and re-measured independently. Key re-measurement elements include the location of plots, DBH and tree height. The re-measurement data shall be compared with the original measurement data. Any deviation between measurement and re-measurement below 5% will be considered tolerable and error above 5%. Any errors found shall be corrected and recorded. Any errors discovered should be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

(3) Verification of data entry and analysis

Reliable estimation of carbon stock in pools requires proper entry of data into the data analyses spreadsheets. To minimize the possible errors in this process, the entry of both field data and laboratory data shall be reviewed using expert judgment and, where necessary, comparison with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analyzing data should be used to resolve any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot should not be used in the analysis.

(4) Data maintenance and archiving

Because of the long-term nature of the A/R CDM project activity, data shall be archived and maintained safely. All project documents and records will be kept in a secure and retrievable manner for at least two years after the end of the crediting period. Data archiving shall take both electronic and paper forms, and copies of all data shall be provided to each project participant. All electronic data and reports shall also be copied on durable media such as CDs and copies of the CDs are stored in multiple locations. The archives shall include:

- Copies of all original field measurement data, laboratory data, data analysis spreadsheet;
- Estimates of the carbon stock changes and non-CO2 GHG and corresponding calculation spreadsheets;
- GIS products;
- Copies of the measuring and monitoring reports.

Sampling plan and locating of PSPs

Ex-post stratification of the planted area will occur at the time of the first verification event, and subsequently prior to proceeding verification events. Ex-post stratification will take into account year of planting, tree species, forest management activities/stand development, site index and catastrophic events such as disease outbreak and fire.

Permanent sample plots (PSPs) are used for sampling over time to measure and monitor changes in carbon stocks of the relevant carbon pools in each compartment. The plots are treated in the same way as other lands within the compartment and stratum e.g. in terms of site preparation, weeding, pruning, thinning, harvesting, etc. Once ex-post stratification has been carried out, the number of PSPs required will be calculated. The ex-post stratification will be carried out in GIS and allow for the area of each stratum to be calculated. Equations 57 and 61 from AR-AM0004 version 4 have been used to calculate number of PSPs required per stratum to achieve a targeted precision level for biomass estimation within each stratum of ± 15% of the mean at a confidence level of 95 % (using parameters derived from existing plantation data from the region). The project participants anticipate using circular shaped PSPs of plot size between 200-400 m^2. For the PSP sample size calculations, an estimate of the biomass (*Q)* at the first verification event, scheduled for 2012, was determined using the yield model timber volumes, *BEFs* and root-to-shoot ratio for each of the species. The standard deviation was assumed to be 50% of the mean – this was assumed to be a conservative value based on PSPs implemented at other GRAS projects.

The plots will be systematically located with a random start in each stratum or sub-stratum following the GRAS Standard Operating Procedure (SOP) for a generation of PSP coordinates. See Table 4.3.1 for calculated number of PSPs and Figure 4.3.1.

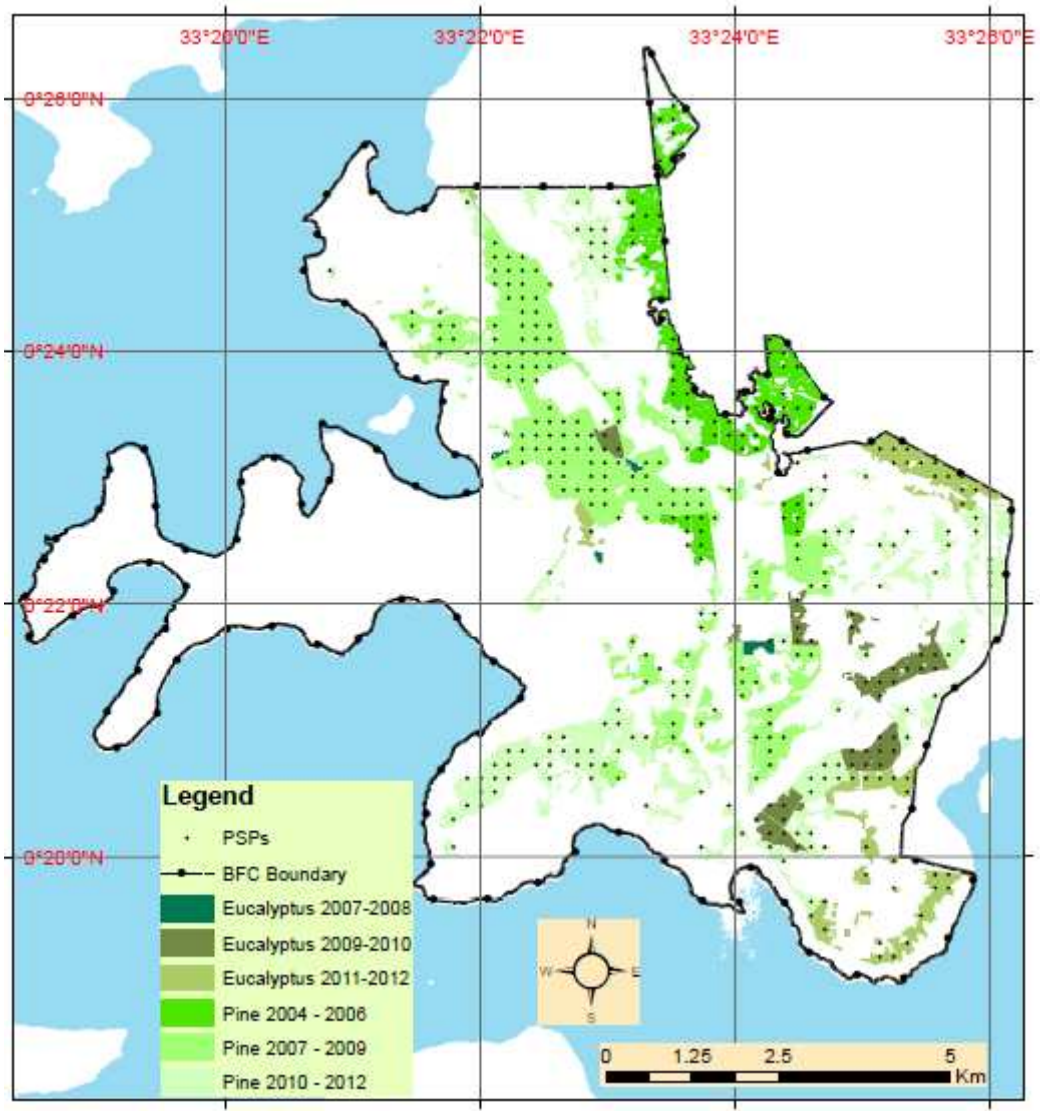
The plots will be marked on the ground by an inconspicuous centre pole marking the centre of the plot. Trees will also be marked but in a way so that they are not clearly visible: only a small spot of paint at breast height and a number marked at the bottom of the trunk.

Table 4.3.1. *Ex ante* calculation of number of PSPs (based on 400 m^2 PSPs) for 2011 verification

Species	Cohorts		
Eucalyptus	2007-2008	2009-2010	2011
	28	30	N/a
Pine	2004-2006	2007-2009	2010-2011

	30	30	N/a
Totals	58	60	N/a

Figure 4.3.1. Map showing location of PSPs within strata



The proposed ARR VCS project will be implemented under the following operational and management structure:

- The proposed ARR VCS project is being developed by Busoga Forestry Company (BFC), a subsidiary company in Uganda of Green Resources AS, whom is providing primary finance for the project. The project will be implemented and managed by BFC. BFC is wholly owned by Green Resources AS from Norway.

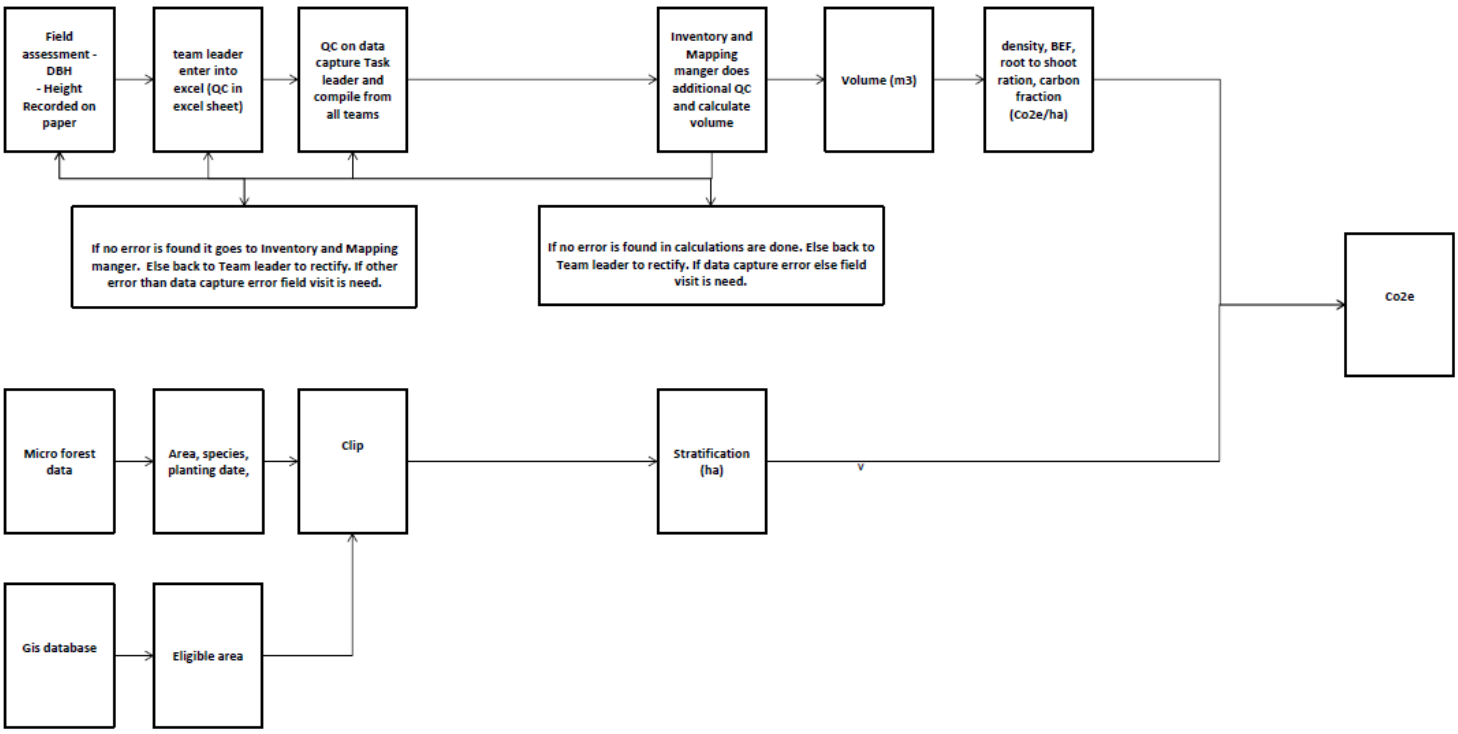
- The Project Management Officers that are established under BFC will be responsible for coordinating the project participants and providing technical services. This includes arranging training for the planting entities and farmers/communities involved, supervising the implementation of the ARR VCS project activity, as well as organizing a technical support panel (TSP) to carry out the monitoring of the project implementation performance and impacts. This includes measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed ARR VCS project activity. The relevant information and data will be documented and archived by the Project Management Officers and project entities in both electronic and paper copy.

- The Green Resource Inventory and Monitoring team will take the lead for the measuring and monitoring of the actual GHG removals by sinks and any leakage generated by the proposed ARR VCS project activity. They will closely work with country PMOs and the project entities by providing technical guidance on the monitoring process; jointly carry out the field measurement and necessary surveys, as well as the data collection and analysis. The project entities will be responsible for the requested routine measurement, data collection and documentation filing according to the project monitoring plan.

- The Makerere University Faculty of Forestry & Nature Conservation and Green Resources management experts will provide technical consultation and training to BFC & BFC technicians and the project entity staff in the measuring and monitoring of the actual GHG removals by sinks and leakage generated by the proposed A/R CDM project activity. FFNC will also verify field data and data entry and analysis, as well as provide guidance for drafting project monitoring report.

- The Bukaleba Plantation Project Entity will be responsible for the implementation of project reforestation activities, forest management and maintenance, forest harvesting and regeneration, as well as the carbon credit trade process. The Entity will also be responsible for day to day project monitoring and providing training to local communities and farmers on plantation management technologies by closely working with the sub-county of Agwata. In addition, the Entity will be responsible for drafting the project progress and monitoring reports under the guidance of expert teams.

Figure 4.3.2. Organizational chart of project monitoring



5 ENVIRONMENTAL IMPACT

Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed ARR AFOLU project activity:

It is a legal requirement of the Government of Uganda that an EIA be conducted for proposed activities that are likely to have significant impacts on the environment. The National Environment Act is the legislative tool and imposes a mandatory duty on a project developer to carry out the EIA. The National Environment Management Authority (NEMA) provides EIA requirement guidelines for project developers and is also the government body which approves proposed activities. BFC therefore conducted an EIA to gauge the impacts of the proposed BFP activities and to receive approval from NEMA. The EIA was carried out in accordance with the NEMA guidelines and EIA guidelines assessing impacts on biodiversity and natural ecosystems based on meetings, interviews with key stakeholders, community consultations and field surveys. The EIA was further complemented by an independent Ecological Assessment, both of which, along with the approval letter, will be made available as supporting information to the DOE as required.

The EIA study identified and evaluated environmental impacts likely to arise from the reforestation project and presented mitigation measures for the planning, design and operational stages of the project. The criteria for assessment of severity of environmental and social impacts is categorised in terms of extent, persistence, magnitude or intensity, probability of occurrence, and the resultant effect.

The EIA study concluded that although the reforestation project by BFC in the BCFR has some negative impacts associated with it, if the feasible mitigation measures that have been presented are implemented, then such impacts will either be eliminated or minimized to the extent of which they are at an insignificant level.

The main points highlighted from the EIA and Ecological Survey relating to environmental impacts were as follows:

- Pollution of soils and aquatic systems with herbicide and fertilizers
- Impacts of afforestation and reforestation activities such as increased traffic accidents
- Occupational health and safety hazards to workers
- Impacts on community health and safety
- Likelihood of increasing pressure on social services due to immigrant population seeing job opportunities
- Road construction
- Risk of fires
- Pest and diseases

The following mitigation measures will be implemented to abate the abovementioned potential negative impacts:

- The Environmental Management Plan that is presented within the EIA will be followed
- Grading shall be carried out during the dry season to minimize soil loss by erosion and potential impacts on the Namwange wetland system
- BFC will ensure that safe water sources for the local community of Bukaleba village shall be available
- Regular environment, health and safety inspection protocols should be conducted as per BFC policy and procedures
- BFC will ensure the harvesting/ decommissioning stage does not cause adverse and irreversible impacts on the environment

The main points highlighted from the EIA in regard to socio-economic impacts were as follows:

- Concerns of limited land for agriculture
- Loss of crops through implementation of the project
- The efficiency with which BFC can maintain the road network as well as provide essential social services
- Sustainable employment opportunities for the local communities

The following mitigation measures will be implemented to abate the abovementioned potential negative impacts:

- A collaborative forest management will be developed with the local communities surrounding the project
- BFC will maintain road networks as well as implement a community development programme, which will include:
    - o health care support through the provision of drugs and medical equipment
    - o roll out of an HIV and AIDS sensitisation programme
    - o support towards water security through the drilling of boreholes and maintenance of water points.
- BFC will employ more than 600 local community members at the project
- The project will provide free seedlings to the local communities so they can establish their own community woodlots

The Bukaleba Forest Project is FSC certified and has thus demonstrated that it is a forestry project which is being sustainably managed. The FSC criteria cover economic, environmental and social aspects of the project.

6 STAKEHOLDER COMMENTS

BFC commissioned both an Environmental and Socioeconomic Impact Assessment[42] and Ecological Survey[43], intended to bring out all issues of concern from the stakeholders. In addition, an earlier EIA was carried out which involved stakeholder consultations from back in April 1999[44]. This earier EIA was completed only in 2005 due to the pause in operations between 2000 and 2004 These studies formed the basis of the stakeholder consultation process and participation in the project design and implementation. Project staff have also been conducting stakeholder consultations at different levels; primary and secondary levels of stakeholder consultations. Reports of stakeholder consultations have been produced and shared with stakeholders at various levels. To acquire comprehensive information regarding the historic and current situation and existing problems in local communities, as well as to understand the needs and wishes of local farmers, a meeting of farmer representatives was held for each selected village. The PRA team also used this chance to introduce the project objectives and specific ARR AFOLU project requests, as well as collect the feedback from the farmers on the project design. To better use the village meeting, group interviews were also conducted**.** The PRA team interviewed village leaders, senior villagers, representatives of ethnic minorities group, representatives of women, farmer households.

iii. Questionnaires:

Questionnaire forms were developed and distributed to different stakeholders, including key informants like schools, farmers, village leaders, sub county governments and forestry authority. The questionnaires covered information and feedback on: the local socio-economic profiles, land use, land tenure and land management, farmer income and sources, farmers' preference in tree species selection and production arrangements, technical and financial barriers in ARR practice.

A copy of questionnaire is available for validation and verification as a supporting document.

v. National, Regional and District Level Discussions:

Following the questionnaires, the project proponent made formal discussions with key stakeholders from the National, Regional and District levels. These discussions were aimed at 1) examining the extent to which the stakeholders understand the activities of the project participant/promoter and the proposed ARR AFOLU project activity; 2) evaluating the performance of the project participants and its impacts to stakeholders and 3) collecting comments for improvement. The following key stakeholders were interviewed in the process: NEMA

[42] Environmental Impact Assessment for Afforestation and Reforestation of Bukaleba -2 Site in Bukaleba Central Forest Reserve, Eastern Uganda

[43] Ecological Survey of Bukaleba Central Forest Reserve, Mayuge District, Uganda

[44] As shown in the EIA proposal

(National Environmental Management Authority), National Forestry Authority (NFA), Ministry of water and Environment (Meteorology department), National Social Security Fund (NSSF) – Jinja District, Uganda Revenue Authority (URA) –Jinja District, Uganda Carbon Bureau, Makerere University (MUK), and Natural Resources Office – Mayuge district and NGOs.

The following methods were used to collect and compile stakeholders' comments:

i. Introduction of the company to stakeholders:

A short profile of BFP (BFC and GRAS) was given to the key stakeholders one month before any discussions began so as to ensure greater awareness among participants regarding the company's objectives and activities. The profile comprised a description of the proposed ARR AFOLU activity, company objectives, operations, certification and achievements including existing contributions towards local community development efforts.

ii. Establishing PRA/ mobilization team:

The teams were set to conduct the PRA, which consists of a social expert and the community representatives. The mobilization team helped generate ideas to improve community support programmes and obtain feedback on both positive and negative impacts of BFP activities on the surrounding communities.

iii. Village meetings:

Stakeholder comments from the range of different levels and groups as outlined above are summarized as follows:

1. Primary stakeholders

- Local communities welcomed the project because it would provide employment opportunities to local people for both skilled and unskilled workers
- The project would also lead to development of community infrastructure around the reserve for example roads, water points, schools, health centres
- Communities would also acquire new knowledge and skills in tree planting and other technologies
- Income generation by selling wood and non-wood products;
- Community investment from the sale of carbon credits;
- Income generation from increased employment: Local farmers can get additional income by participating in the site preparation, planting and forest management practice.
- Easy access to employment due its locality to the communities means that other livelihoods don't need to be sacrificed
- Rejuvenating their shrub-grasslands and barren lands would improve the local environment and shelter croplands
- Local farmers/communities indicated that without the proposed ARR AFOLU project activity it would be impossible for them to plant trees on the project area due to the large pre-investment, lack of technical knowledge, organizational barriers and low economic return in terms of the degraded, remote lands
- Provision of seedlings to communities to establish their own wood lots
- Local farmers and communities favour tree species that grow quickly, fruit trees and those that have a readily available market, such as *Artocarpus hetrophylllus* (Jack fruit), *Khaya senegalensis* (Mahogany), *Gmelina arborea* (Malayina), *Citrus cinensis* (oranges), *Vitellaria paradoxa* (Shea tree), Firewood tree species , *Pinus caribea*, apiary tree species, measopsis eminii etc
- Others felt the project would deprive them of land for cultivation and grazing

2. Secondary stakeholders

- Praised the ARR AFOLU project that would enhance biodiversity conservation in KCFR
- Local governments would generate revenue through taxes on BFP

- Pledged support towards ARR AFOLU project
- Income generated from sale of carbon would be used for community development
- BFP should support community forestry

(1) Local forestry department (NFA): National Forestry Authority as well as local forestry farmers considers that the proposed ARR AFOLU project activity will increase the forest resources, improve the local environment, enhance biodiversity conservation and increase the income of local farmers and communities. They would provide technical training and consultation to communities and planting entities, and supervise the implementation of the proposed ARR AFOLU project activity along with BFP management.

(2) Local Governments: Sub-county and parish governments all consider that the proposed ARR AFOLU project activity can improve the local economy and alleviate poverty to local communities, especially for the ethnic minority group, and at the same time benefit global climate change mitigation and biodiversity conservation as well as improve soil erosion control.

The comments received from the PRA survey were fully taken into account and are being considered as follows:

- Participation of local farmers/communities in the project – through work or development initiatives in communities - is on a voluntarily basis. The community development officer was appointed to develop a platform to facilitate dialogue between communities and the project. The CDO also works with a community mobilization team who were voluntarily appointed by the communities from each village.

- Preferences of local farmers/communities were taken into account in the selection of tree species. Also the company will not plant near the waterways so as to protect these water bodies.
- No fertilizers will be applied but aqua soil will be applied dribbling rather than overall dispersion to minimize its environmental impact. Use of chemical pesticides will be limited. Instead, the diseases and pests will be mainly controlled by mixed tree species arrangement and other biological measures. Herbicides will be applied especially before planting and manual slashing will done after planting until the canopy closes;

- Food shortage and poverty is being addressed by the company employing many more people from 300 to 600 persons and better methods of agriculture will be implemented to solve food shortage. Programmes for agro-forestry and improved agriculture will be incorporated to benefit the community.

- Social livelihood of the people will be improved by the company contributing to the development of existing hospitals, schools and roads and developing the trading centres and settlements through increased employment of the local population. This is well illustrated by the project development plan adopted by integrating the community need assessment in the EIA and ecological study with the sub-county development plan (Bukatube/ Mayuge).

- Some of the tree species used are locally native and a mixed arrangement of species is used in planting to minimise disease attach and use of chemicals. For example indigenous Maesopsis eminii

- The comments collected from stakeholders are also presented to project management in the form of reports; which are then discussed and a suitable response prepared and sent inform of feed back to stakeholders.

- Comments obtained from stakeholders have been incorporated into project management plan at various levels. The project is now reviewing the forest management plan and other relevant project documents to accommodate stakeholder views which are considered pertinent.

- The project has also developed a comprehensive community development plan to address development challenges facing communities in the project area. The Community development plan incorporates the sub-county local government three year development plan, the recommendations of Ecological survey, Environmental and Socioeconomic Impact Assessment and stakeholders comments

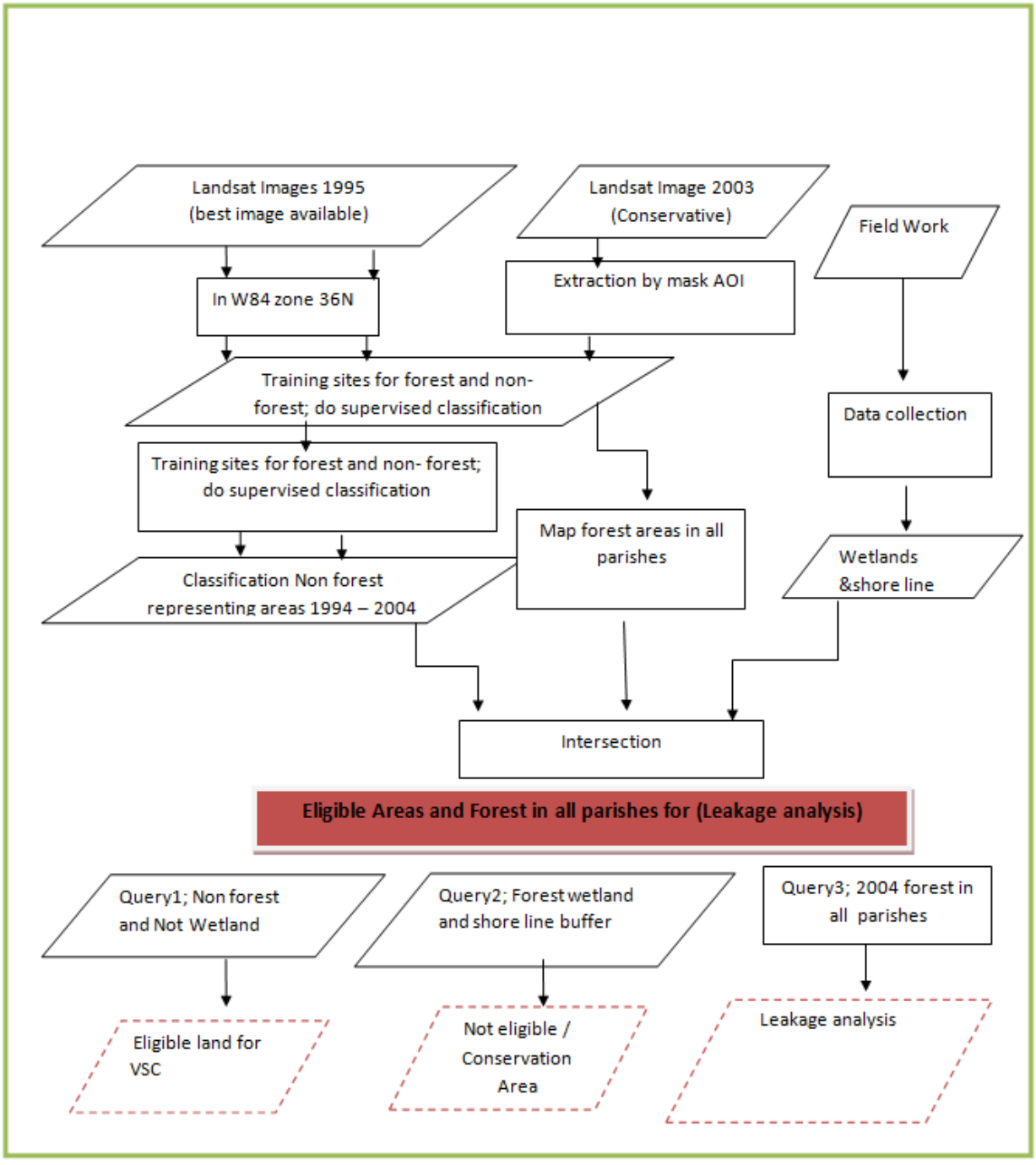
- GRAS employment policy gives priority to local staff both as skilled and unskilled workers. More than 90% of BFP workers both permanent and casual originate from the project area.
- Key recommendations of the Environmental and Socioeconomic Impact Assessment and ecological survey and stakeholder's comments have formed part of project management working documents in project operations. In some instances, prompt corrective measures have already been taken to address some of the issues/concerns raised

- In order to promote community participation in project activities, management has identified community mobilisers from each village of the project whom act as a liaison between communities and BFP

- There is continuous dialogue and interaction with stakeholders at different levels. This is done through consultative meetings, courtesy calls, planning meetings and sharing of information

7 ANNEX 1 – REMOTE SENSING PROCESS

Figure 7.1. Schematic diagram of the analysis process of supervised classifications of Landsat imagery


Landsat Images 1995
(best image available)
Landsat Image 2003
(Conservative)
Field Work
In W84 zone 36N
Extraction by mask AOI
Training sites for forest and non-forest; do supervised classification
Data collection
Training sites for forest and non- forest; do supervised classification
Map forest areas in all parishes
Wetlands &shore line
Classification Non forest representing areas 1994 – 2004
Intersection
Eligible Areas and Forest in all parishes for (Leakage analysis)
Query1; Non forest and Not Wetland
Query2; Forest wetland and shore line buffer
Query3; 2004 forest in all parishes
Eligible land for VSC
Not eligible / Conservation Area
Leakage analysis

8 ANNEX 2 – EMISSION REDUCTION CALCULATIONS

Species inputs	Wood density, t/m^3	BEF	Root:shoot	CF	CO_2/C
Pine	0.424	1.25	0.26	0.5	3.67

Thinning/ harvesting regime				
Year	4	8	12	20
Pine	19%	39%	30%	100%

Wood/ carbon volume

	Pine, m^3/Ha									Pine
	Alder 2004, SI 16			Increment			Loss (thinning/ harvesting)			
Year	CAI	Thinning/ harvesting	Cumulative volume	Above ground biomass	Below ground biomass	Total biomass	Above ground biomass	Below ground biomass	Total biomass	tCO_2e
1	1.0	0.0	1.0	1.2	0.3	1.5	0.0	0.0	0.0	1.2
2	4.9	0.0	5.9	6.1	1.6	7.7	0.0	0.0	0.0	6.0
3	10.3	0.0	16.2	12.9	3.4	16.3	0.0	0.0	0.0	12.7
4	16.4	6.2	26.4	20.5	5.4	25.9	7.7	2.0	9.8	12.5
5	18.9	0.0	45.3	23.6	6.2	29.8	0.0	0.0	0.0	23.2
6	24.4	0.0	69.7	30.5	8.0	38.6	0.0	0.0	0.0	30.0
7	29.1	0.0	98.8	36.4	9.6	46.0	0.0	0.0	0.0	35.8
8	33.4	51.6	80.6	41.7	11.0	52.7	64.5	17.0	81.4	-22.3
9	25.8	0.0	106.4	32.2	8.5	40.7	0.0	0.0	0.0	31.6
10	27.9	0.0	134.3	34.8	9.2	44.0	0.0	0.0	0.0	34.2
11	29.7	0.0	164.0	37.1	9.8	46.9	0.0	0.0	0.0	36.5
12	31.2	58.6	136.6	39.0	10.3	49.3	73.2	19.3	92.5	-33.6
13	20.9	0.0	157.5	26.1	6.9	33.0	0.0	0.0	0.0	25.6
14	25.2	0.0	182.7	31.5	8.3	39.8	0.0	0.0	0.0	31.0
15	25.7	0.0	208.4	32.1	8.4	40.5	0.0	0.0	0.0	31.5
16	25.9	0.0	234.3	32.4	8.5	40.9	0.0	0.0	0.0	31.8
17	26.0	0.0	260.3	32.5	8.6	41.0	0.0	0.0	0.0	31.9
18	25.9	0.0	286.1	32.4	8.5	40.9	0.0	0.0	0.0	31.8
19	25.7	0.0	311.8	32.1	8.5	40.5	0.0	0.0	0.0	31.5

20	25.3	337.1	0.0	31.7	8.3	40.0	421.4	111.0	532.5	-382.8

Species inputs	Wood density, t/m^3	BEF	Root:shoot	CF	CO_2/C
Eucalyptus	0.392	2.7	0.25	0.5	3.67

Thinning/ harvesting regime		
Year	4	10
Eucalyptus	50%	100%

	Eucalyptus, m^3/Ha									Eucalyptus
	Alder 2004, SI 28			Increment			Loss (thinning/ harvesting)			
Year	CAI	Thinning/ harvesting	Cumulative volume	Aboveground biomass	Belowground biomass	Total biomass	Aboveground biomass	Belowground biomass	Total biomass	tCO_2e
1	2.5	0.0	2.5	6.7	1.7	8.3	0.0	0.0	0.0	6.0
2	20.3	0.0	22.8	54.9	13.6	68.5	0.0	0.0	0.0	49.3
3	30.7	0.0	53.6	83.0	20.5	103.5	0.0	0.0	0.0	74.4
4	34.5	44.0	44.0	93.1	23.1	116.2	118.9	29.4	148.3	-23.1
5	36.7	0.0	80.7	99.1	24.5	123.6	0.0	0.0	0.0	88.8
6	25.0	0.0	105.7	67.4	16.7	84.1	0.0	0.0	0.0	60.4
7	24.4	0.0	130.0	65.8	16.3	82.0	0.0	0.0	0.0	59.0
8	23.6	0.0	153.6	63.6	15.8	79.4	0.0	0.0	0.0	57.0
9	22.7	0.0	176.3	61.3	15.2	76.5	0.0	0.0	0.0	55.0
10	21.8	198.1	0.0	59.0	14.6	73.5	535.0	132.5	667.4	-426.8

Pine planting schedule

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ha planted	25	123	142	239	172	382	249.8	242.2	135
Total planted	24.7	148	290	529	701	1,083	1,333	1,575	1,710

tCO_2e Pine										Total
1	29									29
2	148	147								295
3	313	739	169							1,222
4	309	1,566	850	286						3,010
5	572	1,546	1,799	1,434	205					5,557
6	741	2,860	1,776	3,038	1,031	456				9,901
7	883	3,702	3,286	2,999	2,182	2,287	298			15,639
8	-552	4,414	4,254	5,548	2,155	4,845	1,497	289		22,449
9	781	-2,756	5,072	7,182	3,986	4,783	3,170	1,451	161	23,829
10	845	3,902	-3,167	8,563	5,160	8,848	3,129	3,073	809	31,163
11	901	4,223	4,484	-5,348	6,152	11,454	5,789	3,034	1,713	32,403
12	-830	4,501	4,852	7,571	-3,842	13,657	7,494	5,613	1,691	40,707
13	633	-4,145	5,172	8,192	5,439	-8,528	8,935	7,266	3,129	26,093
14	765	3,164	-4,763	8,731	5,886	12,074	-5,580	8,663	4,050	32,991
15	778	3,822	3,636	-8,042	6,273	13,065	7,900	-5,410	4,829	26,850
16	785	3,887	4,392	6,138	-5,778	13,925	8,548	7,660	-3,016	36,541
17	787	3,923	4,466	7,414	4,410	-12,826	9,111	8,288	4,269	29,843
18	785	3,933	4,508	7,541	5,327	9,789	-8,391	8,834	4,620	36,944
19	778	3,921	4,520	7,611	5,418	11,824	6,404	-8,136	4,924	37,264
20	-9,455	3,889	4,506	7,631	5,468	12,026	7,736	6,210	-4,535	33,475
21	29	-47,237	4,469	7,607	5,483	12,138	7,868	7,501	3,461	1,319
22	148	147	-54,280	7,545	5,465	12,170	7,941	7,629	4,181	-9,054
23	313	739	169	-91,641	5,421	12,132	7,962	7,700	4,252	-52,952
24	309	1,566	850	286	-65,840	12,032	7,937	7,720	4,292	-30,848
25	572	1,546	1,799	1,434	205	-146,150	7,872	7,696	4,303	-120,722
26	741	2,860	1,776	3,038	1,031	456	-95,622	7,633	4,290	-73,798
27	883	3,702	3,286	2,999	2,182	2,287	298	-92,712	4,254	-72,819
28	-552	4,414	4,254	5,548	2,155	4,845	1,497	289	-51,677	-29,228
29	781	-2,756	5,072	7,182	3,986	4,783	3,170	1,451	161	23,829
30	845	3,902	-3,167	8,563	5,160	8,848	3,129	3,073	809	31,163
31	901	4,223	4,484	-5,348	6,152	11,454	5,789	3,034	1,713	32,403

tCO_2e Pine										Total
32	-830	4,501	4,852	7,571	-3,842	13,657	7,494	5,613	1,691	40,707
33	633	-4,145	5,172	8,192	5,439	-8,528	8,935	7,266	3,129	26,093
34	765	3,164	-4,763	8,731	5,886	12,074	-5,580	8,663	4,050	32,991
35	778	3,822	3,636	-8,042	6,273	13,065	7,900	-5,410	4,829	26,850
36	785	3,887	4,392	6,138	-5,778	13,925	8,548	7,660	-3,016	36,541
37	787	3,923	4,466	7,414	4,410	-12,826	9,111	8,288	4,269	29,843
38	785	3,933	4,508	7,541	5,327	9,789	-8,391	8,834	4,620	36,944
39	778	3,921	4,520	7,611	5,418	11,824	6,404	-8,136	4,924	37,264
40	-9,455	3,889	4,506	7,631	5,468	12,026	7,736	6,210	-4,535	33,475
41	29	-47,237	4,469	7,607	5,483	12,138	7,868	7,501	3,461	1,319
42	148	147	-54,280	7,545	5,465	12,170	7,941	7,629	4,181	-9,054

Eucalyptus planting schedule

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Ha planted	-	-	-	5	8	30	101	117	90.7
Total planted	-	-	-	5	13	42.8	143.7	261	352

tCO_2e Euc										
1	-									0
2	-	-								0
3	-	-	-							0
4	-	-	-	0						0
5	-	-	-	0	389					389
6	-	-	-	0	588	1,483				2,071
7	-	-	-	0	-182	2,239	4,971			7,027
8	-	-	-	0	702	-695	7,506	5,769		13,282
9	-	-	-	0	477	2,674	-2,329	8,711	4,468	14,001
10	-	-	-	0	466	1,819	8,963	-2,703	6,747	15,292
11	-	-	-	0	451	1,775	6,099	10,402	-2,094	16,632
12	-	-	-	0	434	1,717	5,949	7,078	8,057	23,235

tCO_2e Euc										
13	-	-	-	0	-3,372	1,654	5,756	6,904	5,482	16,425
14	-	-	-	0	0	-12,847	5,546	6,680	5,348	4,726
15	-	-	-	0	389	0	-43,065	6,436	5,174	-31,065
16	-	-	-	0	588	1,483	0	-49,979	4,985	-42,923
17	-	-	-	0	-182	2,239	4,971	0	-38,711	-31,684
18	-	-	-	0	702	-695	7,506	5,769	0	13,282
19	-	-	-	0	477	2,674	-2,329	8,711	4,468	14,001
20	-	-	-	0	466	1,819	8,963	-2,703	6,747	15,292
21	-	-	-	0	451	1,775	6,099	10,402	-2,094	16,632
22	-	-	-	0	434	1,717	5,949	7,078	8,057	23,235
23	-	-	-	0	-3,372	1,654	5,756	6,904	5,482	16,425
24	-	-	-	0	0	-12,847	5,546	6,680	5,348	4,726
25	-	-	-	0	389	0	-43,065	6,436	5,174	-31,065
26	-	-	-	0	588	1,483	0	-49,979	4,985	-42,923
27	-	-	-	0	-182	2,239	4,971	0	-38,711	-31,684
28	-	-	-	0	702	-695	7,506	5,769	0	13,282
29	-	-	-	0	477	2,674	-2,329	8,711	4,468	14,001
30	-	-	-	0	466	1,819	8,963	-2,703	6,747	15,292
31	-	-	-	0	451	1,775	6,099	10,402	-2,094	16,632
32	-	-	-	0	434	1,717	5,949	7,078	8,057	23,235
33	-	-	-	0	-3,372	1,654	5,756	6,904	5,482	16,425
34	-	-	-	0	0	-12,847	5,546	6,680	5,348	4,726
35	-	-	-	0	389	0	-43,065	6,436	5,174	-31,065
36	-	-	-	0	588	1,483	0	-49,979	4,985	-42,923
37	-	-	-	0	-182	2,239	4,971	0	-38,711	-31,684
38	-	-	-	0	702	-695	7,506	5,769	0	13,282
39	-	-	-	0	477	2,674	-2,329	8,711	4,468	14,001
40	-	-	-	0	466	1,819	8,963	-2,703	6,747	15,292
41	-	-	-	0	451	1,775	6,099	10,402	-2,094	16,632
42	-	-	-	0	434	1,717	5,949	7,078	8,057	23,235

Year	Project removals	Cumulative project removals	Baseline	Leakage	Emissions	tCO2e	Cumulative tCO2e	Buffer credits	Saleable VCUs (No time release)
1	29	29	0	2	0	28	28	0	0
2	295	325	0	10	0	285	313	0	0
3	1,222	1,547	0	19	0	1,203	1,516	0	0
4	3,010	4,557	0	31	0	2,980	4,495	0	0
5	5,946	10,503	0	35	0	5,911	10,406	0	0
6	11,971	22,475	0	53	0	11,918	22,325	0	0
7	22,666	45,141	0	70	0	22,596	44,921	13,091	31,830
8	35,731	80,871	0	80	0	35,651	80,572	10,362	25,289
9	37,831	118,702	0	181	0	37,650	118,222	10,971	26,679
10	46,455	165,157	0	265	0	46,190	164,411	13,472	32,718
11	49,035	214,192	0	369	0	48,666	213,078	14,220	34,446
12	63,942	278,134	0	479	0	63,464	276,541	18,543	35,240
13	42,518	320,652	0	621	0	41,896	318,437	0	0
14	37,717	358,369	0	716	0	37,000	355,438	0	0
15	-4,215	354,154	0	801	0	-5,016	350,422	0	0
16	-6,382	347,771	0	791	0	-7,174	343,248	0	0
17	-1,841	345,931	0	777	0	-2,618	340,631	0	0
18	50,226	396,157	0	773	0	49,453	390,084	0	0
19	51,266	447,422	0	1,180	0	50,085	440,169	0	0
20	48,768	496,190	0	1,180	0	47,587	487,756	0	0
21	17,951	514,141	0	1,180	0	16,771	504,527	0	0
22	14,181	528,322	0	1,180	0	13,001	517,528	0	0
23	-36,528	491,795	0	1,180	0	-37,708	479,820	0	0
24	-26,122	465,673	0	207	0	-26,329	453,491	0	0
25	-151,787	313,885	0	207	0	-151,994	301,496	0	0
26	-116,722	197,164	0	207	0	-116,929	184,567	0	0
27	-104,503	92,660	0	207	0	-104,710	79,857	0	0
28	-15,946	76,714	0	207	0	-16,153	63,704	0	0
29	37,831	114,545	0	612	0	37,219	100,922	0	0
30	46,455	161,000	0	612	0	45,843	146,765	0	0
31	49,035	210,035	0	612	0	48,423	195,188	0	0
32	63,942	273,977	0	612	0	63,330	258,518	0	0
33	42,518	316,495	0	612	0	41,905	300,423	0	0
34	37,717	354,211	0	764	0	36,953	337,377	0	0
35	-4,215	349,996	0	764	0	-4,979	332,398	0	0

36	-6,382	343,614	0	764	0	-7,146	325,252	0	0
37	-1,841	341,773	0	764	0	-2,604	322,648	0	0
38	50,226	391,999	0	764	0	49,462	372,110	0	0
39	51,266	443,265	0	1,090	0	50,176	422,286	0	0
40	48,768	492,033	0	1,090	0	47,678	469,964	0	0
41	17,951	509,984	0	1,090	0	16,862	486,826	0	0
42	14,181	524,165	0	1,090	0	13,092	499,918	0	0