Reforestation in grassland areas of Uchindile, Kilombero, Tanzania & Mapanda, Mufindi, Tanzania

VCS Monitoring Report
1st January 2002 to November 30th 2008

Version 8

September 2nd 2010

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Uchindile and Mapanda VCS Monitoring Report

1st January 2002- 31st November 2008

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Report prepared by Jenny Henman and Jakob Sandven

1 Project Activity Implementation

1.1 Short Description of Project Activity

The project is reforesting degraded grassland in the Southern Highlands of Tanzania. The project is a Voluntary Carbon Standard (VCS) Afforestation/Reforestation (ARR) Project which falls under the Agriculture, Forestry and Land Use (AFOLU) category of eligible project activities. The project applies a methodology of the Clean Development Mechanism (CDM) for afforestation/reforestation – namely AR-AM0005, version 3. The project is located in two separate areas; Uchindile Forest Project (UFP) and Mapanda Forest Project (MFP) and the reforestation takes place on many 'discrete' areas of land at the two locations. Green Resources has been allocated title to a total of 18,379ha of land split between 12,121ha at UFP and 6,258ha at MFP. Of this land 7,252ha at UFP and 3,562ha at MFP are plantable, and at the end of the monitoring period 2325 ha and 1764 ha had been planted UFP and MFP respectively. The land is held on a 99-year renewable lease; title deeds that have been issued to the company by the Ministry of Lands for Tanzania. The land acquisition in Tanzania is a bottom-up process that started at the local village level and proceeded through district and then national level channels before final issuance of title is granted.

The project started in 1997 when the company set out to develop a commercially viable reforestation project which combined revenues from carbon and timber. Planting was undertaken from 1997 to 1999 on a trial basis in both areas financed with private money. Foreign investments were invited but did not really take off until 2004 when the 9th Conference of the Parties to the UNFCCC in 2003 agreed on the rules for CDM ARR project activities. It was only when further investment came in that the company was able to increase its annual planting schedule. When the rules for the CDM ARR methodology were finalised the project was ineligible due to its early start date pre-2000. However the project was eligible under the VCS ARR rules and achieved validation on the 17th July 2009. In accordance with the VCS AFOLU rules the earliest date that carbon crediting are calculated from is 2002. The monitoring period for the project is January 1st 2002 until November 30th 2008.

The two species that have been planted are various genera of pine and eucalyptus (see Table 1-1) ; the dominant species that are planted are *pinus patula* and *eucalyptus saligna*. In the baseline scenario, the land would remain as degraded grassland, which has over a period of many years been degraded as a result of regular fire regimes forcing the natural miombo woodland back to the more moist gullies and valley bottoms. The grasslands have remained in a steady state for several decades. Areas where the natural woodland remains are kept as natural woodland and buffer zones between them and the reforestation have been put in place to ensure biodiversity protection. The conservation areas will help to preserve the natural hydrology and promote the protection of biodiversity and wildlife in the area. No carbon benefits are being sought by the company for the protection of these conservation areas. The exotic species being grown in the plantation areas are being done so on a rotation that allows a permanent sink of carbon to be established as well as sustainable harvesting. Green Resources plans on carrying on with sustainable forestry and harvesting at the project sites over the long-term. The harvested

wood will be used to provide high-quality value-added products to local markets such as utility poles, furniture and sawn timber. An added benefit of this is that it will reduce deforestation pressure for timber from the native forest as it provides an alternative sustainable source of timber. The plantation follows best practice in forest establishment, management techniques, stakeholder consultation and environmental protection and received FSC certification on the 8th of August 2008.

Green Resources is committed to full stakeholder consultation and engagement in the project, and achieving net community benefits as a result of the project. UFP employs 58 permanent employees as well as around 400 part-time employees on average, while Mapanda has 41 permanent and around 200 part-time employees. Both have also been significantly financially assisted with the building of classrooms and health centres in the villages. The project has achieved approval from the Government for both its Environmental and Socio-Economic Impact Assessments in the area it is operating.

The project carried out a full verification event in October/November 2008, and had a verification field visit in December 2008 from the Designated Operational Entity, TUV SUD. The total tons of co2 equivalent sequestered by the project during the Jan 1st 2002 to November 30th 2008 monitoring time period is 232,265 tCO2.

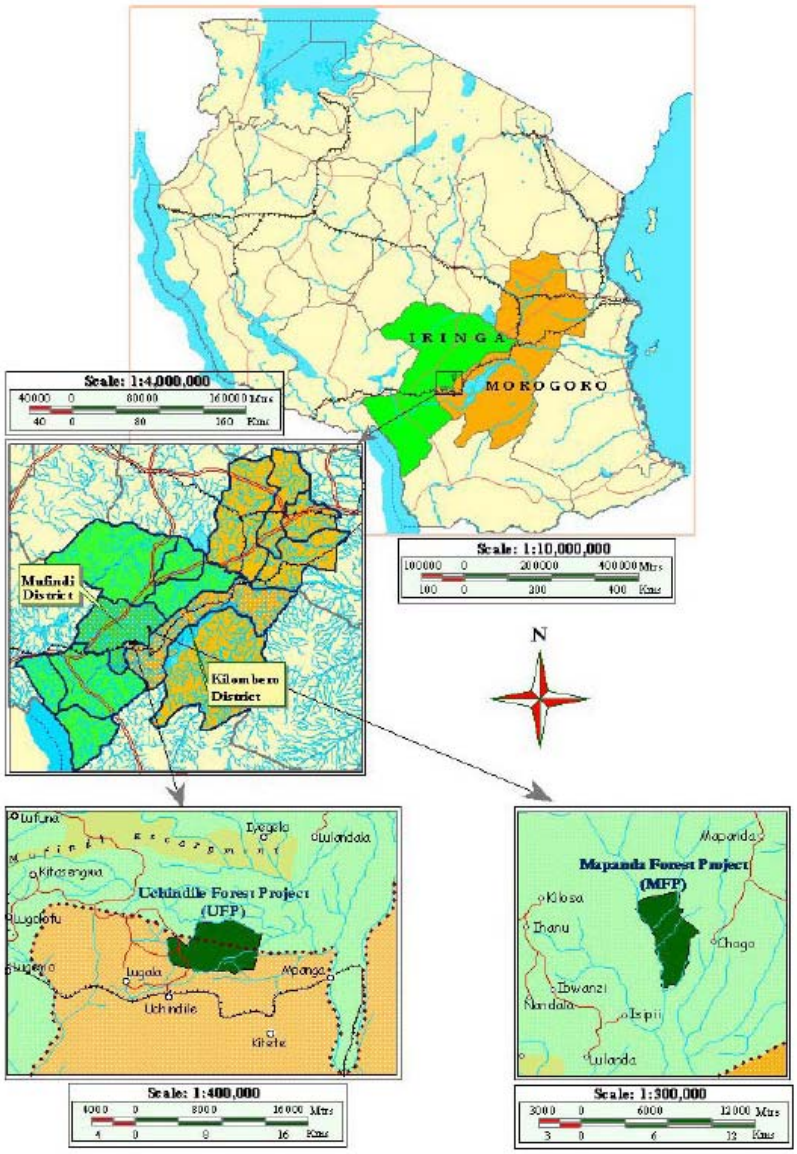
Table 1-1 List of Species and Genera Planted which generate tons at UFP and MFP

Genera	Species
Eucalyptus	*eucalyptus saligna*
Eucalyptus	*eucalyptus globulus*
Eucalyptus	*eucalyptus camadulensis*
Pine	*pinus patula*

1.1.1 Project Location and Area

The project areas are located in the Southern Highlands of Tanzania. UFP lies in the district of Kilombero, Morogoro Region and Mapanda is in the district of Mufindi, Iringa Region. UFP is found at longitude 35°28´13”E and latitude 8°42´11”S, whilst Mapanda Forest Project is found at Longitudes $35^0$39’49’’E to $35^0$44’52’’E and Latitudes $8^0$24’30’’S to $8^0$33’19’’S.

Figure 1-1 Location of Uchindile and Mapanda Projects



The establishment of the forests is taking place on a total of 18,379ha of land split between 12,121ha at UFP and 6,258ha at Mapanda. Of this land 7,252ha at UFP and 3,562ha are plantable at Mapanda. Up until the end of the monitoring period 1764 and 2325 ha have been planted at MFP and UFP respectively, meaning a total of 4089 ha of land has been planted and are included in the monitoring period 1st Jan 2002 to 31st Nov 2008.

As well as the planted area, the project also consists of various other land uses such as habitat conservation areas, buffer zones, roads, fire breaks and trial areas. Below is a breakdown of all the land uses, followed by a further break down of the plantable area into planted, and remaining plantable area post-2008.

Table 1-2 Planted Area, and Land Use division at UFP Forest Project

Land Use	Area (ha)
Planted Area	2325
Remaining Plantable Area	4927
Conservation/ Blue Swallow Habitat Area	1698
Experimental Site	119
Hydrological Buffer Zones	1402
Roads, Valley Bottoms,Gullies, Fire Breaks	1650
Total	12, 121

Table 1-3 Planted Area, and Land Use division at Mapanda Forest Project

Land Use	Area (ha)
Planted Area	1764
Remaining Plantable Area	1798
Conservation/ Blue Swallow Habitat Area	665
Experimental Site	88
Hydrological Buffer Zones	981
Roads, Valley Bottoms and Gullies	710
Fire breaks	253
Total	6258

Figure 1-2 Uchindile Forest Project showing Planted Area and other Land Use, 2008

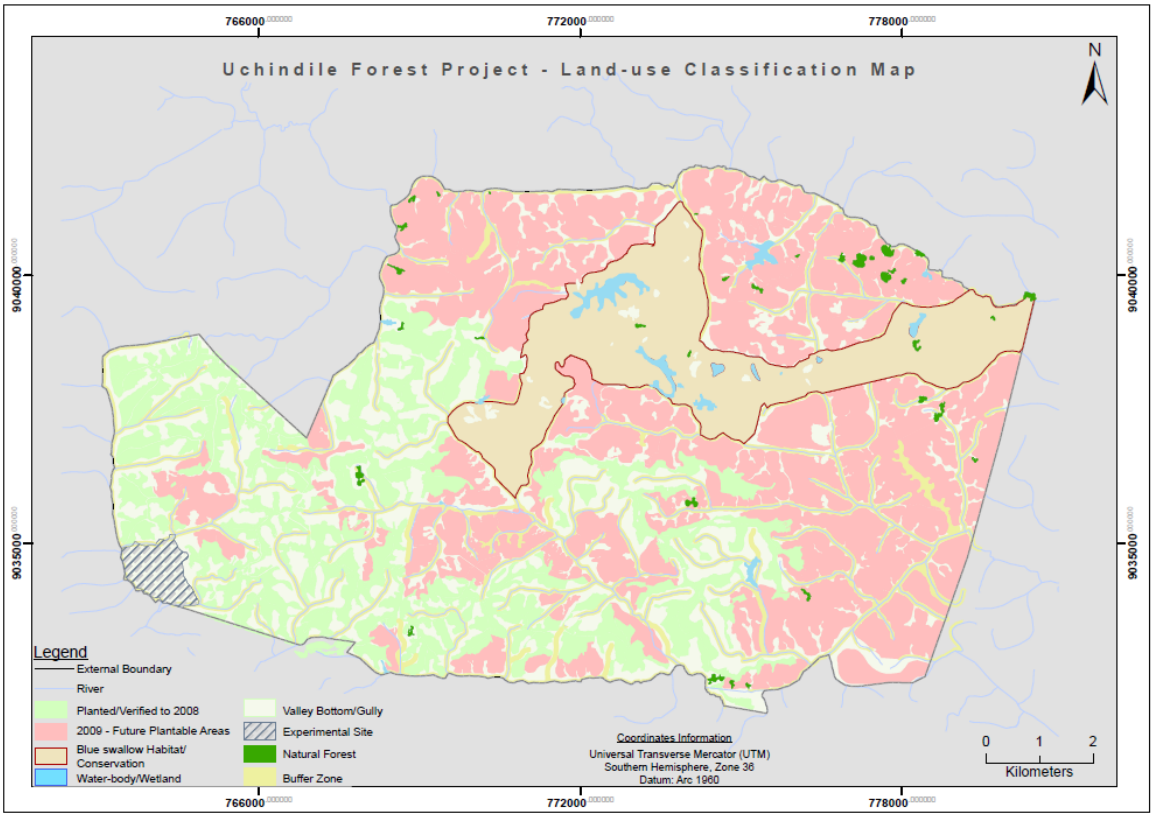
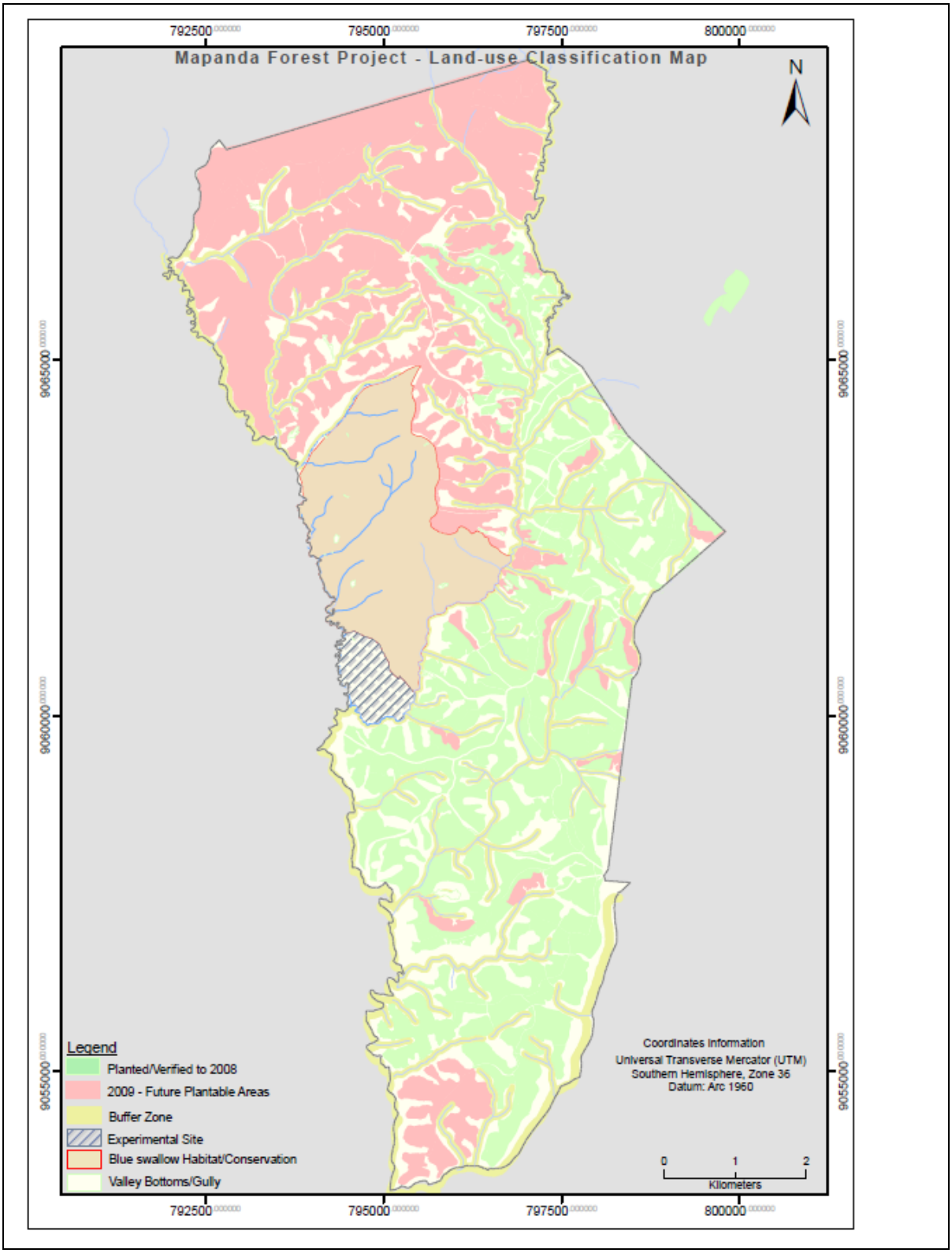


Figure 1-3 Mapanda Forest Project showing Planted Area and other Land Use, 2008.



1.1.2 Baseline Strata

There was one baseline strata identified before the start of the project; grassland with scattered trees. The *ex ante* baseline scenario defined prior to the start of the proposed A/R CDM project activity shall be valid for the entire crediting period. Therefore, this methodology does not require the monitoring of baseline scenario during the crediting period.

1.1.3 Project Strata

The planted area has been stratified ex-post according to species and three year age cohorts based on year of planting. The chosen stratification seemed the most appropriate to minimized variance within stratum. Nine different strata were distinguished during monitoring, based on the year of planting and the species planted in them, and management. For the area which suffered from fire and had to be replanted this land was re-stratified into the age cohort related to the year of replanting.

Figure 1-4 Stratification at UFP

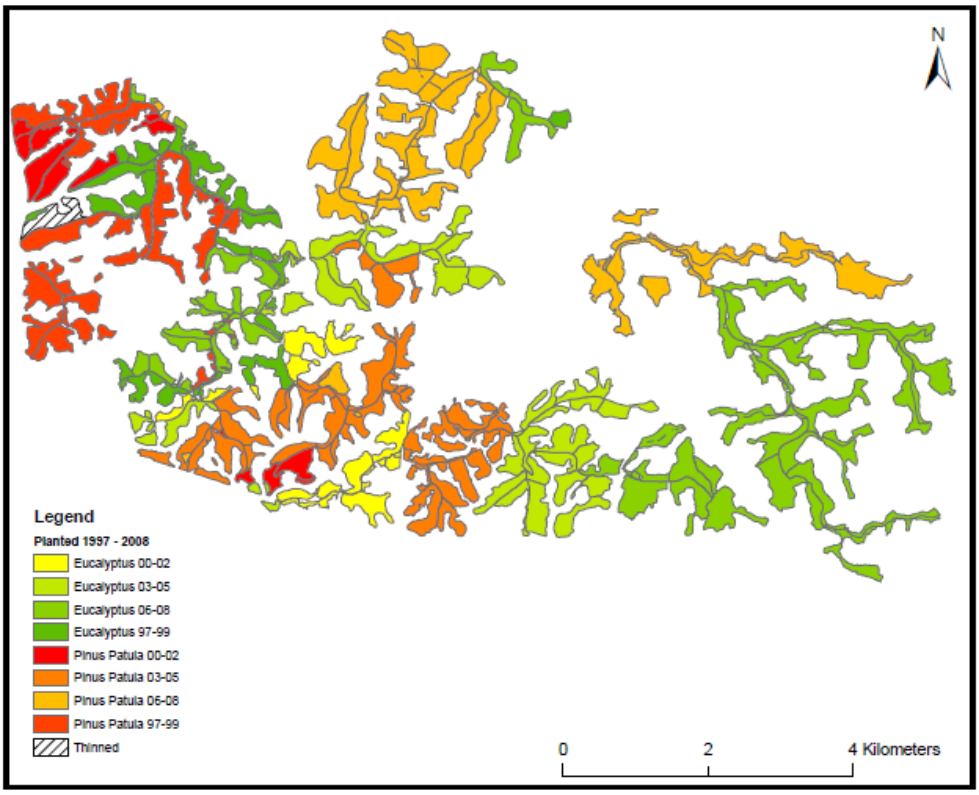


Figure 1-5 Stratification at MFP

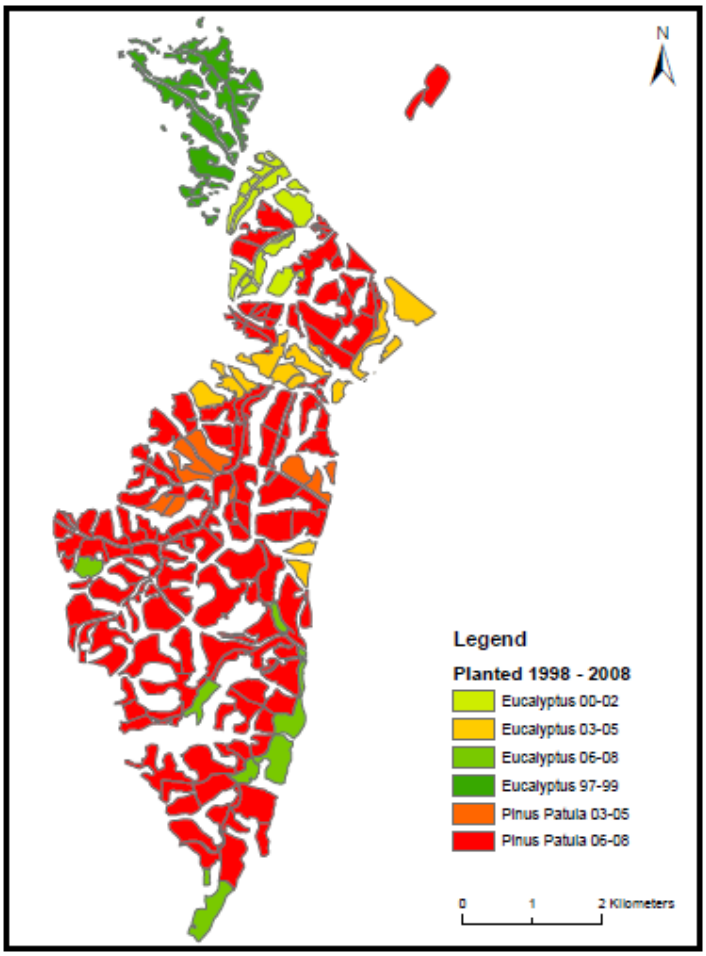


Table 1-4 Planted area per strata

Strata	Uchindile	Mapanda	Total
Pine 1997-1999	273.8	0	273.8
Pine 2000-2002	99.6	0	99.6
Pine 2003-2005	340.7	57.4	398.1
Pine 2006-2008	424.2	1233.5	1657.7
Eucalyptus 1997-1999	161.2	129.7	290.8
Eucalyptus 2000-2002	112.1	97.5	209.6
Eucalyptus 2003-2005	326.1	148.5	474.6
Eucalyptus 2006-2008	566.5	97.1	663.6
Thinned Eucalyptus 2008	21.3	0	21.3
Total	2325	1764	4089

1.1.4 Land Tenure

Land tenure and carbon rights are held by Green Resources Ltd. Uchindile Forest Project has a title deed for the area of land for a period of 99 years from 1st April 2000. Mapanda Forest Project has two titles of ownership both for a period of 99 years from 06th December 2003.

Table 1-5 Title Deeds at Uchindile and Mapanda Forest Projects

Name	Villages	Area	Tenure	Deed
Uchindile	Uchindile, Kitete	12,121ha	99yrs from yr. 2000	50742
Mapanda	Chogo	1,606ha	99yrs from yr. 2003	8954 – MBYLR
	Chogo & Mapanda	4,652ha	99yrs from yr. 2003	8955 – MBYLR

1.2 Organisation

Jenny Henman, the Carbon Certification Manager for GRAS was responsible for the completion of this VCS Monitoring Report in accordance with the VCS monitoring plan. Jakob Sandven, Inventory and

Monitoring Manager, GRAS and Peter Mussami, Research Director, GRL of Green Resources Ltd were responsible for the field measurements and inventory. The full team involved in the mapping, monitoring and reporting was as follows;

- Jenny Henman, Carbon Certification Manager, GRAS,
- Jakob Sandven, Inventory and Monitoring Manager, GRAS
- Peter Mussami, Research Manager, GRL
- Peter Myegeta, GIS and Mapping Manager, GRAS
- Sophia Gogo, GIS/Imagery Analyst, GRL
- Peter Mapesa, IT Manager, GRL
- Anthony Kisondella, Mapping Specialist, GRL
- Moses Ngegba, Carbon Manager Tanzania, GRL
- Vincent Nambombe, Planning Manager, GRL

1.3 Quality Management System

In order to ensure that quality control is ensured throughout the project all standard procedures (SOPs) that are carried out are covered by written instructions. The following Standard Operating Procedures have been developed and are complied with by Green Resources

1. Stakeholder Consultation Process
2. Raising FSC Awareness
3. Complaints, Grievances Disputes and conflict resolution
4. Documents Management and Updating
5. Oil Spillage Response, cleanup and disposal (Spill Prevention control and countermeasures)
6. Control, prevention and monitoring of illegal activities
7. Employee Selection Procedure
8. Company internal audit and car system procedure
9. Waste description and management procedure
10. Specific site environmental impact assessment (form for collection of field data)
11. Chemical Screening Procedure
12. Pests and diseases monitoring procedure
13. Documentation approval procedure
14. Specific Site Environmental Impact Assessment
15. GRL Workers Awareness Process

16. Inventory and Monitoring Guidelines

All staff are also trained according to Green Resources' five-year training programme.

1.4. Remaining FARs from previous Verifications (or forwarded issues of validation report)

This is the project's first verification and monitoring report and there were no forwarded issues from the validation report.

2 Data Management System

2.1 Data Management Procedures for Inventory data from Permanent Sampling Plots

For full details please refer to Annex 6: Green Resources Inventory and Monitoring Guidelines

2.1.1 Raw Data Collection

Verifying planted area accurately and efficiently is crucial to forest inventory, monitoring and management. The goal is to accurately verify the exact area of land that has been planted through GPS measurements, and create a corresponding map in GIS from the data which is collected to determine area. Planting verification should take place following the planting and be subsequently repeated once every 5 years at a minimum. Additionally following catastrophic loss (pest attack, fire, illegal logging) to a planted area then re-measurement of the boundary should also be carried out to re-establish the new boundary of the planted area. (See SOP 'Monitoring the Planted Area Boundary, Survival Checking and Planting Density')

The updated GRAS inventory guidance states that after a complete inventory is carried out in the PSP's, at least 10% of all plots must be re-measured and checked by another team or a senior manager, and compared with the original measurements. In addition the team which is doing inventory is encouraged to check each others work. Pointing out of errors is encouraged by all members of the team, regardless of position.

The following items will be checked by another team in the 1-5 sample plots which are measured again: (critical levels/tolerance level are noted in brackets):

- The DBH of all trees in the plot (± 2 cm)
- If the DBH marking is at the correct height 1.3 meter. (± 10 cm)
- Check that all marked trees are inside the plot. (± 1 cm)

- Height of the trees measured in the plot. (± 1 m)
- If the location of the PSP is random. (IF IT IS NOT A RANDOM SELECTION IT IS A FAILURE)
- Trees inside the PSP should be treated the same as the rest of stand, e.g. PSPs must be treated exactly the same in terms of silvi-cultural treatment as the rest of the compartments
- Check that the numbering of the trees is correct.
- Check that the GPS is using the correct datum. If this is wrong, it can give an error of almost 300 meter.

All these rules are written in the Green Resources Inventory Guidelines (Annex 6) which all inventory staff have been trained in.

Quality Control for 2008 Verification Event

At the point of the 2008 verification the current GRAS inventory guidelines, and associated quality control measures described above were not in place. Nevertheless, a QC procedure was implemented by a senior manager as described in the PDD. Checking of DBH, height, correct plot size and use of callipers was carried out. This qualify control was carried out by Jakob Sandven, Inventory and Monitoring Manager, GRAS in February 2009.

2.1.2 Raw Data Archiving

Once data collected from the field has been transferred from raw field copy to electronic copy in the local office then the raw copy of the data is transferred to Dar. The soft and hardcopy of the data is stored in the company office in Dar es Salaam in a designated filing cabinet. Jakob Sandven, the Inventory and Monitoring Manager, is responsible for the implementation of this process.

2.1.3 Data Protection

The IT manager (Peter Mapesa) at the Dar es Salaam office is responsible for backup and maintenance of the server. Back up is carried out once a week. This is where the electronic copies of the inventory data will be held. The safekeeping of the hardcopy of the data is the responsibility of the Inventory and Monitoring Manager (Jakob Sandven).

2.1.4 Data Transfer

The data which has been collected in the field must be entered into excel the same day as the data is collected or as soon as possible afterwards. This is to avoid unnecessary data entry error. The data should be entered by a single person and not as a group so as to avoid unnecessary errors. When entering the data use database entry form see Annex 02 of the Inventory Guidelines (annex 6). The hard

copy must be stored at the Inventory and Monitoring department at Dar es Salaam. In addition one of the senior staff must check that data entry so as to check if there is big difference between this year's measurement and last year's measurement. (see section 4.2 of the Green Resources Inventory Guidelines)

2.1.5 PSP - database

After data is entered and stored in excel, the excel should include the data from the previous years so as to make database, see Annex 02 which shows fields to be included in the excel. The data will be stored as the backup database to the server computer. It is important that the data is entered according to the database for ease and consistency of analysis.

2.1.6 PSP- overview

After measurement of the PSP is done and the data has been entered into the excel sheet, the overview of each PSP will be written so as to describe each PSP based on the information as Annex 1 is concerned. This will be easier to make a follow up of the data by knowing where, when and who measured those PSP's.

2.1.7 Data Processing

All data processing is carried out using Excel 2007.

2.2 Data Management Procedures for GPS data

2.2.1 Data archiving

Once data collected from the field has been transferred from the GPS unit to the computer the data will be stored in GIS. A copy of the data will be stored in the Dar office. A hardcopy of the point file table containing the GPS points will be printed out, and stored in the Dar office. Peter Mygeta, GIS and Mapping Manager, GRAS is responsible for implementation of this process.

2.2.2 Data protection

As above for inventory data from sampling plots, except that Peter Mygeta, GIS and Mapping Manager, GRAS will be responsible for the safekeeping of the data.

2.2.3 Data transfer

For the transfer of data from the GPS to the computer appropriate software is to be used. For Garmin GPS units 'mapsources' is used. The raw data file will be stored with an appropriate file name, which includes the project name, the feature mapped and the date. (e.g.Uchindile_roads_090304). The file will be stored in DXF format for transfer into ArcGIS. (Save as - *.DXF)

2.3 Data processing

All the data processing is done using ArcGIS.

2.4 Description of Data Management Procedures for GIS data

2.4.1 Data archiving

Once a data layer is finished, a copy of the data will be stored on the server. Old versions will also be kept on the server as a means to track map history and evolution.

2.4.2 Data protection

As above for inventory data from sampling plots, except that Peter Myegeta the Mapping Manager will be responsible for the safekeeping of the data.

2.4.3 Data processing

All the data processing is done using ArcGIS.

2.5 Raw Data Archiving and Protection Measures

Green Resources have developed a system to protect data from unnecessary errors and losses. Wherever possible the system has been designed to reduce risk from 'human' data entry error. The following means are being implemented to this end:

Area and PSP data is copied directly from the PSP and GIS databases. An accuracy check for the PSP data is always carried out by a senior member of staff. Excel spreadsheets used for data entry have protection placed on what data can be entered; ensuring data beyond a logical range cannot be entered.

GIS data is regularly checked for errors, by overlaying it on satellite imagery to ensure landscape features appear in a logical location spatially.

2.5.1 Data transfer

To minimize risk of data loss it is backed up through email, hard copy and storing of soft copies not only on individual PCs but also on the server. Old copies of data are also kept, with newer versions being saved with the date on.

2.6 Data processing – Protocol Algorithms and Results

2.6.1 Field Measurements

Ex-post sampling of trees took place following the sampling techniques described in the monitoring plan in the PDD, and the Green Resources Inventory and Monitoring Guidelines (see Annex 6). Only trees older than 2-3 years (depending on observed tree growth and site conditions) and hence planted prior to 2006-2005 were measured. Circular shaped permanent sampling plots (PSPs) were used in all strata. The plots were 400 m^2, with a radius of 11.28 meter (400m^2), where all trees with DBH greater than 2 cm were measured. The sampling plots were located systematically with a random start point for each strata. A standard Microsoft excel calculation tool is employed that uses formulae derived from the project methodology in order to transfer the monitored data into final results that calculate the volume of GHG emissions reductions, and ultimately voluntary carbon units (tons)

2.6.2 Ex-post actual net GHG removals by sinks

To calculate tree volume (and ultimately carbon sequestration) in 2002 site index (derived from actual measurements taken in 2008) has been applied to the Malimbwi model, and from this volume at the age of the stand in 2002 is computed. Tree volume is estimated using yield tables from a model developed in neighbouring government plantations. [1, 2] Two different models have been applied. For the older stands where both DBH and Dominant Height can be measured the volume model is used. For the PSP's where DBH is not measurable because the trees are too small then stocking is used in combination with volume tables to calculate volume.

For Pine (p. patula): Two volume equations are used a) for stands younger than six years and b) for stands older than six years. In addition site index (SI) and basal area (BA1 & BA2) calculation were used for estimation of the standing volume in 2002. All the formulas used are from the Malmbwi model. (see annex 1 for the complete code used for the simulations.) These simulations where run in excel.

For pine stands younger than five years the following equation was use:

Volume in m3/ha = Exp (-0.0476 + 1.00679 * ln(BA1) - (1.4379 / Age) + 0.88471 * Ln (Hdom))

For pine stands older than five years the following equation was used:

Volume m3/ha= Exp (0.06192 + 0.73434 * Ln(hdom)+1.0786 * Ln(ba1)

Where:

Hdom (Dominant height) in meter= 1.32 * SI * (1-Exp (-0.13 * Age) 1.83)

SI (site index)

*BA1 (Initial Basal Area) in m2/ha= Exp (-0.3618 + 0.14365 * Hdom+0.00119 * N)*

*BA2 (Basal Area Growth) in m2/ha= Exp (-0.02 + 3.94 * (1-A1/A2) + 0.02844 * (1-A1/A2) * SI + (A1/A2)*

A1: Year 1 and A2: Year 2

Ln is natural logarithm

For eucalyptus (e. saligna:) One volume equation is used to calculate stand volume. In addition site index and basal area growth is used to estimate standing volume in the 2002 stands:

For eucalyptus stands the following volume equation was used:

Volume (m3/ha) = Exp (1.83184 + 0.21614 * Ln(Hdom)+0.96278 * Ln(BA))

Where:

Hdom =Dominating height from the 100 tallest trees pr. Hectare

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[1] Malimbwi, R. E., Mugasha, A. G. & Zahabu, E. (1998). Yield tables for *Pinus patula* at Sao Hill Forest Plantations, Southern Tanzania.

[2] Malimbwi, R. E., Mugasha, A. G. & Zahabu, E. (draft). Yield tables for *Eucalyptus saligna* at Sao Hill Forest Plantations, Southern Tanzania.

Hdom (Dominant height) =Exp (Ln(site index)+0.57824-6.0443/Age+2.61854(1/Age^2))Ba*

*BA (basal area) = 0.3327 * hdom ^ 1.5088 * Age ^ -0.35063*

For the calculation of volume in 2008 basal area is calculated for each plot and then extrapolated to basal area per hectare. Dominant height is used for these estimates. For the calculation of volume in 2002 and incremental growth there after (in line with the VCS restriction on carbon crediting starting from 2002) the Malimbwi model is used. For this site index is calculated for each plot, and combined with age related basal area to calculate the standing volume in 2002.

The estimates of the actual net ex-post GHG removals by sinks in the project activity are based on the carbon stock change in aboveground and belowground biomass using equations described in the monitoring section of the approved methodology. The changes in carbon stocks in the living biomass pool are estimated based on the changes in carbon stocks of the living biomass of trees (gain and losses) minus any increase in emissions of GHG within the project activity boundary. Only carbon stock changes in the pine and eucalyptus species are accounted for as sinks in the calculation of ex-post actual net GHG removals; carbon stock changes in pools of soil organic matter, dead wood and litter are not counted as part of the net GHG removals by sinks.

The methodology does not require the monitoring of the baseline scenario during the crediting period.

2.6.3 Changes in carbon stocks:

Verifiable changes in carbon stocks of living biomass of trees (above ground and below ground) are estimated using Equations M.3-M.5 and M.15- M.19. (for above ground- and below ground biomass respectively) of the methodology AR-AM0005 version 03.. Biomass loss from site preparation is deducted, applying equations M.19 to M.22, and M.26. In the absence of specific national and regional parameters at the current time for the biomass expansion factors (BEF), Wood density (D), Carbon fraction (CF) and Root to shoot ratio, we are applying default values from the GPG LULUCF 2003 (Table 3A.1.10) and from other relevant regional and peer reviewed literature. The BEFs given in Table 3A.1. of the GPG LULUCF 2003 represent averages for average growing stock or age. The project participants uses the following BEF in the carbon model; pine = 1.3, eucalyptus = 2.0.[3] The variables to be used in equations M.15 and M.16 are shown in the Table 2-1 below:

Table 2-1. Parameters used to calculate carbon stocks

Biomass Expansion Factor (BEF)	Wood density (D)	Carbon Fraction (CF)	Root to shoot ratio (R)

[3] Taken from Table 3A.1.10 of the GPG LULUCF 2003. Value taken for Tropical Pine

P.patula	*E.saligna*	*P.patula*	*E.saligna*	0.50	*P.patula*	*E.saligna*
1.3	2.0[4]	0.45	0.8[5]		0.32[6]	0.35[7]

The parameters as listed in Table 2-1above fall within the range provided by the GPG LULUCF 2003 (Table 3A.1.10).

Table 2-2 Worked Calculation of Above and Below Ground Carbon Dioxide storage applying equation M.15 and M.16

	Above ground					**Below ground**		**Total**
Strata	volume (m3)	Biomass Expansion Factor (BEF)	Carbon Factor (CF)	Wood Density (D)	$C0_2e$= BEF *CF *D * 44/12	Root to shoot ratio (r)	Co_2e= r*above ground CO_2e	Above + Below carbon (CO_2/ha)
Pine 1997-1999	152.8	1.3	0.5	0.45	163.88	0.32	52.44	216.32
Pine 2000-2002	78.0	1.3	0.5	0.45	83.67	0.32	26.77	110.44
Pine 2003-2005	11.1	1.3	0.5	0.45	11.92	0.32	3.81	15.73
Pine 2006-2008	NA	1.3	0.5	0.45	0.00	0.32	0.00	0.00
Eucalyptus 1997-1999	106.3	2.0	0.5	0.8	311.73	0.35	109.11	420.84
Eucalyptus 2000-2002	62.1	2.0	0.5	0.8	182.30	0.35	63.81	246.11
Eucalyptus 2003-2005	2.1	2.0	0.5	0.8	6.08	0.35	2.13	8.21
Eucalyptus 2006-2008	0.0	2.0	0.5	0.8	0.00	0.35	0.00	0.00
Eucalyptus Thinned	27.1	2.0	0.5	0.8	79.44	0.35	27.80	107.25

The project applies equation M.19 and M.21-M.22 to account for biomass loss from site preparation. In the case of the Uchindile and Mapanda site preparation has taken the form of slashing of vegetation manually around the planting pit as described in the PDD. No biomass burning has taken place. In the case of this project a biomass loss from site preparation is deemed insignificant, in accordance with new guidance criteria laid out in annex 21 at the EB 50th meeting.

Green Resources is applying a deviation from the PDD in relation to the decision at the fiftieth meeting of the EB in which accounting of GHG emissions from 'Removal of Existing Vegetation due to Site

[4] Teobaldelli et al, 2009, Generalized functions of biomass expansion factors for confers and broadleaved by stand age, growing stock and site index, Forest Ecology and Management VOl 257 pp1004-1013

[5] Taken from the book 'The Commercial Timbers of Tanzania' by J.M.Bryce revised edition of 1999.

[6] Taken from Table 3A.1.8 10 of the GPG LULUCF 2003. Mean value taken from the Conifer Forest/Plantation category with aboveground biomass (t/ha) of 50-150.

[7] Taken from Table 3A.1.8 10 of the GPG LULUCF 2003. Mean value for Eucalypt Plantation taken for biomass of 50-150 t/ha.

Preparation' can be determined insignificant if certain criteria are complied with. We believe our project to fall into the situation whereby GHG emissions are deemed insignificant, and hence are no longer including them in calculations.

In the case of the Uchindile/Mapanda Forest Projects criteria 2a and 3b of annex 21 of EB 50 is applicable:

It can be demonstrated (e.g. as a part of developing the baseline scenario) that fire due to natural or anthropogenic causes is a common occurrence in the proposed A/R CDM project area and also that such fire has occurred at least once in the last 10 year.

Natural or anthropogenic causes have resulted in the majority of woody species being killed and/or cleared at least once within the proposed project boundary within the 10 years prior to project commencement.

There are accounts from villagers and evidence from site visits which provide evidence on the prevalence of fires in the 10 years prior to project start at Uchindile and Mapanda Forest Projects.

The project applies M.31 for its final calculation of tons of CO2 equivalent sequestered by the project. It is through this equation that net anthropogenic greenhouse gas removals by sinks are calculated. Actual new greenhouse gas removals represent the sum of the changes in the carbon stocks in the carbon pools considered under this methodology minus the sum of all GHG emissions by sources increased due to the implementation of the project activity. Baseline removals and leakage are subtracted from the total carbon sequestered through the tree growth (actual new anthropogenic greenhouse gas removals) to compute the net anthropogenic greenhouse gas removals by sinks. In the case of this project both leakage and baseline removals are zero. To calculate the final number of Voluntary Carbon Units (VCU's) generated by the project the risk buffer percentage is subtracted from the net anthropogenic greenhouse gas removals. The risk buffer is decided at verification by the Designated Operating Entities (DOE's) from the double review process of the risk buffer.

Equation M.31:

$$C_{AR-CDM,t} = \Delta C_{ACTUAL,t} - \Delta C_{BSL,t} - LK_t$$

where:

$C_{AR_CDNM,t}$ Net anthropogenic greenhouse gas removals by sinks; tonnes CO_2-e yr^{-1} for year *t*

$\Delta C_{ACTUAL,t}$ Actual new greenhouse gas removal by sinks; tonnes CO_2-e yr^{-1} for year *t*

$\Delta C_{BSL,t}$ Baseline net greenhouse gas removals by sinks; tonnes CO_2-e yr^{-1} for year *t*

LKt Leakage; tonnes CO_2-e yr^{-1} for year *t*

The project is carrying out its first verification, and has no leakage. For the purposes of calculating carbon for the issuance of tons a further calculation is required. The VCS regulations stipulate that only carbon

sequestered from 2002 onwards is eligible for crediting under the VCS. As this project started reforestation in 1997, this means that carbon sequestered prior to 2002 must be deducted from total actual net anthropogenic greenhouse gas removal by sinks.

Table 2-3: Ex post volume estimates per strata

	Strata	Original Mean Volume 2008 (m3/ha)	Mean Volume 2002 (m3/ha)	Standard Error (%)	One Standard Error at the 95% CI	Mean Adjusted Volume (m3/ha)**
Pinus Patula	97-99	222	34.1	8.10%	35.4	152.8
	00-02	109	1.8	18.60%	29.0	78
	03-May	18	0.0	32.70%	7.1	11.1
	06-Aug	0	0.0	0.00%	0.0	NA
Eucalyptus spp	97-99	223.2	76.7	9.20%	40.2	106.3
	00-02	90	0.0	23.00%	28.0	62.1
	03-May	8	0.0	152.00%	6.2	2.1
	06-Aug	0	0.0	0.00%	0.0	0
	Thinned	263	175.3	15.40%	61.0	27.1

****Calculated by a) Subtracting mean volume in 2002 from mean volume in 2008 a) Subtracting one standard error at the 95% confidence interval from the adjusted volume**

Table 2-4 Ex-post volume and carbon estimates per strata

Strata	Adjusted Mean Timber Volume (m3/ha)	Above Ground Carbon (CO2/ha)	Below Ground Carbon (CO2/ha)	Total Carbon (CO2/ha)
Pine 1997-1999	152.8	163.9	52.4	216.3
Pine 2000-2002	78.0	83.7	26.8	110.4
Pine 2003-2005	11.1	11.9	3.8	15.7
Pine 2006-2008	NA	0.0	0.0	0.0
Eucalyptus 1997-1999	106.3	311.7	109.1	420.8
Eucalyptus 2000-2002	62.1	182.3	63.8	246.1
Eucalyptus 2003-2005	2.1	6.1	2.1	8.2
Eucalyptus 2006-2008	0.0	0.0	0.0	0.0
Eucalyptus Thinned	27.1	79.4	27.8	107.2

Table 2-5 Ex post net anthropogenic GHG removals by sinks per strata

Strata	Area of Strata (ha)	CO2/ha (t CO2e)	Total Carbon Stock in the Strata tCOe
Pine 1997-1999	273.8	216.3	59228
Pine 2000-2002	99.6	110.4	11004
Pine 2003-2005	398.1	15.7	6263
Pine 2006-2008	1657.7	0.0	0
Eucalyptus 1997-1999	290.8	420.8	122394
Eucalyptus 2000-2002	209.6	246.1	51579
Eucalyptus 2003-2005	474.6	8.2	3897
Eucalyptus 2006-2008	663.6	0.0	0
Eucalyptus Thinned	21.3	107.2	2284
Total	**4,089.2**		**256,650**

Table 2-6 Ex post net anthropogenic GHG removals by sinks, deducting non-CO2 emissions from fires that occurred 1997-2008.

Strata	Estimation of cumulative total net GHG removals by sinks (tCO2 e)	Non-co2 emission fires (tCO2 e)	Cumulative net anthropogenic GHG removals by sinks accounting for other project emissions (tCO2 e)
Pine 1997-1999	59228.1	2397.9	56830.2
Pine 2000-2002	11004.0	1937.7	9066.3
Pine 2003-2005	6263.2	796.3	5467.0
Pine 2006-2008	0.0	0.0	0.0
Eucalyptus 1997-1999	122394.3	5757.1	116637.2
Eucalyptus 2000-2002	51578.6	2609.7	48968.9
Eucalyptus 2003-2005	3897.1	6895.4	-2998.4
Eucalyptus 2006-2008	0.0	2.7	-2.7
Thinned Eucalyptus	2284.3	0.0	2284.3
Indigenous Planted Areas	0.0	3988.4	-3988.4
Total			232,264.5

The total number of tons of CO2 equivalent sequestered by the project during the Jan 1st 2002 to November 30th 2008 monitoring time period is 232,265 tCO2.

Table 2-7: Data and variables used to monitor the actual net GHG removals by sinks

ID number	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[8]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
2.1.1.01	Stratum ID	Alpha numeric	c	Before the planting starts	100%	Each compartment has been given a different alpha numeric ID. Compartments are grouped together to form stratum, which are given an alpha numeric name. See Annex 1, Figure 3-3, Figure 3-4.
2.1.1.02	Sub-stratum ID	Alpha numeric	c	Before the planting starts	100%	Sub-stratum are divided up into 'compartments'. Each has a separate alpha numeric ID. See Figure 3-3 and Figure 3-4
2.1.1.03	Confidence level	numeric	c	Before the planting starts	100%	The number of PSPs has been calculated to ensure 95% for the purpose of QA/QC and measuring and monitoring precision control. More PSPs will be put in to ensure this is met in future verifications.
2.1.1.04	Accuracy	numeric	c	Before the planting	100%	The number of PSPs has been

				starts		calculated to ensure 5% accuracy for the purpose of QA/QC and measuring and monitoring precision control. The number of PSPs needed will be recalculated to ensure there are enough in place to meet desired level of accuracy during future verifications. See Excel sheet in annex 1
2.1.1.05	Standard deviation of each stratum	numeric	E	Before the planting starts	100%	The standard deviation of each stratum was estimated before the PSPs were laid out, and re-calculated per stratum following verification. See Excel sheet in annex 1
2.1.1.06	Number of sample plots	numeric	E	Before the planting starts	100%	The number of sampling plots was calculated using equation M. 1 from the AM AR 5. See Excel sheet in annex 1
2.1.1.07	Sample plot ID	Alpha numeric	Named	5 years	100%	Numeric series ID has been assigned to each
2.1.1.08	Plot location	Alpha numeric	M	5 years	100%	Plots were located in the office before field verification and measurement took place.
2.1.1.09	Tree species	n/a	Named	5 years	100%	All trees planted are

						pine and eucalyptus. A list of all species is found in Table 1-1
2.1.1.10	Age of plantation	Year	C	5 years	100% sampling plot	Counted since the planted year
2.1.1.11	Number of trees	Number	C	5 years	100% trees in plots	Counted in PSP measurements. All tree measurement are listed in Annex 1 or Annex 10 for measurements taken pre-2008
2.1.1.12	Diameter at breast height (DBH)	Cm	M	5 years	100% trees in plots	DBH of all trees in PSPs is measured at verification. (see Annex 1) For measurements pre-2008 see annex 10
2.1.1.13	Mean DBH	Cm	C	5 years	100% of sampling plots	Calculated in the PSP data sheet (see Annex 1) For measurements pre-2008 see Annex 10
2.1.1.14	Tree height	m	M	5 years	100% trees in plots	Height of the 4 tallest trees is measured in each PSP (see Annex 1) For measurements pre-2008 see Annex 10
2.1.1.15	Mean tree height	m	C	5 years	100% of sampling plots	Calculated in the PSP data sheet (see Annex 1) , and data available in annex 10 for pre-2008 measurements
2.1.1.16	Merchantable (Standing) volume	M^3ha^{-1}	C	5 years	100% of sampling plots	This is calculated per stratum. See Annex 1 and see table Table 2-3

						. For volume pre-2008 see Annex 10
2.1.1.17	Wood density	td.m.m^{-3}	C	5 years	100% of sampling plots	Default and applicable values from the literature have been applied. See table Table 2-1 and Annex 1.
2.1.1.18	Biomass expansion factor (BEF)	Dimensionless	C	5 year	100% of sampling plots	Default and applicable values from the literature have been applied. See Table 2-1.
2.1.1.19	Carbon fraction	tC.(t d.m)$^{-1}$	E	5 year	100% of sampling plots	A carbon fraction of 0.5 has been applied.
2.1.1.20	Root-shoot ratio	Dimensionless	E	5 year	100% of sampling plots	Default and applicable values from the literature have been applied. See Table 2-1, and Annex 1.
2.1.1.21	Carbon stock in above-ground biomass of plots	tCha^{-1}	C	5 year	100% of sampling plots	Calculated using equations M.3, M.4. See Annex 1. For pre-2008 data see Annex 10
2.1.1.22	Carbon stock in below-ground biomass of plots	tCha^{-1}	C	5 year	100% of sampling plots	Calculated using equations M.3 and M.5. See Annex 1
2.1.1.25	Mean Carbon stock in aboveground biomass per unit area per compartment per species	tCha^{-1}	C	5 years	100% of Compartment	Calculated using equations M.3, M.4. See Annex 1 For pre-2008 data see Annex 10
2.1.1.26	Mean Carbon stock in belowground biomass per unit area per compartment	tCha^{-1}	C	5 year	100% of Compartment	Calculated using equations M.3 and M.5. See Annex 1 For pre-2008 data see Annex

	per species					10
2.1.1.27	Area of compartment	ha	M	5 years	100% of Compartment	The areas of each compartment are found in annex 1.
2.1.1.28	Carbon stock in aboveground biomass of compartment per species	tC	C	5 years	100% of Compartment	See Annex 1. For pre-2008 data see Annex 10
2.1.1.29	Carbon stock in belowground biomass of compartment per species	tC	C	5 years	100% of Compartment	See Annex 1.
2.1.1.30	Carbon stock change in aboveground biomass of compartment per species	$tCyr^{-1}$	$tCyr^{-1}$	5 years	100% of Compartment	See Annex 1. For pre-2008 data see Annex 10
2.1.1.31	Carbon stock change in belowground biomass of compartment per species	$t\ C\ yr^{-1}$	$t\ C\ yr^{-1}$	5 years	100% of Compartment	See Annex 1. For pre-2008 data see Annex 10
2.1.1.32	Total carbon stock change	$tCO_2\text{-}eyr^{-1}$	$tCO_2\text{-}eyr^{-1}$	5 years	100% project area	See Annex 1.

A deviation is requested in relation to measurement of height within PSPs, namely parameter 2.1.1.14 above. Whilst all DBHs of trees within the PSP are measured, only the 4 tallest trees are measured in the PSP. Hence it is requested that this deviation from the monitoring plan be accepted for this and future verifications.

3 Monitoring Plan Implementation

3.1 List of Parameters to be monitored

A number of different parameters are recorded and monitored by the company to ensure that the project follows the VCS methodology in the validated PDD and that the inputs to the carbon calculations are both accurate and up-to-date.

3.1.1 Project Boundary

In order to monitor the external and internal boundaries of their projects Green Resources uses a combination of both ground-truthing and remote sensing. GPSs were used to verify planted areas in existing compartments on the ground and in UFP and MFP. This was done by physically walking round the boundaries and taking reference points using handheld GPS equipment. Special attention was paid to monitoring of the compartment borders close to the valley bottoms. Supplementary information which was recorded during the ground truthing, in addition to the GPS points were compartment particulars including checking species, planting density and any other important features. All the data collected during the fieldwork was then transferred to GIS software. Shapefiles of the planted area were made and compared with the original estimates of the plantable area.

On the ground verification of plantable area was supplemented with boundary delineation using satellite images for the older stands. Stands 3-4 years and older were visible, and so could be delineated. For this, Google Earth Professional was used by importing shapefiles of the original boundaries from ArcGIS and making adjustments as observed necessary. Planted area was further verified in this way. The satellite images used for the UFP were from Digital Globe and captured in December 2005. For the Mapanda Forest Project high resolution satellite images from KOMPSAT2 was acquired, and data processing and visual interpretation was done using ArcGIS.

- **Project Boundary UFP**: This area of land is confined within a titled parcel of 12,121ha of land, located on the lower elevation of Mufindi Escarpment, between latitudes 8°39′ 34″ S to 8°44′ 55″ S and longitudes 35°23′ 28″ E to 35°32′ 59″ E , in an altitude of between 1100m and 1437m above sea level. The external boundaries are mainly rivers with Kihata to the West, Luiga to the North, Mgelela to the South. The area is grassland with the landscape dominated by undulating ridges with steep slopes. The topography is generally covered with steep valleys with gradient as high as 7- 10% in some locations.

- **Project Boundary MFP**: The MFP project activity is confined within a titled parcel of 6,258 ha of land, located on the lower elevation of Mufindi Escarpment, within latitudes 8°24′30″S to 8°33′19″S and longitudes. The altitude varies from 1400m to 1753m above sea level. The external boundaries are rivers and the government owned Sao Hill Forest plantation to the West, to the North and the East is village land and to the south is convergence of Mkungwe and Mwenga rivers. The area is grassland.

3.1.2 Project Name and Company Background

Escarpment Forest Company Ltd (EFC) started in March 1996, with the objective of having mobile sawmills and also plantations; there were two plantations one in Mapanda Village which was called Mufindi Forest Project and another one in Uchindile Village which was called Kilombero Forests Project.

Both projects were owned by EFC. On 18th Dec 1998 two new companies were formed for the purpose of running the forests plantations, so that EFC could soley concentrate on the sawmilling. The first company was Kilombero Forests Ltd which was running KFP and the second company was Mafinga Forests Ltd which was running MFP. In 2001 these two companies were merged (amalgamated) together into GRL whereby GRL took over the two projects till today. At this point Kilombero Forest Project was renamed Uchindile Forest Project, and Mufindi Forest Project was renamed Mapanda Forest Projects respectively. Escarpment Forest Company changed its name to Sao Hill Industries, and now handles the industry side of the operations of the Green Resources AS group. Sao Hill Industries is not involved in management of the plantations, that is the sole responsibility of Green Resources Ltd Tanzania.

Table 3-1 The unique identification of the polygons for the UFP

BLOCK ID	Grid Coordinates (UTM)	
	Eastings	Northings
UFPBLOCK I	764576	9037500
UFPBLOCK II	767026	9034664
UFPBLOCK III	768652	9037758
UFPBLOCK IV	770328	9033967
UFPBLOCK V	773372	9034740
UFPBLOCK VI	777653	9034612
UFPBLOCK VII	778710	9037087
UFPBLOCK VIII	772778	9037758
UFPBLOCK IX	770663	9040931

Table 3-2 The unique identification of the polygons for the MFP

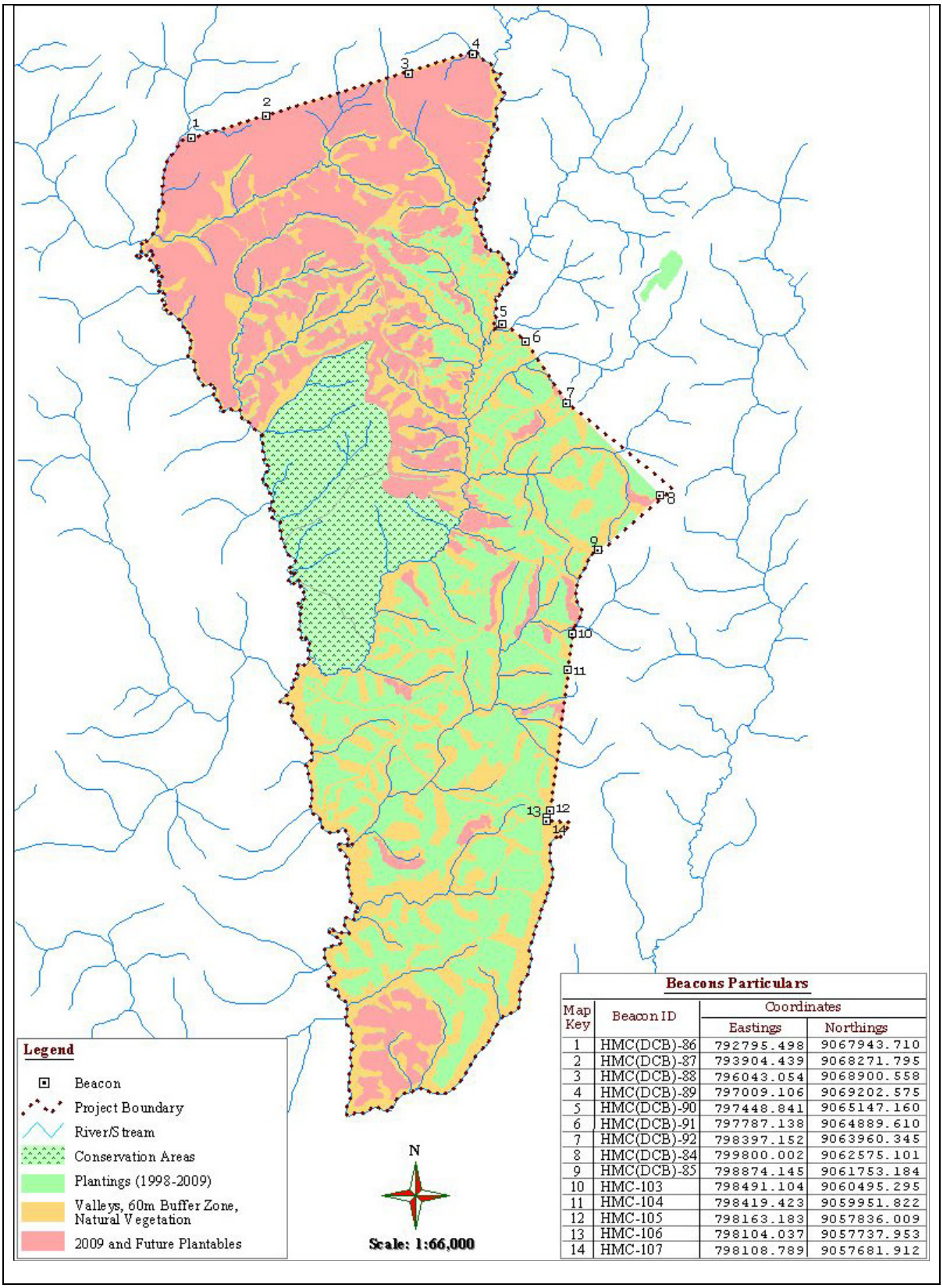
BLOCK ID	Grid Coordinates (UTM), 36S	
	Eastings	Northings
MFPBLOCK I	797103	9065791
MFPBLOCK II	798177	9062737
MFPBLOCK III	797019	9060526
MFPBLOCK IV	796450	9058019
MFPBLOCK V	795102	9065075
MFPBLOCK VI	793691	9066149

MFPBLOCK V II	795692	9068044

Table 3-3 Data and Variables used to monitor project boundary

ID number	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Number of data points	Comment
E.1.1.01.	Project ID	Alpha numeric		Before the start of the project	100%	The Projects are now named Mapanda Forest Project and Uchindile Forest Project. Previously Uchindile Forest Project was called Kilombero Forests Limited. Kilombero Forests Limited was taken over by Green Resources Limited, and re-named Uchindile Forest Project in 2001.
E.1.1.02.	Project location	Alpha numeric	M	Before the start of the project	100%	The project boundaries have been mapped, and grid co-ordinates for the outer boundaries are provided in Table 3-1 and Table 3-2
E.1.1.03.	Compartment ID	Alpha numeric		5 years	100%	Each compartment has a unique identification number. See Figure 3-3 and Figure 3-4.
E.1.1.04.	Beacon ID	Alpha numeric		5 years	100%	Each beacon has a unique national number and name. See Figure 3-1, Figure 3-2.
E.1.1.05.	Bearing	Degrees	M	5 years	100%	The angular magnitude between one beacon to the other. See Figure 3-1, Figure 3-2.
E.1.1.06.	Distance	Metres	M	5 years	100%	The vectoral magnitude between one beacon point to the other along the project boundary See Figure 3-1, Figure 3-2.
E.1.1.07.	Natural ID	Alpha		5 years	100%	Natural boundaries are named in section 3.1.1.

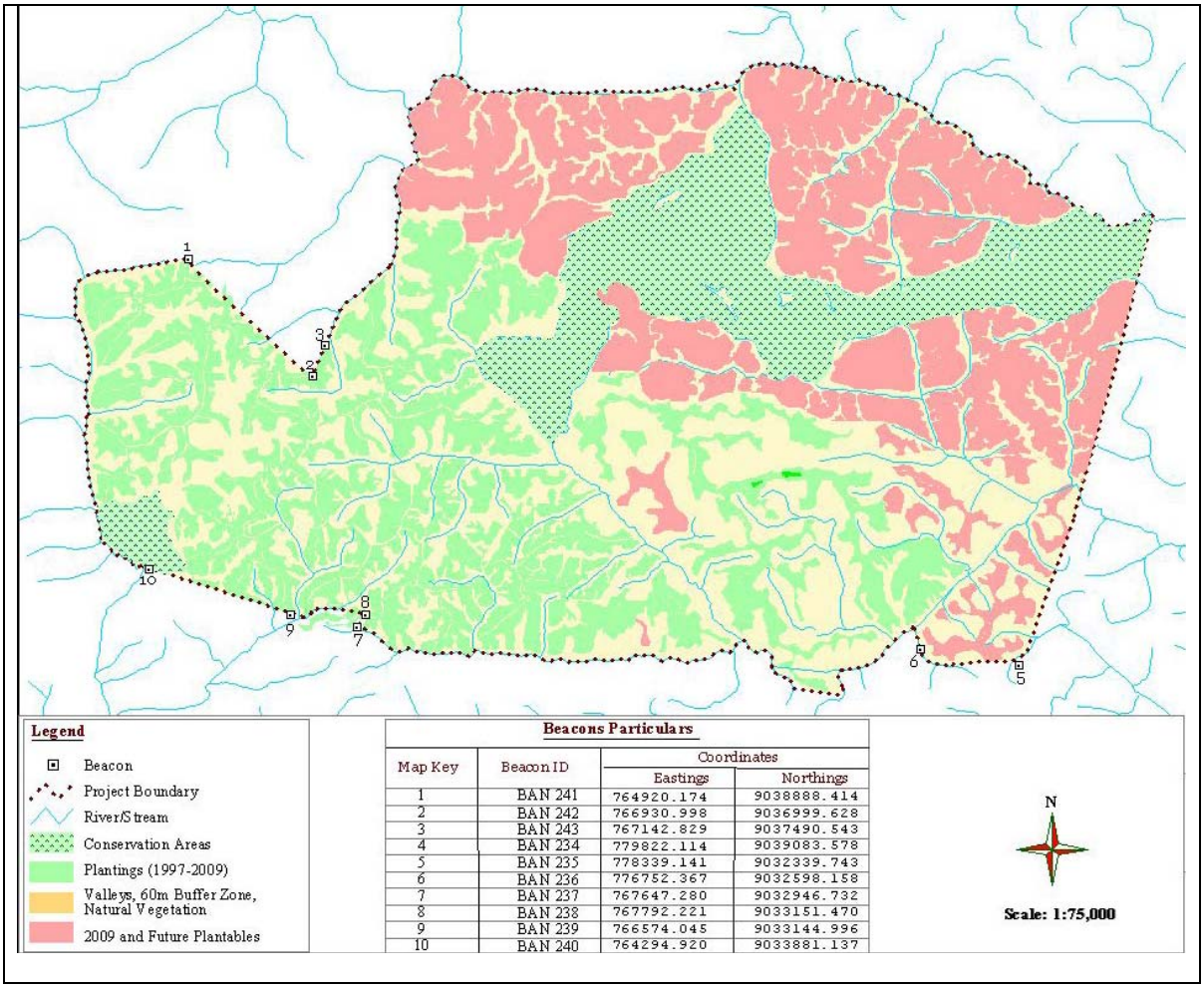
Figure 3-1 Map to show beacons and boundaries at Mapanda Forest Project



Beacons Particulars

Map Key	Beacon ID	Coordinates	
		Eastings	Northings
1	HMC(DCB)-86	792795.498	9067943.710
2	HMC(DCB)-87	793904.439	9068271.795
3	HMC(DCB)-88	796043.054	9068900.558
4	HMC(DCB)-89	797009.106	9069202.575
5	HMC(DCB)-90	797448.841	9065147.160
6	HMC(DCB)-91	797787.138	9064889.610
7	HMC(DCB)-92	798397.152	9063960.345
8	HMC(DCB)-84	799800.002	9062575.101
9	HMC(DCB)-85	798874.145	9061753.184
10	HMC-103	798491.104	9060495.295
11	HMC-104	798419.423	9059951.822
12	HMC-105	798163.183	9057836.009
13	HMC-106	798104.037	9057737.953
14	HMC-107	798108.789	9057681.912

Figure 3-2 Map to show beacons and boundaries at UFP



Beacons Particulars

Map Key	Beacon ID	Coordinates	
		Eastings	Northings
1	BAN 241	764920.174	9038888.414
2	BAN 242	766930.998	9036999.628
3	BAN 243	767142.829	9037490.543
4	BAN 234	779822.114	9039083.578
5	BAN 235	778339.141	9032339.743
6	BAN 236	776752.367	9032598.158
7	BAN 237	767647.280	9032946.732
8	BAN 238	767792.221	9033151.470
9	BAN 239	766574.045	9033144.996
10	BAN 240	764294.920	9033881.137

3.2 Forest Establishment

Green Resources uses a comprehensive set of parameters to monitor the establishment of its forests, in order to record and ensure the various standards of implementation in the methodology are adhered to in accordance with section A.4.4 of the PDD. Forest Establishment follows the specifications set out in the Plantation Management Plan. The monitoring, and subsequent documentation of forest establishment activities starts with a compartment folder (see annex 2) that details the compartment identification number, its size, central point and year of establishment being created and stored at the plantation office. The plantation manager is responsible for ensuring that these are completed to ensure proper monitoring and documenting of activities.

Figure 3-3 Compartment Map Mapanda Forest Project

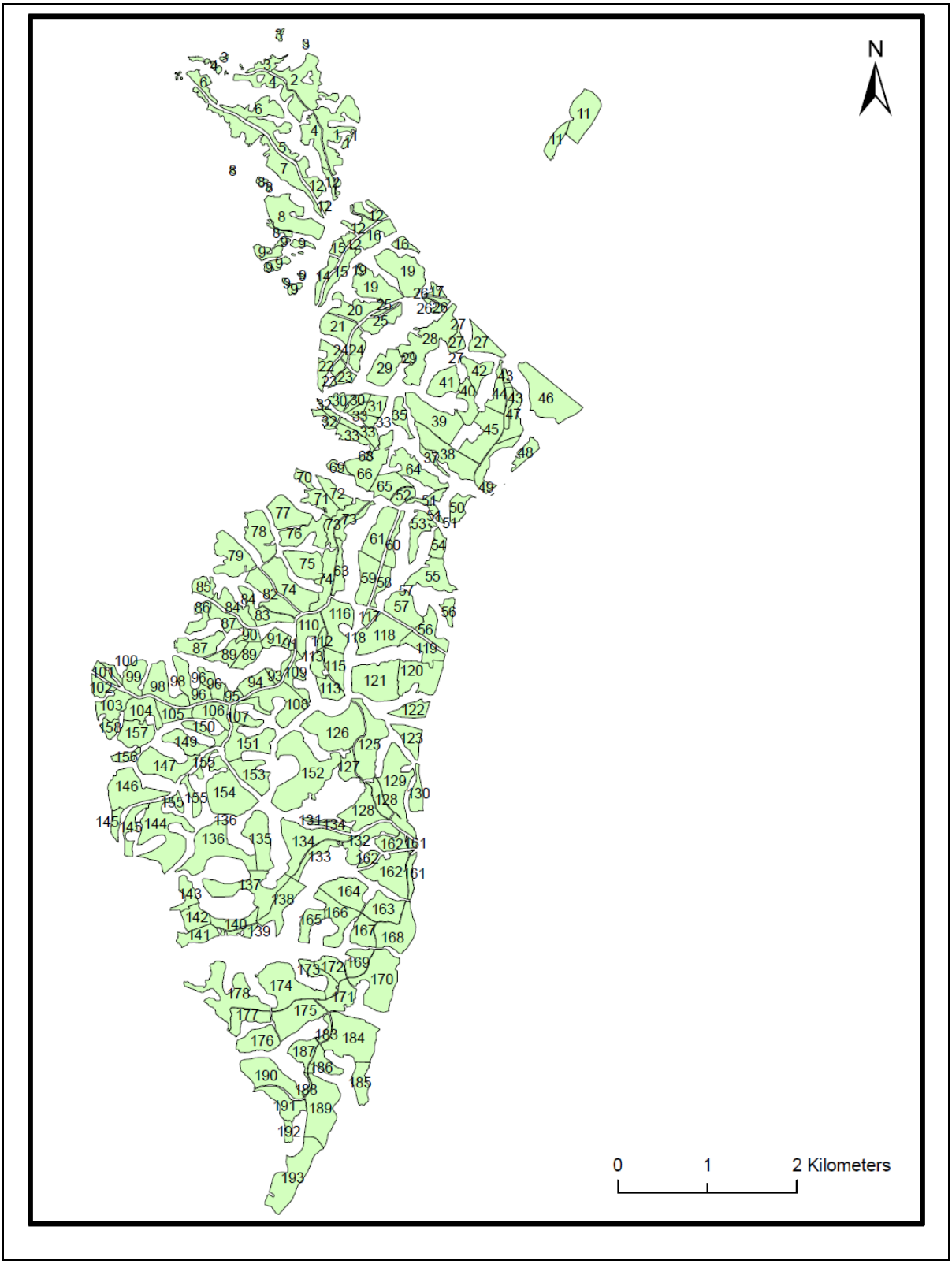
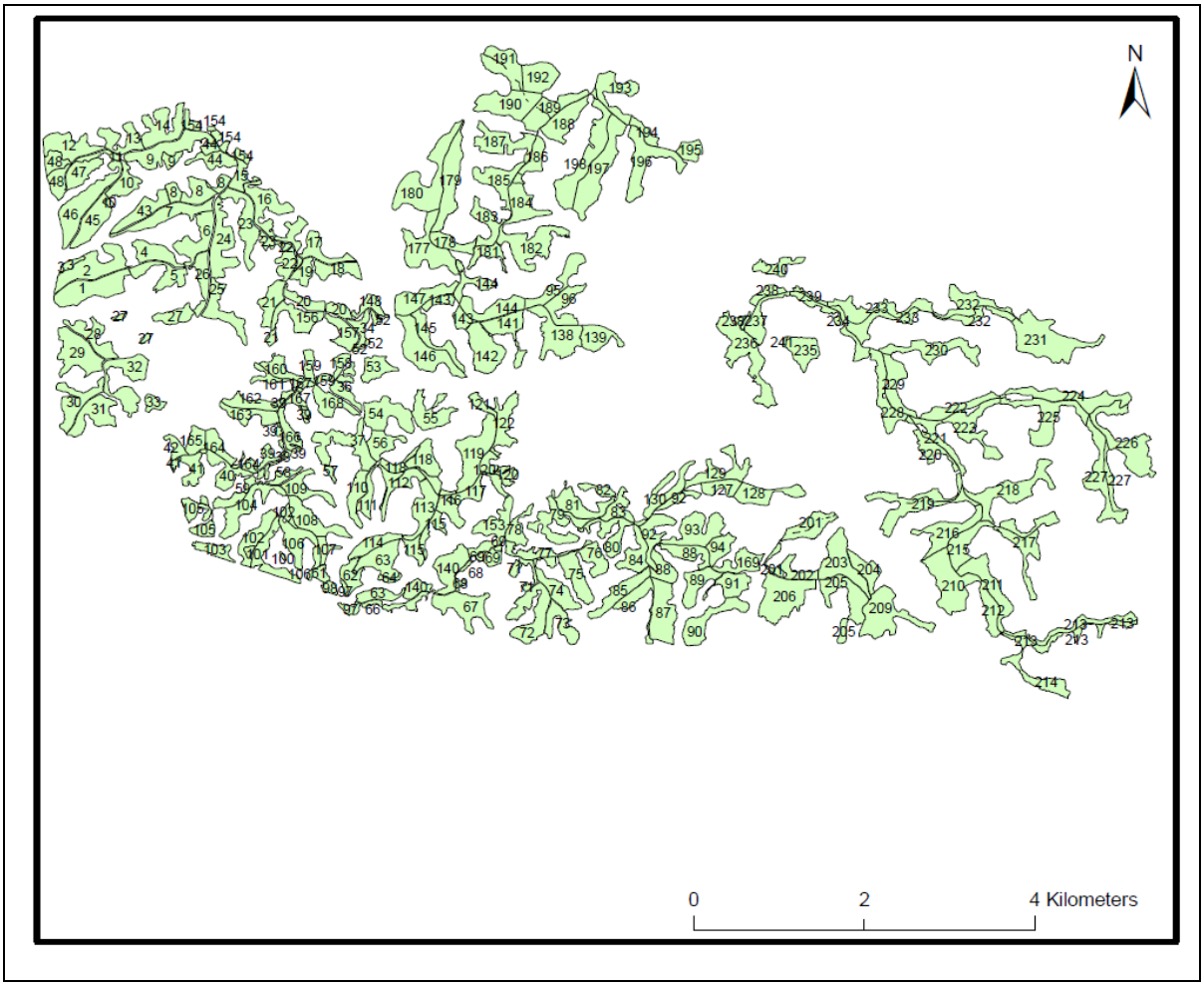


Figure 3-4 Compartment Map UFP



Within the compartment folders the following data is recorded:

- Information on the number of species planted, area of stratum, and planting layout as per the management plan (i.e .Parameter E.1.2.11 area planted per stratum)
- Confirmation that site preparation was carried out based on practices documented in section A.4.4, for instance no slash and burn and overall tillage was used in the site and soil preparation
- Confirmation that the size and strength of the planted seedlings conformed to the silvicultural activities described in the national technical notes and standard (available as Annex in the forest management plans).
- Results of the survival assessment, the format for which Green Resources has revised since the original PDD. Survival is now checked 2-3 months after tree planting. It is checked in all compartments planted that year. In every compartment the number of trees is counted along every tenth line, and trees are noted as either dead or alive (if a tree is missing then that

classes as dead also). From this a % survival rate can be computed. Checking for correct spacing of saplings will be done in future at the same time, using a calibrated chain.

Table 3-4: Survival Rates per strata[9]

Strata	Survival
Pine 1997-1999	82%
Pine 2000-2002	81%
Pine 2003-2005	86%
Pine 2006-2008	62%
Eucalyptus 1997-1999	59%
Eucalyptus 1997-1999 MFP	60%
Eucalyptus 2000-2002	60%
Eucalyptus 2003-2005	32%
Eucalyptus 2006-2008	39%

- Spot weeding was carried out during the second and third year after planting with checks that it conformed to the weeding practices as described in the forest management plan.
- Surveying and checking of the area of planted species and planting year including areas affected by natural and anthropogenic disturbances
- The Permanent Sample Plots (PSP) that are established 3 years after planting in every compartment, with GPS readings taken at the centre of each plot
- Records of any deviations in the implementation in relation to the management or silvicultural plan and information on such deviations and the justification of them are presented in the monitoring report.

The data recorded by the company in order to monitor the forest establishment are shown in the table below:

Table 3-5 Data and variables used to monitor forest establishment

ID number[10]	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Number of data points measured	Comment
E.1.2.01	Compartment ID	Alpha numeric		Before the start of the project	100%	Every compartment is named by a number or a number and letter in cases where a compartment has to be divided. The ID of each compartment can found in the compartment folders. See Annex 1 and Figure 3-3 and Figure 3-4
E.1.2.02	Compartment location	Grid / geographical units	m	Before planting	100%	GPS is used to locate geographical coordinates of the compartment boundary before start of the project. These can be found in the compartment folders and seen in Figure 3-3 and Figure 3-4
E.1.2.03	Compartment size	Ha	c	Before planting	100%	Calculated from the geographical points collected by GPS, this information is also kept in the compartment folders and in annex 1.
E.1.2.04	Compartment composition			Following planting	100%	Every compartment has its composition recorded in its compartment folder including year of establishment, species planted, year planted. See annex 2
E.1.2.05	Marking of planting spots	M	m	Before planting	100%	A calibrated chain is used to establish the appropriate planting spacing. This is checked and the spacing is noted in the compartment folder.
E.1.2.06	Areas cleaned (screefed)	M^2	c	Before planting	100%	Hoes are used to remove grass around marked areas before pitting (diameter 75-100cm). Once the area has been checked it is noted in the compartment folder. Any individual areas that have not been cleared sufficiently are done again until the whole compartment meets the clearing specifications.
E.1.2.07	Volume of pit	M^3	c	Before planting	100%	Hoes are used to remove soil around the screefed area before a pit (diameter 75-100cm) is dug. Once all the pits in a compartment meet the specifications it is noted in the compartment folder. Where pits are not of the required standard they are re-dug to comply.
E.1.2.08	Height of seedlings	Cm	m	Before planting out	100%	Before leaving the Nursery for planting, Seedlings should reach 20-25cm in height. This is checked by the nursery manager.
E.1.2.09	Area weeded	M^2	c	Once a year for the first 3 years	100%	Weeding is conducted to minimise competition from grass three months after planting. Completion of the weeding is noted in the compartment folder.

E.1.2.10	Area slashed	M^2	c	In year 2 and 3	100%	Slashing is conducted in the second and third year after planting. Slashing is recorded in the compartment folders.
E.1.2.11	Area planted per stratum	Ha	c	Every 5 years	100%	The spatial extent of the area per strata is determined by the use of GPS and can be seen in Figure 1-2 and Figure 1-3
E.1.2.12	Number of trees survived	numeric	c	Every 5 years	100%	Seedlings are counted after planting activity to determine the survival rate.
E.1.2.13	Survival rate	%	c	After planting season	100%	A sampling survey for each planted compartment is performed after the planting season and the calculated figure is recorded in the compartment folder. Where survival is over 80% no action is taken, between 50-80% beating up takes place and if it is below 50% replanting is done. See Table 3-4.
E.1.2.14	Stock count	ha	c	5 years		The total number of trees is calculated from the PSPs and individual PSP data can be found in annex 1. This was also measured in the past, and information is available in the PSP database (Annex 10)
E.1.2.15	Stocking rate	%	c	5 years		This is calculated from the PSP data. See Table 3-4, and Annex 10 for older records.
E.1.2.16	Area of fireline and fire breaks	ha	c	5 years	100%	The firelines and firebreaks are mapped via ground surveys and their area calculated and this can be seen in Figure 3-7 and Figure 3-8
E.1.2.17	Biomass stock per unit area before slash and burn	t d.m.ha-1	c	5 year	100%	No burning is taking place. See compartment folders for records.

3.3 Forest Management

Forest Management has been monitored in accordance with the monitoring plan of the VCS validated PDD. Thinning has been limited in the 2002-2008 time period. It occurred in 2008, at UFP in Compartment 2. (Figure 1-2). Only thinning has occurred so no replanting is required.

A number of fires occurred, especially in the early years of forest establishment. Their extent and location are shown in Figure 3-5 and Figure 3-6. When a fire occurs and destroys the stand the area is replanted, and the area will be re-stratified into a new compartment and strata for monitoring purposes. In cases where the fire passed through an area but no substantial damage to the trees were incurred this area remained in the same strata.

Table 3-6 Fire occurrence data for UFP

Year	Description of event	Area of forest affected (ha)
1997	Year of first planting with no incidence	-
September 1998	Fire got out of control from a child of the Village preparing farm on village land	55
October 1999	During controlled burning, fire crew unable to control the fire	54
January 2000	Lightening	59.93
2001	No incidence	-
2002	No incidence	-
October 2003	Arson	115
August 2004	During controlled burning, fire crew unable to control the fire	661.05
December 2004	Lightening striking in two different places at the same time	5
2005	No incidence	-
2006	Arson	1.5
March 2007	Lightening	2
September 2007	During controlled burning, fire crew unable to control the fire	6
December 2007	Unknown	22
December 2007	Lightening	11
2008	Lightening	6
Total		979.48

Table 3-7 Fire occurrence data for MFP

Year	Description of event	Area of forest affected (ha)
1998	No incidence	
1999	No incidence	
2000	No incidence	
2001	No incidence	
2002	No incidence	
2003	No incidence	
July 2004	During controlled burning, fire crew unable to control the fire	20
November 2005	Fire got out of control from neighboring farmer preparing his farm	188
November 2005		
December 2005	Fire got out of control from by farmer preparing his farm	198
2006	No incidence	

2007	No incidence	
2008	No incidence	
Total		386

Figure 3-5 Location of Fires at UFP

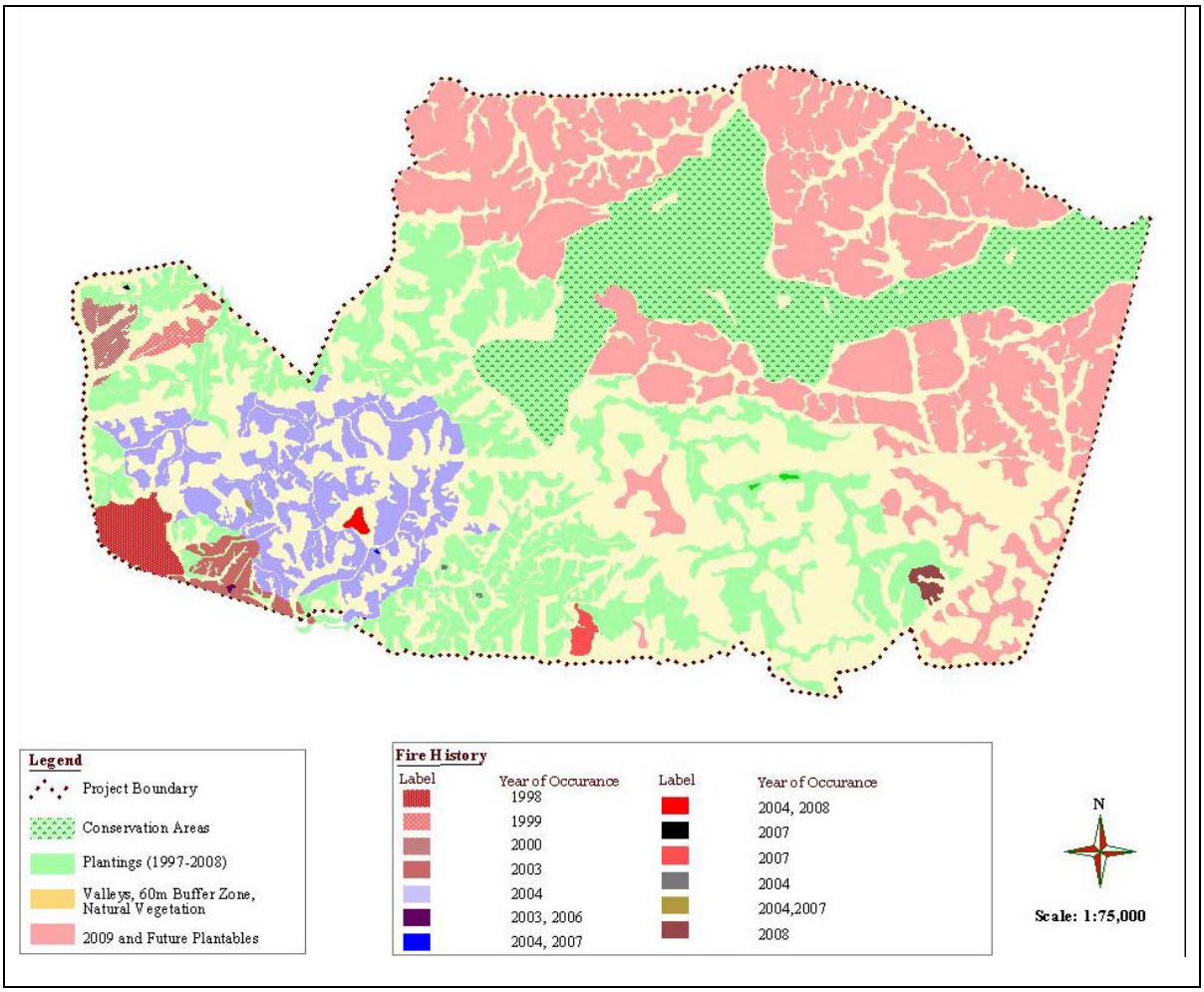
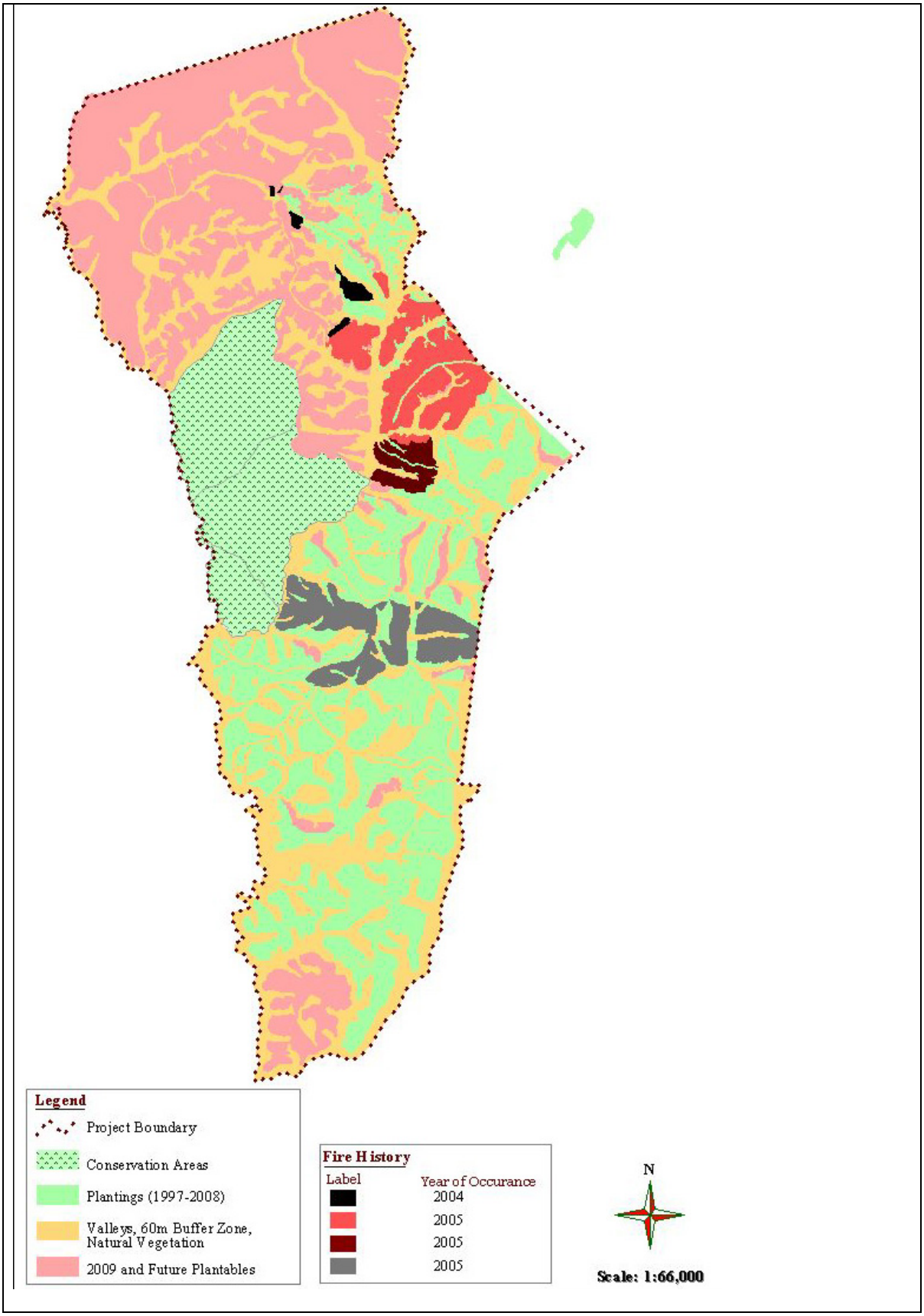


Figure 3-6 Location of Fires at Mapanda Forest Project



- The project has firebreaks to prevent the spread of fire in case of outbreak. By the end of 2008 171.4 ha and 163 ha of firebreaks had been put in place at UFP and MFP respectively.

Figure 3-7 Firelines at UFP

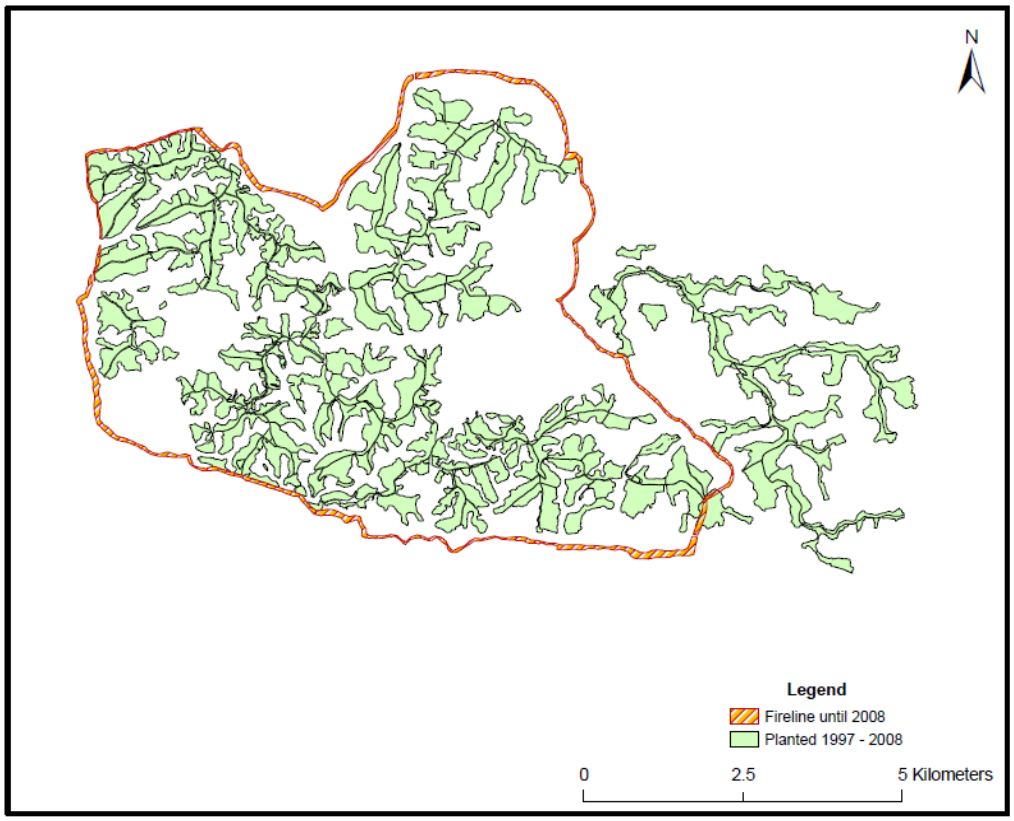
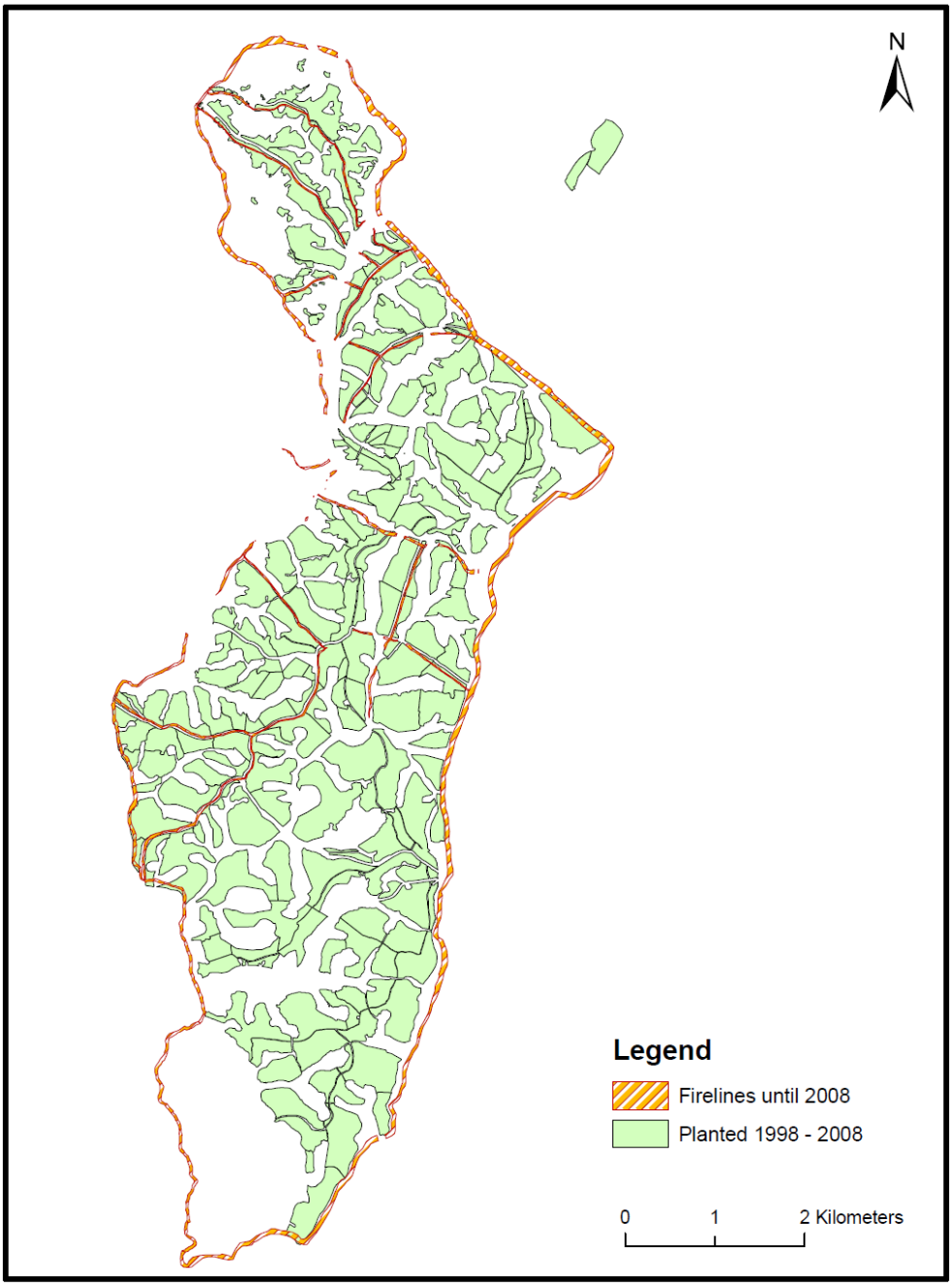


Figure 3-8 Firelines at Mapanda Forest Project



3.3.1 Project Emission.

As per AR AM 005 only non-co2 emissions from biomass burning are considered applicable in this project. Both leakage and baseline emissions are not applicable in this project for reasons explained in the PDD.

Uchindile and Mapanda Forest Projects both encountered fires during the 1997 to 2008 verification period. These fires are listed in Table 3-6 and Table 3-7.

In the case of areas that were affected by fire at UFP/MFP they were either cleared completely following fire, and replanted with pine or eucalyptus or they were left following fire, and they recovered.

Non-CO2 emissions resulting from incomplete combustion of biomass as a result of fire is calculated following equations M.23, M.24 and M.25. The parameters in Table 3-8 were used:

Table 3-8 Parameters used for calculation of non-co2 emissions from fires

EF ch4	0.012
GWP ch4	21
ration of molecular weight of ch2 and carbon, dimensionless	1.33

To estimate the carbon stock in the plantation at the time of the fire, estimates from application of the Mwalimbi model were used. To estimate the carbon stock in the plantations below five and three years of age for pine and eucalyptus respectively a linear growth rate was assumed. Additionally fire did strike areas of native tree species that were planted on VCS eligible land, and effected small planted areas of Tectonia Grandis, Cederella Odorate, Cupressus Lusitanica and Grevillea Robusta. The maximum age of any natives species stand that suffered fire attack was 3 years. Growth rates and volume estimates are not well established for the region for the native species that were planted, and it is know that the native species that were growing were performing very poorly. For the purposes of this analysis it is conservatively assumed that the native tree species sequester the following amounts of carbon over the first three years (see Table 3-9). This is conservative given we know the native species were not growing well. It is assumed the burning proportion is 50% in line with the IPCC GPG default value.

Table 3-9 Carbon Storage Estimate for years 1-3 for native tree species at UFP/MFP

Year	Carbon Dioxide per ha
1	5
2	10
3	15

See annex 11for excel spreadsheets with the full calculation of non-CO2 emissions. In summary however tables

Table 3-10 and Table 3-11 below shows total emissions from UFP/MFP from the different fire events from 1997-2008 in terms of tonnes of CO2 equivalent emissions.

Table 3-10 Uchindile Forest Project Non-CO2 emissions from Fires

Year of Fire Occurrence	Date of Fire Occurrence	Species affected	Planting Year	Age at Point of Fire (Year)	non-GHG emission (CH4) in tC equivalent (application of equation M.24)
1998	07.09.1998	Eucalyptus saligna	1998	< 1	142
1999	25.10.1999	Eucalyptus saligna	1998	1	139
2000	08.01.2000	Pinus patula	1998	2	30
		Eucalyptus saligna	1997	3	15.
2003	27.10.2003	Pinus patula	2002	1	28
		Eucalyptus saligna	1998	5	512
2004	18.08.2004	Pinus patula	1998	6	1057
		Pinus patula	2002	2	134.
		Pinus patula	2003	1	37
		Eucalyptus saligna	1998	6	1664.
		Eucalyptus saligna	2002	2	638
		Eucalyptus saligna	2004	< 1	11
		Tectona grandis	2003	1	3
		Cederella odorata	2003	1	3.0
	16.12.2004	Pinus patula	2003	1	1
2007	18.03.2007	Pinus patula	2005	2	1
	14.08.2007	Pinus patula	2004	3	1
	02.09.2007	Pinus patula	1998	3	4
	11.12.2007	Eucalyptus saligna	2004	3	170
2008	04.01.2008	Eucalyptus saligna	2007	1	13
	31.01.2008	Pinus patula	2005	3	0.8
	22.05.2007	Pinus patula	2005	3	8
TOTAL tC					4610
TOTAL tCO2					16907.

Table 3-11 Mapanda Forest Project Non-CO2 emissions from Fires

Year of Fire Occurrence	Date of Fire Occurrence	Species affected	Planting Year	Age at Point of Fire (Year)	non-GHG emission (CH4) in tC equivalent (application of equation M.24)
2004	31.07.1998	Eucalyptus saligna	1998	6	257
2005	16.11.2005	Eucalyptus saligna	1998	7	76
		Eucalyptus saligna	1999	6	764
		Eucalyptus saligna	2002	3	419
		Eucalyptus maidenii	2002	3	159
		Eucalyptus globulus	2002	3	97
		Pinus patula	2002	3	7
		Pinus patula	2005	< 1	1
		Cupressus lusitanica	2002	3	4
		Grevillea robusta	2003	2	10
	18.11.2005	Eucalyptus saligna	2004	1	43
		Cupressus lusitanica	2003	2	9
		Grevillea robusta	2003	2	1
	02.12.2005	Pinus patula	2005	< 1	15
		Eucalyptus maidenii	2005	< 1	173
		Cupressus lusitanica	2005	< 1	4
TOTAL tC					2040
TOTAL tCO2					7479

Thinning started in UFP in October 2008. During November and December 2008 poles were sold to Sao Hill Industries.Table 3-12 shows the quantity of product sold from this thinning. It is noteworthy that this was just a scheduled thinning, rather than a final harvest. No thinning occurred at Mapanda Forest Project during the verification time period.

Table 3-12 Poles sold from Green Resources Ltd thinning at UFP

Date of Sale	Purchaser and Invoice No.	Pole Length	Number of Poles	Unit Price (Tz Shillings)
Nov-08	Sao Hill Industries INV 001	10m	336	19000
Nov-08	Sao Hill Industries INV 001	13m	140	35000
Dec-08	Sao Hill Industries INV 002	10m	368	19000
Dec-08	Sao Hill Industries INV 002	13m	131	35000

Table 3-13 Data and variables used to monitor forest management

ID number[11]	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Number of data points measured	Comment
E.1.3.02	Area of thinning	ha	c	5 years	100%	The thinning areas are stored in the GIS database and on management (silviculture) maps to determine thinning schedule. Only one compartment has been thinned so far (compartment 2 at UFP in 2008) the location of which can be seen in Figure 1-2
E.1.3.03	Biomass stock lost per ha during thinning	t $d.m.ha^{-1}$	c	5 years	100%	The biomass removed during the thinning process is accounted for during the following year of inventory., as well as a note of commercial volume being recorded. See Table 3-12 Poles sold from Green Resources Ltd thinning at UFP
E.1.3.04	Harvesting location		m	5 years	100%	Spatial locations of mature blocks to be harvested in a given time are prepared by GIS. No harvesting has occurred yet.
E.1.3.05	Area of harvest	ha	c	5 years	100%	No harvesting has occurred yet.
E.1.3.06	Volume harvested	m^3	c	Following harvest	100%	No harvesting has occurred yet.
E.1.3.07	Area replanted	ha	c	5 years	100%	No harvesting has occurred yet, so no replanting is necessary.
E.1.3.08	Area allowed to regenerate/resprout	ha	c	5 years	100%	No re- sprouting has occurred.
E.1.3.09	Area affected by diseases and pest	ha	c	5 years	100%	No significant areas have been affected by pest or disease.

						Constant checks for pests and diseases are made.
E.1.3.10	Area burnt by fire	ha	c	5 years	100%	Figure 3-5 and Figure 3-6 shows the areas damaged by fire.
E.1.3.11	Location burnt	m	m	5 years	100%	See Figure 3-5 and Figure 3-6
E.1.3.12	Volume of biomass lost due to fire	m^3	c	5 years	100%	All biomass was lost from sites where fires occurred. Areas have been replanted in their entirety.
E.1.3.13	Area re-growth after fire	m^2	c	5 years	100%	Area is replanted completely, so no regrowth occurs.
E.1.3.14	Area of fire breaks	ha	c	5 years	100%	The firebreaks are mapped via ground surveys and their area calculated and this can be seen Figure 3-7 and Figure 3-8 Firebreaks cover 171.4 ha at UFP, and 163 ha at MFP.

Table 3-14 Data and variables used to monitor GHG emissions by sources as a result of the project activities

ID number	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[12]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
2.1.2.01	Area affected by biomass burning	ha	C	Annually	100%	No biomass burning was carried out as part of site preparation
2.1.2.02	Mean above-ground biomass stock before burning	t d.m.ha-1	C		100%	No burning occurred in site preparation. Fires occurred at the plantations as documented in section 3.3.1.
2.1.2.03	Proportion of biomass burned	dimensionless	C	Annually	100%	See Table 3-10 and Table 3-11.
2.1.2.04	Biomass combustion efficiency	dimensionless	E	Before the start of the project	100%	IPCC default value (0.5)
2.1.2.05	Carbon fraction	t C.(t d.m)-1	E	5 year	100%	IPCC default value (0.5)
2.1.2.06	Loss of above-ground biomass carbon due to biomass burning	t CO2-e yr-1	C	5 year	100%	See Table 3-10 and Table 3-11

2.1.2.07	N/C ratio	dimensionless	E	Before the start of the project	100%	IPCC default value (0.01) is used if no appropriate value found
2.1.2.08	N2O emission from biomass burning	t CO2-e yr-1	C	5 year	100%	Not included as considered negligible in AR AM 005. See M.23
2.1.2.09	CH4 emission from biomass burning	t CO2-e yr-1	C	5 year	100%	see Table 3-10 and 3-11.
2.1.2.10	Increase in non-CO2 emission as a result of biomass burning	t CO2-e yr-1	C	5 year	100%	see Table 3-10 and 3-11.
2.1.2.11	Total increase in GHG emission	t CO2-e yr-1	C	Annually	100%	see Table 3-10 and 3-11.

3.4 Monitoring Instrumentation

3.4.1 Inventory device

Table 3-15 List of Equipment used for measurement of PSPs

Equipment	Manufacturer model	Measurement range	Measurement unit	Calibration	Uncertainty level
Hypsometer	Suunto 731869	0-35m	Meters(m)	0.2m	
Vertex		0-999 m	Meters(m)	10 m	1% or better
GPS	Etrex Legende		Corrdinate system (UTM)	none	5-10 meter
Caliper	Haglof S-882 00	0-50cm	Meters(m)	0.1m	1mm
Ranging pole		0-2m	Meters(m)	0.5m	1 mm
Compass	Suunto 721038		Directions/slope	0.5^0	Low

3.4.2 GPS

A Garmin etrex GPS unit is used. The GPS units use the WGS 84 coordinate system. The first measurement of the sample centres was made using the 1960 coordinate system. The instruments are state of the art.

3.5 Sampling Information

3.5.1 Sample Plots for Monitoring of Project Activity

The number of permanent plots (PSPs) needed for monitoring depends on the accuracy desired, variability of the carbon stock, composition of the species and costs associated with sampling. CDM AR AM 005 adopts a maximum permissible error of ±10% of the mean, at the 95% confidence interval.

Initially, before the 2008 VCS verification event PSPs had already been laid to monitor growth of the trees, using a sampling intensity of 0.05% and with PSPs of 0.04ha. However these initial PSPs laid out were in their majority located in the older stands planted pre-2000. The data from these PSPs was used to determine the sampling intensity needed to meet the accuracy requirements stipulated in CDM AR AM 005. The number of PSP's needed to ensure a confidence interval of 95% was computed using equation M.1 in the methodology. This equation computes the number of sampling plots needed for the inventory based on the different strata. If t_α is calculated a result lower than 1.96 shows that the result is less than 95% result above 1.96 shows that error is above 95%. Using the predicted estimates of variation between plots at the forest project M.1 came out with an estimate of 75 required PSPs. Regardless of this prediction, and with a knowledge of high variability between stands in the Uchindile and Mapanda Forest Projects GRL decided to put increase the number of PSPs to 130 for the 2008 VCS verification event. Each PSP remained at 0.04 ha in size, and circular.

(M.1) Calculation of total number of PSPs required:

$$n = \left(\frac{t_\alpha}{E}\right)^2 \cdot \left(\sum_{i=1}^{I} W_i \cdot s_i \cdot \sqrt{C_i}\right) \cdot \left(\sum_{i=1}^{I} W_i \cdot \frac{s_i}{\sqrt{C_i}}\right)$$

n = (1.96/42.1) * (18.5*18.5)

n = 74.02 (Rounds up to 75 plots)

(M.2) This equation is used for the distribution inside the different stratums[13].

$$n_i = n \cdot \frac{W_i \cdot \frac{s_i}{\sqrt{C_i}}}{\sum_{i=1}^{I} W_i \cdot \frac{s_i}{\sqrt{C_i}}}$$

Where:

n	Sample size (number of sample plots required for monitoring)
t_α	*t* value for a significance level of α (0.05) or confidence level of 95%
N_i	Number of sample units for stratum *i,* calculated by dividing the area of stratum *i* by the area of each plot
N	Total number of sample units of all stratum levels, *N* = Σ *i N*
s_i	Standard deviation of stratum *i*
E	Allowable error (±10% of the mean)
C_i	Cost to select a plot of the stratum *i*
i	Stratum *i* (total number of strata I)

Once the inventory had been completed, and statistical analysis run on the data the results unfortunately revealed the standard error to in fact be unacceptably high amongst all strata except for the 1997-1999 strata. This is unfortunate, and for future verifications Green Resources will add more PSPs to avoid such an occurrence. However, it appears this may have happened because the data used to estimate the number of PSPs needed was skewed to the older PSPs measurements, where variation in the stands was lower and underestimated variations likely in younger stands/strata.

Table 3-16 below shows the calculation of standard error per strata. Strata 97-99 for both Pine and Eucalyptus were within acceptable limited. For all the other strata the standard error is high than 10% so unacceptably high. See Table 2-3: Ex post volume estimates per strata.

Table 3-16 Standard Error per Strata

Species	Strata	No plots (PSP)	Mean volume (m3/ha)	Standard Deviation (m3/ha)	Standard Error	Standard error (m3/ha)	Coefficient of Variation	95% Confidence interval
Pinus Patula	97-99	17	222	74.5	8.1%	18	34%	35.4
	00-02	11	109	49.1	13.6%	15	45%	29.0
	03-05	19	18	15.9	19.9%	4	87%	7.1
	06-08	9	0	-	0.0%	0		-
Eucalyptus spp	97-99	27	223.2	106.5	9.2%	20.5	48%	40.2
	00-02	11	90	47.4	15.8%	14	53%	28.0
	03-05	17	8	13.0	38.2%	3	157%	6.2
	06-08	8	0	-	0.0%	0		-
	Thinned	4	263	62.3	11.8%	31	24%	61.0

To correct for the unacceptably high standard error, and ensure the data which is used is conservative we decided to adopt a statistical approach to ensure the data we used is conservative. We subtracted one confidence interval from the mean for the strata where the standard error was too high. The CI is shown in Table 3-16 above, and has been calculated as follows:

CI-= X - SE*1.96

Where:

CI is confident interval

X = is mean of stratum

SE = standard error (Standard deviation / square root of number of observations)

1.96 = is the t-value for 95%

Table 3-17 below shows the new values which will be used. In strata 97-99 for pine and eucalyptus no correction is make, since the error level is in the acceptable range. In strata 00-02 for pine and eucalyptus mean minus CI is used.

In strata 03-05 for both species the error is unacceptably high, so there a value of 0 is assigned. Similarly strata 06-08 for both species is set as zero, as here the trees were too small to measure.

Table 3-17 Adjusted volume per strata

Species	Strata	No plots (PSP)	statistically adjusted mean volume (m3/ha)
Pinus Patula	97-99	17	152.8
	00-02	11	78.0
	03-05	19	11.1
	06-08	9	n/a
Eucalyptus spp	97-99	27	106.3
	00-02	11	62.1
	03-05	17	2.1
	06-08	8	0.0
	Thinned	4	27.1

Locating Permanent Sampling Plots (PSPs):

PSPs were located randomly. The number of PSPs per stratum was calculated from M.2. The location of PSPs have always been chosen on the map before any field work is carried out according to the monitoring plan depending on species and planting year. This is now done at the compartment level in GIS. Previously it was done on a hard copy of the map pre-field work and then found in the field. The plots are not located systematically because of the steep and hilly terrain which means locating them at a set interval from one another on a grid impossible. Instead they are located across compartments by the inventory manager, in GIS from a random start point, but ensuring they are distributed across all the compartments.

The PSPs at Uchindile and Mapanda are always marked, but they are treated like anywhere else at the plantation. Because of the fairly high turnover of inventory staff it is more accurate to measure trees which have been marked. Everyone is aware the plots must not be treated any differently, plus the inventory team of the company is separate from the plantation management team. The graphs below show the location of the PSPs that have been established at Uchindile and Mapanda.

The PSPs will be measured each year by the Inventory team, and new PSPs will be laid out as new plantations are planted.

Measurements of the PSPs in the 2008 inventory were carried out by three inventory teams, with three separate team leaders; Dr Peter Mussami, Jakob Sandven and Peter Nguyeie who are in charge of the quality of the data collected.

The data analysis and calculations to determine volume, biomass and carbon totals were carried out by Jakob Sandven.

Figure 3-9 PSPs at Uchindile

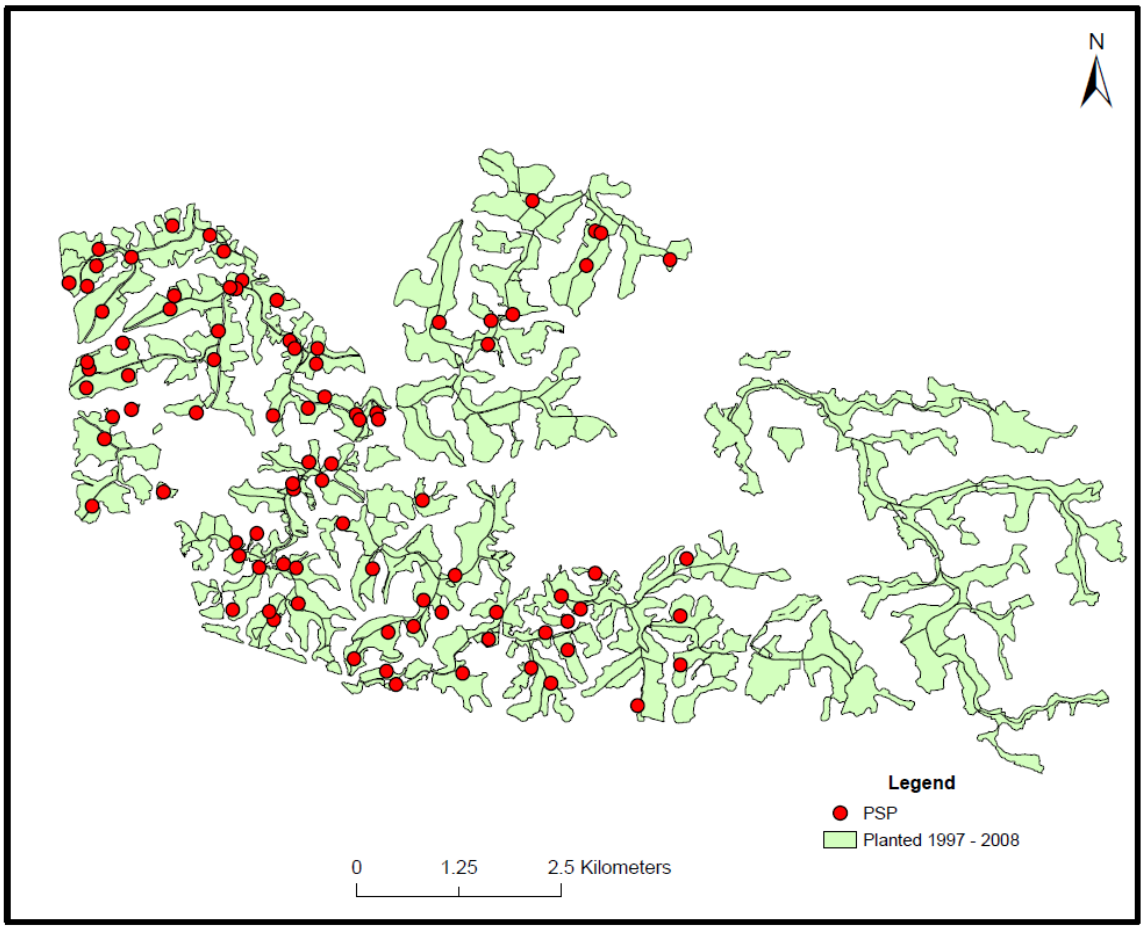
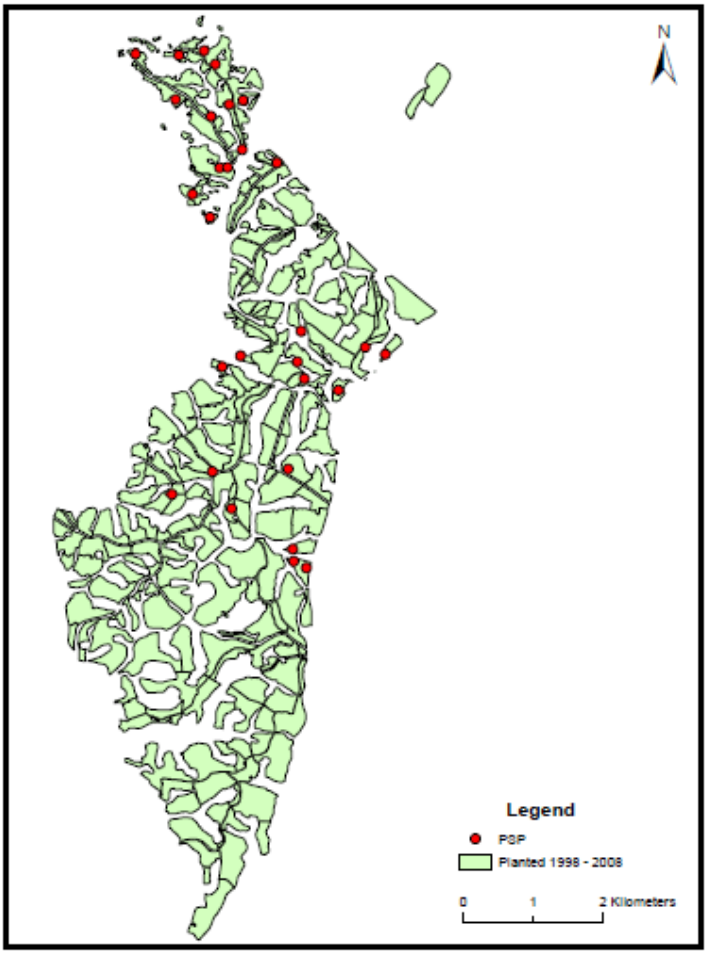


Figure 3-10 PSPs at MFP



3.6 Accounting information

Table 3-18 below shows accounting records for biomass removed during the first thinning at Uchindile Forest Project.

Table 3-18 Accounting information on sale of timber from October 2008 thinning

Month	Size of pole	Quantity (poles)	Unit Price (Tz Shillings)
Nov-08	10m	336	19000
	13m	140	35000
Dec-08	10m	368	19000
	13m	131	35000

3.7 Monitoring of Environmental and Social Project Dimensions

Green Resources Limited has met with all legal requirements in Tanzania in relation to environmental aspects of its project development. It has received the necessary permits and met with the environmental monitoring requirements of the National Environment Monitoring Council (NEMC).

In the validated PDD Green Resources outlined many environmental monitoring parameters that went beyond the requirements of the VCS. Not all these monitoring parameters have been met, and progress is listed in the section below. Moving forward Green Resources will implement a revised monitoring protocol, which will include the 2010 Green Resources Biodiversity Monitoring Plan.

3.7.1 Conservation of water resources:

In order to conserve the water resources within the project activity boundaries the following will be adhered to:

Site / Species assessments will be conducted to identify suitable areas and suitable species for planting based on, amongst other things, the consideration of water retention and biodiversity aspects;

The location of the planting of pine and eucalyptus has been selected according to altitude, aspect and soil type.

No planting of trees will take place in valley bottoms and along streams. A distance of 30 meters on either side of water courses will be respected;

A distance of 30 meters has been observed around all water courses for plantings that started before May 2004 and 60 meters for areas planted after May 2004

Groundwater levels will be monitored during the dry season in order to establish long term effect of the planting on the slopes;

Groundwater monitoring is not occurring.

Water quantity and water quality in the rivers throughout the plantation areas will be monitored;

Since establishment of the plantation there has been no noted pollution in the rivers; water is suitable for irrigation and domestic use. This has been reported by the regional Water Quality Office. (Table 3-19 and Table 3-20)

Table 3-19: Mapanda Water Quality Data

Sampling Point			**U/Mkungwe**	**G/Mwenga**	**Mvino**	**Kiverege**	**Permissible Limits (WHO 1994)**
Parameters	**Units**	**Date**	**Analytical Results**				
		5/07	1.4	1.3	0.9	1	
		10/07	1.5	1.6	1.0	1	
		4/08	0.06	0.04	0.03	0.03	30
	mg/l	11/08	0.01	0.2	0.4	0.4	
		5/07	0.002	0.006	0.001	0.001	
		10/07	0.016	0.014	0.012	0.016	
Nitrites	mg/l	4/08	0.044	0.006	0.007	0.006	Not Specified
		11/08	0.003	0.004	0.007	0.004	
		5/07	0.01	0.06	0.06	0.05	
	mg/l	10/07	0.05	0.06	0.01	0	
Ammonium		4/08	0.18	0.33	0.08	0.07	0.5
		11/08	0.06	0.11	0.08	0.04	
		5/07	0.23	0.17	0.18	0.06	
	mg/l	10/07	0.24	0.29	0.18	0.1	
Ort'phosphate		4/08	0.25	0.22	0.29	0.18	Not Specified
		11/08	0.47	0.11	0.08	0.04	
		5/07	32.4	28.7	15.4	14.4	
		10/07	32.0	26.0	28.0	26.0	
	mg/l	4/08	22.0	32.0	14.0	16.0	5500
Bicarbonates		11/08	18.0	28.0	14.0	26.0	
	$CaCO_3$						
		5/07	26	24	18	16	
		10/07	36.1	38.4	38.3	12.9	
Salinity	mg/l	4/08	25.8	37.8	12.0	14.0	Not Specified
		11/08	18.8	29.4	15.0	30.0	
		5/07	<1	<1	<1	<1	
		10/07	0.0	0.0	0.0	0.0	
Sediments	mg/l	4/08	0.0	0.0	0.0	0.0	0.0
		11/08	0.0	< 0.1	0.0	0.0	
		5/07	7.25	7.01	6.85	6.9	
		10/07	7.2	7.22	7.32	7.37	
pH		4/08	6.85	6.61	6.94	6.89	
		11/08	7.1	6.61	6.87	6.88	6.5-8.5
		5/07	21.7	21.4	21.6	21.4	

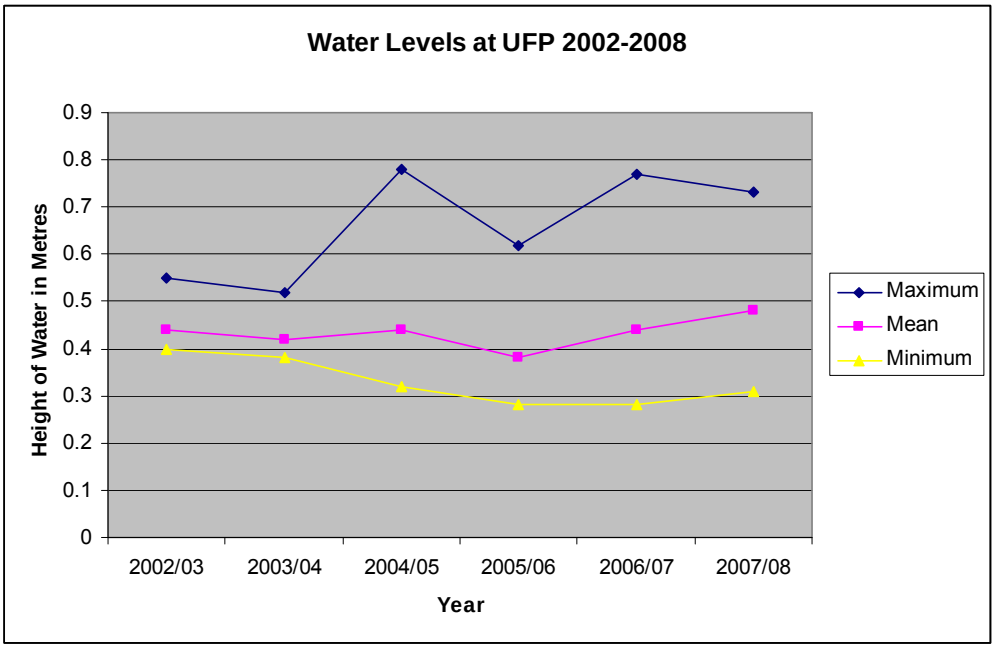
Temperature	^{o}C	10/07	24.1	24.1	24.2	24.1	Not Specified
		4/08	23.6	25.6	25.6	24.9	
		11/08	25.0	25.6	25.6	24.9	
Transparency	%T	5/07	98.0	96.0	96.0	98.0	90-100%
		10/07	98.0	97.0	96.0	98.0	
		4/08	98	98	97	98	
		11/08	98	97	98	98	
BOB_5	mg/l	5/07	6.0	8.0	6.0	6.0	10
		10/07	6.2	6.0	7.9	6.2	
		4/08	6.0	6.2	7.5	6.1	
		11/08	6.2	6.0	6.2	6.2	

Table 3-20: Uchindile Water Quality Data

Sampling Point			**Kihata**	**Luiga**	**Mgelela**	**Mp'chi**	**Selasini**	**Permissible Limits (WHO 1994)**
Parameters	Units	Date	Analytical Results					
Nitrates	mg/l	9/06	0.9	0.6		0.9		30
		3/07	0.7	0.5	0.5	0.5	0.6	
		10/07	0.5	0.3	0.4	0.4	0.3	
		3/08	0.3	0.2	0.5	0.3	0.2	
		11/08	1.0	0.6	0.7	0.6	0.4	
Nitrites	mg/l	9/06	0.003	0.004	na	0.005	Na	Not Specified
		3/07	0.008	0.007	0.01	0.009	0.007	
		10/07	0.007	0.003	0.014	0.003	0.004	
		3/08	0.004	0.001	0.003	0.002	0.002	
		11/08	0.005	0.006	0.007	0.006	0.006	
Ammonium	mg/l	9/06	0.22	0.09	na	0.14	Na	0.5
		3/07	0.56	0.26	0.32	0.35	0.33	
		10/07	0.22	0.11	0.19	0.3	0.13	
		3/08	0.16	0.25	0.16	0.21	0.21	
		11/08	0.15	0.04	0.11	0.12	0.12	
Ort'phosphate	mg/l	9/06	0.56	0.23	na	0.19	Na	Not Specified
		3/07	0.27	0.18	0.11	0.21	0.17	
		10/07	0.24	0.34	0.27	0.23	0.11	
		3/08	0.09	0.09	0.01	0.0	0.0	
		11/08	0.01	0.09	0.03	0.09	0.12	
Bicarbonates	mg/l $CaCO_3$	9/06	18.0	16.0	na	16.0	Na	5500
		3/07	20.0	20.0	18.0	20.0	10.0	
		10/07	10.0	32.0	18.0	14.0	26.0	
		3/08	34.0	10.0	12.0	12.0	12.0	
		11/08	10.0	14.0	16.0	14.0	12.0	
Salinity	mg/l	9/06	12.1	15.3	na	16.2	Na	Not Specified
		3/07	18.7	20.3	18.2	25.6	16.8	
		10/07	9.5	34	17	13	11.2	
		3/08	40.0	13.8	15.6	15.6	12.6	
		11/08	11.4	16.2	18.6	15.0	13.8	
Sediments	mg/l	9/06	<0.1	<0.1	<0.1	<0.1	<0.1	0.0
		3/07	<0.1	<0.1	<0.1	<0.1	<0.1	
		10/07	<0.1	0.0	0.0	0.0	0.0	

		3/08	0.0	0.0	0.0	0.0	0.0	
		11/08	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
pH		9/06	6.86	6.92	na	6.63	Na	6.5-8.5
		3/07	6.2	5.8	6.3	6.2	6.2	
		10/07	8.0	6.9	7.6	7.5	7.2	
		3/08	6.3	6.2	7.5	7.1	6.6	
		11/08	6.73	6.83	6.65	6.61	6.80	
Temperature	^{o}C	9/06	22.9	22.8	na	22.8	Na	Not Specified
		3/07	22.1	21.9	22.3	22.1	22.0	
		10/07	23.6	23.5	23.6	23.6	23.6	
		3/08	19.8	19.9	19.8	19.9	19.9	
		11/08	24.7	25.8	27.6	26.4	25.8	
Transparency	T%	9/06	95	97	na	98	Na	90 – 100%
		3/07	95.0	98.0	96.0	95.0	85.0	
		10/07	97.0	99.0	95.0	98.0	99.0	
Transparency		3/08	96	98	96	98	97	90-100%
		11/08	98	99	97	98	99	
BOB_5	mg/l	9/06	3.0	3.0	na	4.0	Na	10

Figure 3-11: Water Levels at UFP



The differences in water levels between one year and another are low, indicating that there is no significant change in the water levels in the course of plantation establishment.

In case chemicals are used during site preparation in order to destroy termites, consultation and approval from the Water Resource Authority Office (i.e. the Rufiji Basin Water Office) will be sought; and,

No chemicals have been used to destroy termites

Site preparation will be done with a minimum clearing and ploughing.

No ploughing has been carried out at the project site. Clearing has been kept to a minimum with slashing only occurring directly around the sapling that is being planted.

3.7.2 Forest Plantation Management

Minimum disturbance during logging activities (use the best techniques and technology) as a soil conservation measure to reduce soil erosion on slopes and immediate planting after clear felling to protect the litter and avoid soil exposure, to increase soil fertility and to conserve and benefit from soil nutrients;

The selected harvesting that has occurred at the Uchindile project during the monitoring period has followed FSC procedures for harvesting. No replanting has occurred as no clear fell harvesting has occurred during the monitoring period.

Plan forest roads and extraction routes before opening up a compartment for harvesting and aim for minimal impact and minimal distances;

Roads have been planned pre-harvesting aiming for minimal impact and distances.

Identify sensitive areas (e.g. for erosion), conservation areas, and river streams before a harvesting plan is made and demarcate them in the field during operations;

All areas deemed sensitive, have been excluded from planting, e.g. catchments, wetlands, streams and riverbanks with at least a 60-meter buffer. Biodiversity rich areas are conserved as shown in maps. Areas with steep sloped will be harvested with special techniques and precaution as explained in the management plan. In addition, EIA is conducted before harvest.In addition a mini-EIA was conducted immediately preceding the selected harvesting at Uchindile to ensure all sensitive areas were protected. Since the harvesting an FSC surveillance visit was carried out by SGS, and the project successfully continued to meet FSC requirements.

Use proper felling techniques to control felling direction;

Followed, in accordance with FSC requirements. A successful FSC surveillance audit was conducted in 2010 following all harvesting, and confirming it complied to FSC standards.

Identify a safe area for maintenance and refuelling of chainsaws so as to avoid oil spills etc.;

Followed, in accordance with FSC requirements. A successful FSC surveillance audit was conducted in 2010 following all harvesting, and confirming it complied to FSC standards.

Minimise the removal of litter and fine logging slash at the harvesting time, as the residue will act as a source of nutrients for the subsequent crop and conserves soil moisture and reduces the growth of weeds;

Followed, in accordance with FSC requirements. A successful FSC surveillance audit was conducted in 2010 following all harvesting, and confirming it complied to FSC standards.

Weeding to be done until the trees close up their canopy to avoid soil moisture and nutrients competition with the planted trees;

Followed, as per the weeding activities described in the PDD and recorded in the compartment folders.

Preventive and control measures on pests and diseases will be enforced by using an integrated pest management programme which shall include the monitoring of insects and pathogens in the plantations;

Forest health is being monitored constantly through the following procedure:

The monitoring team that is responsible for data collection in the Permanent Sample Plots (PSPs) is also responsible for observation and detection of symptoms of pests and diseases as one of the monitoring parameters. Patrolmen are used to check the forest diseases and pests during the normal or routine works. When diseases or pests are detected, they are reported immediately to the Project Manager and the following is the chain of response:

1. The Patrol Men report the incidence to Project Manager
2. The Project Manager checks the situation and reports it to the Head Office
3. From head office the Research Manager goes to the field to assess the situation of the infestations and informs Management of the steps to be taken
4. If the infestations are not severe, the research manager informs management while more follow up of the disease is conducted
5. If the infestation is severe the Research Manager reports to Management of the effect of the infestation and external expertise is sought as remedy to the situation.

Usually Tanzania Forest Research Institute (TAFORI) and/or Kenya Forestry Research Institute (KEFRI) experts (Entomologists or pathologists) are contracted to check the diseases or pests attacks.

To report and document disease outbreak, a special form called "Forest Health and Safety Monitoring" designed for that purpose is used. The form is also applicable for fire incidence reporting. Trained patrolmen are used to check the forest health during their routine work. When they sight any abnormality in the forest they report it to the project manager, who also goes to the place of the incident to assess the situation there. If it is found to be a serious case the project manager reports the occurrence to the head office at Mafinga. Then either a team from head office or the research manager goes to the respective project to assess the situation and if it is found to be a serious one he advises management to call in external experts to check the situation. The experts will then assess the situation and advise management accordingly. A document named 'Disease Control System for GRL Plantations' has been developed where the protocol for reporting and responding to disease is designed.

Overall the risk is considered to be low. Following 10 years of implementation of the forest project at UFP/MFP there have been no incidences of pest and disease outbreak, which has destroyed, or negatively affected the growth of the forest stands. The only pests/ diseases, which are known to occur in the area which effect forest plantations are described above, and none of these have a devastating effect on forest stands, rather they might affect the growth of the forest stand in the short term, until they are identified and treated.

Thinning and pruning are important measures to keep the plantation stands healthy and to produce good quality products with sound diameter growth and stem quality in a stand.

Thinning and pruning of stands are being carried out, as per compartment folders.

3.7.3 Fire Fighting:

Preparation and implementation of a systematic fire prevention program and control measures to avoid burning of the plantations, measures to include clearing of fire breaks/lines, weeding of the plantations, clearing of bushes/grasses adjacent to the plantation and local community education on fire hazards;

A fire prevention and management strategy was put in place as per the PDD

Establishment of the belts of Eucalyptus sp. on the periphery of the plantation, open corridors, and around plantation blocks, especially for the pine blocks; and,

This has not been done, and is no longer a planned activity.

Local community involvement in project management and education on the importance of the forest plantation, ensure employment for the maintenance of the periphery fire belts.

At the annual plantation party awareness on fire prevention and control is raised.

3.7.4 Biodiversity:

Assist the local community with the establishment of woodlots to alleviate the shortage of fuelwood and building materials;

The community has been encouraged to establish their own woodlots through provision of seedlings and training.

Promote the use of indigenous species in order to maintain/restore the genetic diversity of the grassland. The local communities will be guided on the silvicultural performance of the indigenous tree species;

Pilots with indigenous tree species have been carried out, although their success has been quite disappointing. The project is constantly searching for indigenous species to plant in the project area so as to restore the genetic diversity and for enrichment planting. The project is training the communities and field staff to detect indigenous species, about conservation and about environmental benefits by conserving such species.

Establish and monitor the performance of designated "Control Areas" to be used as an example of the natural grassland as compared with the landscape of the forest plantation;

Areas of grassland have been set aside for conservation, partially for the protection of Blue Swallow habitat. The boundaries of this area are monitored. To date biodiversity monitoring has not been carried out in the grasslands, but this will take place from 2010 onwards, following the introduction of a more detailed biodiversity monitoring plan at GRL.

Locate civil works (e.g. roads and bridges) in areas with low density of biodiversity, do not remove indigenous vegetation, and align roads so as to avoid steep slopes and erosion hazards, wherever possible and practicable; and,

Civil works have been located according to biodiversity considerations

Monitor and control the spread of plantation species into the conservation areas.

This has been monitored through the use of PSP's within the conservation areas. In future monitoring periods this will be further monitored through following the more detailed new 'GRL Biodiversity Monitoring Plan.'

Monitoring programme:

As the plantation project develops, it will be necessary to monitor a number of parameters, in order to follow overall progress and impact, but also to obtain information that is to be used for re-planning of the activities under implementation. The monitoring plan is approved by the National Environment Management Council (NEMC), a statutory body of the Government responsible for all environmental matters in the country. For any amendments to the monitoring plan, the project participants will seek approval from NEMC.

3.7.5 Monitoring of Soil Parameters should be done once during the dry season and repeated once during the rainy season.

NEMC confirmed that this would only need to be measured once every five years in the planted areas and continue the same way after planting in other areas.

Soil composition, texture and structure, nutrient status and soil moisture shall be monitored to determine their impacts on various species of trees;

Only pH levels have been measured as the EIA only indicated that was required

Changes in salinity, porosity, pH level and types of biota in the soils shall be monitored in the plantations;

NEMC(2008) approved that soil parameters should be monitored once every five years in areas with forests. This will continue the same way in new plantations

Soil analysis shall be carried out regularly to determine whether (organic) fertilizers are needed for replenishment in the plantations and in what quantities;

Fertilizer use is only practised in the nursery.

Soil erosion monitoring shall also be carried out through collection of sediment in the gauging stations;

UFP and MFP Sediment levels are included in Table 3-19 and Table 3-20

In case of severe nutrient deficiency the land will be left fallow to enable natural fertility to regenerate;

This has not been the case. No severe nutrient deficiency has been observed.

A nutrient management scenario will be prepared after every rotation through the assessment and quantification of the nutrient balance.

The project is still in the first rotation period so this has not been done yet.

3.7.6 Water Resources Monitoring:

A monitoring program to follow the development of the water balance and the water yield is outlined below:

Installation of gauging stations on the rivers draining through the project areas;

At Uchindile Forest Project gauging stations have been put in place at five locations: Selassini, Luiga, Kihata, Mgelela and Mpombochi Rivers, respectively. For Mapanda Forest Project, four gauging stations have been put in place.

Installation of a Meteorological Stations in the project areas;

Collection of meteorological data from the installed meteorological station: temperature, rainfall, wind speed and direction, cloud cover, dew point and relative humidity;

Meteorological data has been collected since 2002 at the Uchindile site. The data is presented in table Table 3-21 below. For MFP measurements have only been taken for one year (2008) at the time of verification, so no trends can be analysed yet.

Table 3-21 Meteorological Data UFP

Year	EIA	2002	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08
Rainfall (mm)	1600	217.6	1054.4	1169.8	1461.8	1046.5	1431.1	1540.6
$Temp._{max.}$ ^oC	24.5	18.7	18.8	18	19.1	19.5	19.5	20.9
$Temp._{mean.}$ ^oC	16	14.5	15.7	15.2	15.7	15.8	15.8	17.4
$Temp._{min.}$ ^oC	9	12.2	12.8	12.3	12.2	12.1	12.1	13.9
RH%	75	81.1	81.6	81.5	83.5	81.7	83.9	79.0
D/Temp. ^oC		13.8	15.2	15.0	15.5	15.5	16.0	17.1

Collection of discharge and water levels at the installed gauging stations: water levels, water samples for assessing the water qualities (sediment loads, Biological Oxygen Demand, Transparency, pH level, salinity and nutrients contents), water flow measurements and checking of planktons;

See table 3-19 above.

Assessment of runoff characteristics;

Not assessed

Assessment of the hydrological characteristics of the main aquifer in the project area;

Not assessed

Assessment of base flows in the drainage system.

Not assessed

Analysis of the data collected and provision of remedial measures.

The analysis of the data in table 3-19 points to no unexpected or negative changes in hydrology.

3.7.7 Monitoring of plantation development:

Apart from following the overall growth of the plantation and different species, monitoring should focus on the succession after the first harvest.

Yield studies will be conducted to compare first and second harvests to determine suitable rotations for the plantation, also in relation to the use of fertilizers and disease resistance.

This has not been conducted yet.

Study and establish the optimal mix for the combination of exotic and indigenous tree species through provenance and progeny tests for representative species.

So far, silviculture knowledge on indigenous species has not proven successful enough to warrant large scale planting of indigenous trees. Small scale pilot plantings of indigenous trees continue.

Monitor and determine the wind firmness as well as the fire resistance of different species will be done.

This has not been carried out, and it is not anticipated that it will be done.

Coordinate with the networks of research scientists and pest management specialists to exchange information on experiences of handling various insects and pest problems.

Where specific skills are lacking within the staff, institutions and research centres have been consulted. These have included researchers from Sokoine University of Agriculture, University of Dar es Salaam, Kenya Forest Research Institute, Tanzania Forest Research Institute, Tanzania National Environmental Management Council, Tanzania Tree seed Agency, Vice President`s Office Division of Environment, Department of Forestry and Beekeeping, Wildlife Conservation Society of Tanzania, Rufiji Water Basin Office, Mufindi Environmental Trust, Sao Hill Forests, Ministry of Natural Resources, Mufindi and Kilombero District Council, Tropical Pesticides Research Institute and local NGOs. These partner organizations assist GRL through the provision of technical consultation and guidance as needed, including training courses, quality control checks and technical inputs for the preparation and implementation of the proposed activity, and whenever GRL needs key-specific assistance.

Monitor the behaviour and attitude of the communities adjacent to the forest and identify and implement possible extension programs that reduce pressure and avoid damages to the forest on the plantation resource, encourage the local communities to plant trees on their own farms and woodlots.

Community woodlot schemes has been promoted, and uptake has been high, with mature woodlots now observable around the villages. Every 3 years Participatory Rural Appraisals are carried out to monitor community attitude and behaviour.

3.7.8 Disease Monitoring

- *The type of diseases and pests affecting planted trees will be monitored in collaboration with TAFORI, KEFRI, SUA and other researchers in order to determine remedial and preventive measures;*
- *The monitoring of emerging pests and insects in and around the project area will be carried out to assist in the choice of species for plantation establishment and innovation steps to combat the pests and insects;*
- *Periodical assessment and reporting of risks of pests and insect attacks and/or plagues will be done so as to ascertain the safe handling of possible outbreaks;*
- *Workers will be trained and sensitized on diseases identification and reporting.*

Monitoring, prevention and control of diseases out-break and pests was conducted at one of GRL sister projects by Research & Monitoring Manager Dr. Peter Mussami in March 2008. Plantation workers were trained on detecting signs, prevention, and control of diseases and pests outbreak. This is an annual event in GRL.

Pest Summary Uchindile Forest Project.

Giant Conifer aphids were observed in some of the pine plantations in July 2004. An expert was invited from Kenya Forestry Reserch Institute (KEFRI) and identified the aphids as Pine Needle Aphids (PNA), Pine Wooly Aphids (PWA) and Black Pine Aphids (BPA). In his report the expert advised that the aphids be checked again at the peak of drought in September/October. However, there was rain in August of the same year and during inspection in October, the aphids were not seen. Symptoms of Pine Needle Aphids (yellowish ring on different parts of leaves) were observed again in March 2006 but neither infestations nor aphids were observed. Monitoring of the aphids in the plantation is continuing on a daily basis by using plantation patrolmen and during PSP measurements. Whenever a situation is noticed, an external expert is invited for assessment to appraise and give advice.

Pest Summary Mapanda Forest Project.

Since the project started, only symptoms of Giant conifer aphids namely; Pine Needle Aphids (PNA), Pine Wooly Aphids (PWA) and Black Pine Aphids (BPA) were observed in 2006 without any damage to the plantations. Field check ups show that in some areas of the young eucalyptus plantation there is stunted growth in *E. saligna* especially on hilltops and flat lands. In such areas the trees' heights range from 0.7 to 1.8 or 2.0 m. This might be due to hardpans in the area or poor nutrient absorption caused by immobility of the soil nutrients due to hardpans. In *E.globulus* plantations the trees have leaf damage. The damage might be caused by fungus leading to botching. These are circular dry spots on the leaves. In the *P. patula* stand symptoms of black pine aphids were seen although there were no disease infestations. Monitoring at MFP is also continuing in the same vane as at UFP.

3.7.9 Monitoring of Biodiversity:

Changes in bio-composition and fauna and their impacts to the existing ecosystems shall be monitored and recorded and protection of biodiversity shall be implemented as follows:

- *Organizing tree planting in areas with a gradient up to 42% (or planting of indigenous species on steeper slopes for conservation purposes) and protect areas above this gradient for monitoring vegetation changes and for safeguarding some of the native grassland.*

No tree are planted on land with a gradient above 60%.

- *Pockets of indigenous vegetation other than the grassland, predominantly in the valleys and gullies, shall be left intact and protected;*

Large areas of vegetation have been put into conservation. See maps below.

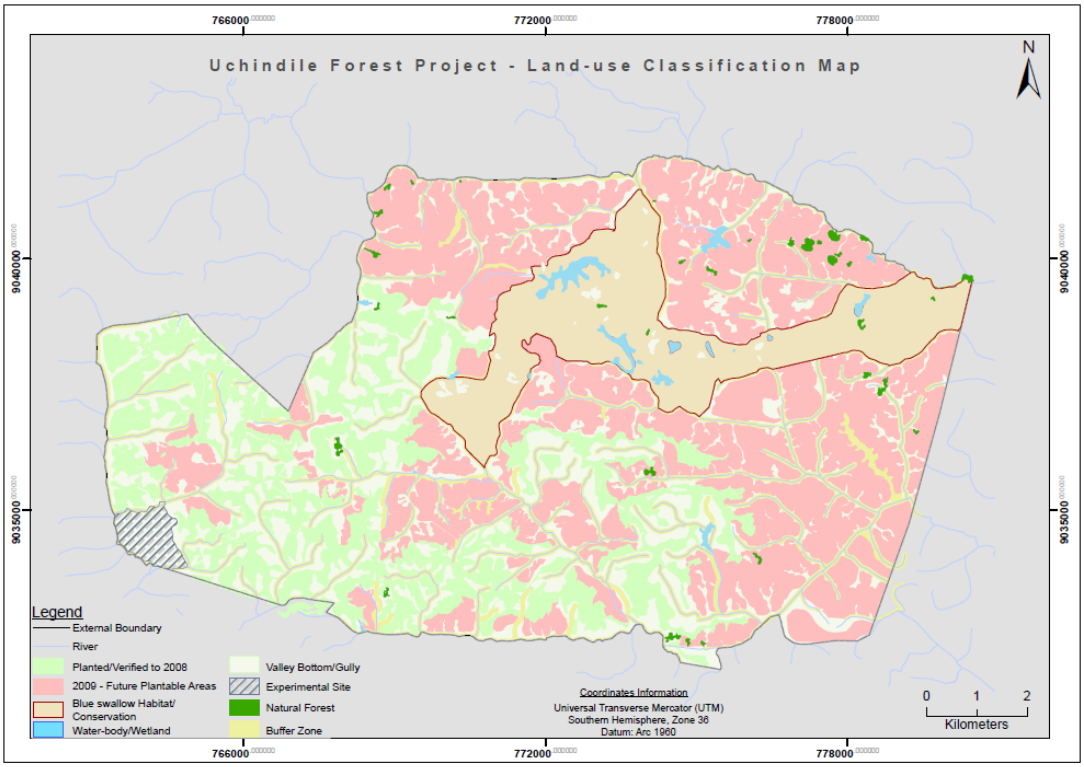


Figure 3-12: Uchindile Forest Project, showing planted area and other land use (2008)

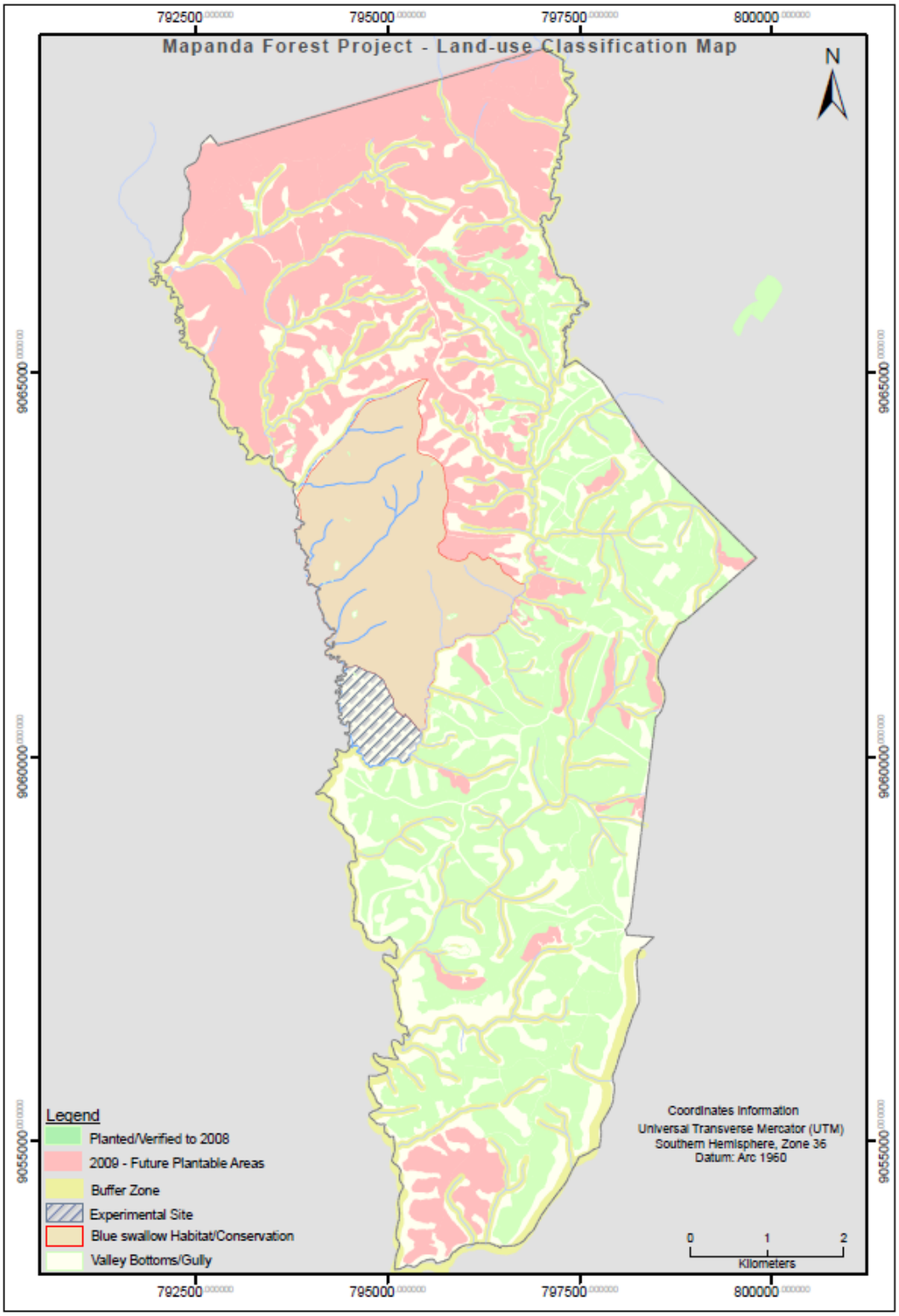


Figure 3-13: Mapanda Forest Project showing planted area and other land use (2008)

See maps in Figure 3-12 and Figure 3-13. In total 1698 ha hectares of land have been put into conservation/blue swallow habitat for UFP, and 66h ha for MFP. All valley bottom areas have been put into conservation, including hydrological buffer zones which adds up to 1402 ha and 981 ha, for UFP and MFP respectively.

- *A buffer zone of 30 metres will be respected along each stream and river as limits for plantations establishment for protection of water sources*

This has been complied with.

- *Areas containing original vegetation will be set aside and mapped as control for monitoring and studies on vegetation changes and to safeguard some of the native grasslands that may contain endemic or rare species.*

Figure Figure 3-13above illustrates the conservation areas for UFP and MFP. Within the boundary of the project area there are existing patches of naturally growing shrubs and trees, and vegetation cover, which are mainly observed along river banks, valleys and steep slopes. These are left as conservation areas so as to protect the areas from erosion by rainwater, as well as protect rivers and streams from any negative hydrological impacts from the tree planting activity. Any patches of natural species, water bodies, areas where RTE species have been observed, are left undisturbed for biodiversity protection reasons as recommended by EIA and ecological surveys.

- *Planting of water conserving species and fruits in valley bottoms and conservation and regeneration of these species shall be implemented for improved water levels as recommended in the botanical survey carried out by the Tanzania Tree Seed Agency in February 2006.*

This has been carried out, on a small scale.

- *Changes in the vegetation genetic resources, species and their habitats and migratory species if found to exist in the project area will be encouraged.*

The company do not promote the use of genetically modified organisms. Any use of GMO`s are strictly prohibited.

- *Endangered/rare/ threatened and endemic species shall be protected.*

Done. See map.

- *Burning of vegetation before planting and collection of firewood shall be prohibited.*

Burning of the vegetation will be prohibited throughout the project lifetime (as we cannot control burning prior to project commencement). Communities are encouraged to conserve the environment through education and community woodlot establishment.

- *The project participants will ensure protection of the breeding habitats of rare wildlife (birds) species*

The project proponents have created conservation zones in areas that favour RTE species, their breeding, nesting, roosting and feeding identified and recommended by WCST Ecological study, April 2008.

- *The project participants will implement the company fire protection plan in collaboration with the local community by reinforcing extension education, introduction of fire lines, and establishment of fire towers and look outs with well trained and equipped fire fighters.*

This is complied with and well-documented.

The project carried out trial planting with indigenous species. Table 3-22 below shows species and areas planted. Unfortunately all plantings have failed. Green Resources is endeavouring to better understand growing conditions and silviculture practises which will lead to survival of indigenous tree reforestation efforts.

Table 3-22 Indigenous Trees Planted and remaining at UFP/MFP

Year	Species	Common Name	Area Planted (ha)	Growing Conditions

2005	Khaya anthotheca	African mahogany	1,6	Low-land species
2006	Khaya anthotheca	African mahogany	17	Low-land species
2006	Spathodea campanulata	Kibobakasi	15,5	Growing 10-30 m high, does well in red or forest soil, but can also grow in black-cotton soil at altitudes of 1 500-2 000 m.
2007	Milicia excelsa	-	0,1	Common in wetter lowlands of Tanzania. Survives in the mature forest as a canopy tree. Found as a scattered tree, and grows with about 700 mm rainfall if access to supplementary source of water.
2007	Syzyigium spp	-	0,5	-
2007	Khaya anthotheca	African mahogany	1	Low-land species
2008	Olea europea/africana	-	-	Growing 10-15 m in height, but can also be a stunted shrub with a much-branched, rounded crown and grey-green foliage; widely distributed in dry forest and forest margins at altitudes of 750-3000 m asl.

3.7.10 Forest Stewardship Council (FSC) Surveillance Visit Findings

Compliance with the FSC standard is not a requirement under the VCS. However it is noteworthy to mention Green Resources Limited achieved certification under the FSC standard for the Uchindile and Mapanda Forest Project. The company has been monitoring the environmental and social impacts of the project in line with the requirements of the Forest Stewardship Council (FSC). In 2008 the project

achieved FSC certification demonstrating it has followed best practise in environmental and community aspects of the project.

3.7.11 Community Consultation and Assessment

Socio-economic surveys were conducted in the years 2003, 2005 and 2007 which were focused on acquiring comments on the socio-economic impacts of our Projects from key stakeholders surrounding GRL forests projects and from other identified stakeholders outside the projects:

- The exercise assessed the actual and potential impacts to local communities surrounding GRL project activities at UFP and MFP
- To acquire comments from other identified stakeholders on the performance and activities of GRL at UFP and MFP

The surveys have revealed the following issues:

- GRL projects have been improving in providing temporary and permanent employment to surrounding communities. This has improved incomes, micro-entrepreneurship and changed lifestyle and welfare of these communities. The villages have urged GRL to increase employment opportunities further.
- GRL has been involved in assisting villages in social services e.g. schools, health and infrastructure development e.g. roads
- The village recommended the issue of tree planting assistance by GRL for improved landscape and future incomes. A request for more seedlings supply has been made by majority of people as well as training and inputs e.g. seeds for raising own seedlings.

GRL has been giving support in the villages of Uchindile, Lugala, Kitete, Mapanda and Chogo which are in a close proximity to the forest projects at Uchindile and Mapanda. The company has as one of its objectives helping local people in improving their living standards and also bringing development in the surrounding villages. GRL has been making efforts in giving employment and other support to these communities. The plan now is to ensure that the programme is implemented and appraised for future plans.

Table 3-24 shows the programmes that were supported since 1997 until the end of 2008. The activities that were supported were chosen by villages from their 'parish development goals', which were selected through a democratic process through their village councils. Details of expenditure in relation to community support can be found in annex 3.

Table 3-23 Monitoring of Socio-economic and cultural issues/activities

MONITORING OF SOCIO-ECONOMIC AND CULTURAL ISSUES/ACTIVITIES			
Thematic Area	**Frequency**	**Type of Information**	**Baseline**
Public relation	Stakeholders' consultation meetings seminars/workshops have been done since the projects inception Local stakeholders' consultation has been done in all villages. These have been carried out twice a year since 2003 to 2008, These are recorded in the annual PRA reports. Complaints can be raised during the PRA studies once at the end of the year Complaint boxes are installed at the project area, any person inside and outside the company can raise his/her contention to the attention of the Managing Director and they will be reviewed by a special committee. The committee respects the principle of honesty and conscientiousness. The undertaken actions are monitored by the responsible person, in order to control their efficacy to solve the dispute. Any feedback about these undertaken actions is considered. The managing director records the actions and results in the Register of Dispute, being sure to note in the dossier the closing date	**Number of conflicts, court cases, grievances** In 2008 there were 3 stakeholders meetings conducted at Mufindi, Kilombero Districts, and Iringa Municipal where presentations were carried out on GRL operations; the meetings were attended by the top Regional and District leaders. -In 2008 complaints were raised by Uchindile community demanding the fulfillment of the promises made in 2005. The promises are now fulfilled and the complaint is resolved following a negotiation with the community -No court cases are recorded/raised .	**Labour laws** The project meets Tanzania and international labour laws. See Green Resources Green Resources Employees Handbook
Workers safety, health and occupation rights	Twice a year Training is conducted with workers on safety, health and occupational rights, twice a year each year since 2007	**Salary levels, safety measurements and disease control** List of Training: -ISO training on Environmental Management systems and Occupational Health and Safety -FSC Trainings	**Existing work regulations and labour laws** Green Resources Ltd is in compliance with Tz and international labour laws Green Resources Employees handbook

			outlines working conditions
Economic impact	PRAs have been carried out every year since 2007. In addition it is planned that the socio-economic questionnaire will take place once every three years. This has not taken place yet, and currently is in the design phase.	**Economic activity profile to villagers around the company economic gains by District through service charges** Mostly employed by the GRL, small business and small scale farming and livestock keeping in kraal.	**Economic performance prior establishment of the project** Now many villagers at the FP's work in the GRL plantations, work in their community woodlots, as well as continuing with subsistence agriculture
Effects on culture	This is assessed annually during the PRA. It will also be looked at in the socio-economic questionnaire which will take place once every three years	**Changes in behavior** -Changes have has been noted in terms of housing style where most people are building good houses made of brick and corrugated iron sheet. Environmental conservation awareness through: - awareness on rare and threatened species - fire damage awareness - community woodlots	Current state prior establishment of the project -Construction as mainly muddy houses covered grass - In the baseline scenario bush fires were common – often for the purposes of hunting. Communities have now reduced bush fires as they know it threatens their own woodlots and home, as well as the plantations.
Health occupation	Once a year	**Prominent diseases trend in STI and HIV/AIDS.** Information on prominent diseases trend in STI, and HIV/AIDS is generally provided during the plantation cerebration party. Health screening of workers is not currently carried out.	Health data prior to the established of the project does not exist

Table 3-24 List of Community Support Projects at Uchindile Forest Project

S/N	Indicator	Item	Status
1.	**Roads**	Maintenance of Roads and bridges joining Uchindile and Lugala village, Uchindile and Kitete Village.	Done
2.	**School**	Two classrooms at Uchindile primary school - Constructed	Done
		One classroom at Uchindile primary school – cost shared constructed	Done
		Two classrooms at Uchindile Secondary school – Constructed	Done
		One dormitory at Uchindile secondary school which can carry 48 students	Done
		Finishing support of Three classrooms at Uchindile secondary school	Done
3	**Welfare**	412,000 Seedlings support since 2002-2008/2009 to Uchindile and Kitete	Supported
		Village office and community hall at Uchindile village	Planed
4	**Health**	Medical equipment for Uchindile dispensary.	Supported
		Construction of Kitete dispensary	At roofing stage
		Construction of dispensary house attendant at Kitete	At roofing stage
5	**Sports and games**	Football equipment to Uchindile and Kitete village teams i.e. Footballs, jerseys and pumps.	Done
		Leveling of football ground	Done

Table 3-25 List of Community Support Projects at Mapanda Forest Project

S/N	Indicator	Item	Status
1.	Roads	16 km of road joining Mapanda and Chogo villages	Done
2.	School	1 classroom for Mapanda Primary school	Done
		1 classroom for Mtwivila primary school	Done
		2 classroom at Chogo primary school	1 done and 1 on finishing stage
		Additional of 1 classroom at Chogo primary school, to start soon	on going
		Teacher's house at Mapanda Secondary school	On finishing stage
		One classroom for Mapanda secondary school	Done
		Support of construction materials for Mapanda Secondary school.	Supported
3	Welfare	636,186 Seedlings support since 1998-2008/2009 to Mapanda and Chogo villages	Supported
		Construction material to Mapanda village office and Chogo.	Supported
		Village office and community hall at Chogo village	On foundation stage
		Village office and community hall at Mapanda village	Planned
4	Health	Medical equipment for Mapanda dispensary and Chogo dispensary	Supported
		Construction materials for Mapanda and Chogo dispensary	Supported
5	Sports and games	Football gears to Mapanda and Chogo village teams i.e Footballs, jerseys and pumps.	Done

Table 3-26 Population in villages around UFP

Village	**1994**	**1998**	**2003**	**2006**	**2007**	**2008**
Uchindile	1,020	1,103	902	1,060	935	933
Lugala	500	486	874	744	700	631
Kitete	314	419	357	214	450	162
Total	**1,834**	**2,008**	**2,133**	**2,018**	**2,085**	**1,726**

The trend shows that there is population growth in the villages surrounding the plantations.

Table 3-27 Population in villages around MFP

Village	**1998**	**2002**	**2006**	**2007**	**2008**
Mapanda	2,954	5,597	4,357	5,342	5,342
Chogo	100	1,200	1,600	1,200	1,779
Total	**3,054**	**6,797**	**5,957**	**6,542**	**7,121**

The trend shows that there is population growth in the villages surrounding the plantations. The decrease in year 2006 might be caused by the people shifting to other areas for reasons beyond our knowledge.

c). Fuel Wood

Due to the ages of the plantations being on the young stages, no fuel wood collection has been done so far. If acute shortage of wood fuel is observed in the area the company will grant permission to the local people to collect fuel wood from areas of the plantation where harvesting, thinning or pruning has been done. In the meantime the company is supplying seedlings to the local communities and training them to establish their own woodlots as a precautionary measure to prevent any anticipated wood shortage and raise their income from sales of timber and wood products.

4 Risk Assessment

The presentation of risk categories remains the same since validation of the PDD.

Risk Factors Applicable to ARR projects

Table 4-1 Overview of Risk Factors and Risk Rating

Risk factor	Risk Rating	Comment
Project longevity/Commitment Period		
Long-term commitment with harvesting	Medium	Project lands are under 99 year leases, and will operate under FSC certifications
Medium-term commitment with harvesting	High	
Short-term commitment with harvesting	Fail	
Long-term commitment (i.e., many decades or unlimited) with no harvesting	Low	
Long-term commitment with no harvesting in politically unstable countries	Medium	
Medium-term commitment (i.e., a few decades) with no harvesting	High	
Short-term commitment with no harvesting	Fail	
Ownership type		
Established NGO or conservation agency; owner-operated private land	Low	
Rented or tenant-operated land	Medium	Land is under 99 year lease from the national and local governments. The land is now being used as collateral again a loan from the IFC
Uncertain tenure but with established user rights	High	
Uncertain land tenure and no established user rights	Fail	

Technical capability		
Proven technologies and ready access to relevant expertise	Low	Necessary forest establishment and management technology and local in-house expertise have been employed– as demonstrated by successful project implementation and management since 1998.Furthermore, GRAS subsidiaries in Uganda (since 1996) and Mozambique (2006) also implement forestry and carbon projects with in-house staff
Technologies proven to be effective in other regions under similar soil and climate conditions, but lacking local experimental results and having limited access to relevant expertise	Medium	
Financial capacity		
Demonstrable backing from established financial institutions, NGOs and governments	Low	Project backed by private sector investors; parent company is well capitalized and has access to other sources of finance for expansion. Loan from IFC secured and loan from Norfund under negociation
No external financing	Medium	
Management capacity		
Substantial previous project experience (≥ 5 projects) with on-site management team	Low	Project in operation since 1998; on-site management team in place since 1997. The company policy is to employ predominantly

		senior local management with a proven track record in planting, forestry and carbon operations
Limited project experience (<5 projects) with on-site management team	Medium	
Limited project experience (<5 projects) without on-site management team	High	
Future income		
Appropriate management plan and financial analysis include future income to finance future management activities (e.g. carbon finance to be used for project management, tending operations, etc.)	Low	Yes, in place
Future costs and income not considered	High	
Future/current opportunity costs		
Alternative land uses are unlikely to occur in the future	Low	Past and likely alternative use is unmanaged grassland – with no related income
Project is competing with other land uses that are likely to become more attractive in the future	High	
Endorsement of project or land-use activity by local or national political establishment		
Endorsement given and not likely to change in the future	Low	
Endorsement given but may be subject to change in the future	Medium	Bottom to top process used in Tanzania with approval starting from the Village elders to the President
No endorsement given	High	

Risk of social instability

Social structure in the project area and wider region

The studies analyzed the pre-existing conditions of the communities in the area. The project area itself was largely abandoned prior to the projects inception. This dates back to 1975 and Tanzania's historic move towards 'villagization' under 'Ujamaa Village Programme' in which families living in rural isolation were moved into villages to live together and share common goods and properties. As such very few families were reported living in the area before the project commenced, as most of them were living in the

villages of Uchindile, Lugala, Kitete, Mapanda and Chogo (or other villages namely Uhafiwa and Ihimbo). The main land use was agriculture with limited livestock grazing. The economy was based on smallholder agriculture where crops were grown for food and the surplus sold.

The project is located on the land of the "Hehe" people. The Hehe tribe is an ethnic and linguistic group based in the Iringa Region in south central Tanzania. The Hehe began as a number of chiefdoms made up of mixed people who were in some instances related to one another. Historically, no chiefdom had over 5 000 people. In contemporary Hehe society, the political authority of chiefdoms has been replaced by locally elected chairmen and village councils. In 1994 the Hehe population was estimated to a number of 750.000[14]. The Hehe society is comprised mainly of Christians. The largest town[15] in the region is Mafinga, and had in 2002, a population of 33 669. The main employment in the region is agriculture, forestry, and Tanzania`s largest tea industry.

Migration[16]

Given the project started more than 10 years ago Green Resources is able to quantify the population growth and inward migration that has been experienced in the communities around the project area. GRL uses government census data for determining the population status for the villages.(Source: Tanzania National Census 2002 and survey's carried out by village officials and submitted to the district post 2002) This data is also available at each village office. At Uchindile since the project started, the population growth has increased, but it does not indicate a significant increase as a result of immigration but rather as a result of natural growth. In contrast at Mapanda village there has been quite a large increase in population. This can be explained by the Kilhansi hydropower station near Mapanda, which had the peak of its establishment operations in the early 2000's. The power station has employed many people from villages around the district. Some of these people were stationed at Kihansi, but also in other villages where activities such as road construction were taking place. This explains the increase in population in Mapanda Village, rather than the reforestation project which prioritises jobs for the long term population of the village in accordance with the land agreement.

Table 4-2: Population dynamics - Uchindile Villages

Village	1994	1998	2003	2006	2007
Uchindile	1,020	1,103	902	1,060	935
Lugala	500	486	874	744	700
Kitete	314	419	357	214	450
Total	**1,834**	**2,008**	**2,133**	**2,018**	**2,085**

Table 4-3: Population dynamics - Mapanda Villages

Village	1998	2002	2006	2007

Mapanda	2,954	3,969	4,211	4,274
Chogo	1000	909	964	979
Total	**3,054**	**4,878**	**5,175**	**5,253**

Institutions

Each village has an elected chairman and a village council. The village council consists of 25 representatives. Elections take place every 5th year, in which the following are elected: 1. Chairman (one representative), 2. Hamlet leaders (number depends upon number of hamlets in the village), All people above 18 years have voting right. Representatives for the different village committees are being elected; i.e. health, environment, financial, social and planning committee.

Within villages there are different groups and societies. Some institutions present are schools (nursery/primary/secondary), religious societies; both churches and mosque. Other organizations present are youth social clubs, women groups and also some of the villages have their own football teams.

Local stakeholders

The villagers have been involved since the early stages of the project development, and are continuously informed about project activities and plans. Stakeholders have the opportunity to have their say and give suggestions. The project has carried out extensive stakeholder consultation[17] which has shaped the projects design. Stakeholders were consulted through meetings, semi-structured interviews, and focus group discussions to capture information pertaining to the project. Participatory Rural Appraisals were carried out in the villages to identify the problems, views and concerns of local stakeholders and incorporated into the project design and management plan. Villagers employed by GRL are trained on environmental conservation, diseases, pests and other risks.

Table 4-4 Overview of Consulted Stakeholders.

Stakeholders at local level:	Name:
Uchindile Village Chairman	Humphrey Matimbwi
Uchindile Station Master	Mr. James
Uchindile Dispensary	
Mapanda Primary School Head Teacher	Calvin George
Lutheran Church Priest	Ole Kimaia
Chogo Primary School Assistants	Joseph Kinyunyu Robinson Lufyagile
Chogo Dispensary	Dr. Sanga
Chogo Village Chairman	Mr. Kitinusa

Chogo Village Executive Officer	Ayubu Kiwelu
Stakeholders at National and District level:	
Tanzania Tree Seed Agency (TTSA)	
Regional Water Supply Office	
Regional Forest Officer – Iringa	
Tanzania Electricity Supply Company (TANESCO) – Mafinga	
National Social Security Fund (NSSF) – Mafinga	
Tanzania Revenue Authority (TRA) – Mafinga	
District Commissioner – Mufindi	
District Executive Director (DED) – Mufindi	
Natural Resources Office – Mafinga	
Land Development Officer - Mafinga	
Mufindi Environmental Trust – Mafinga	
Sao Hill Forest Project (SHFP) - Mafinga	

Once a year, there is a celebratory day at each of the plantations. On this day in addition to providing a feast and entertainments, the project informs the community about evaluation and achievements of the project in the year accompanied by more training on fire prevention and diseases. Government leaders and other stakeholders at the district level are also invited to this event. Research Institute representatives as well as students from Sokoine University of Agriculture are also invited. It is desirable that the information they acquire shall be disseminated to other regions over the nation.

Community Benefits

As part of the agreements with the villages certain commitments have been made in relation to the support that would be provided to the village. For GRL improvements to the livelihoods of local communities is a priority. Key areas of focus for community support are education, health and others proposed by the community from their Parish Development Goals.

Green Resources has developed a community monitoring survey which will be administered every 3 years. Variables to be monitored include poverty level, infrastructure, food security, housing, education and health services. The study shall involve representative groups within the community, from the poorest of the poor to those in better standing in the community. The major objective of monitoring communities is to monitor the impact of the project on community livelihoods and well being. The community monitoring plan will be executed in 2009.

The community has been closely involved since the projects inception when the project participants were applying for land. The project followed land acquisition procedures as guided by the Government of Tanzania under the Ministry of Lands and Human Settlements and the Land Act.

Table 4-5: A brief summary of GRL community support - Uchindile and Mapanda Villages.

Aspect of improvement	Activity/support/ Benefit
Education	- Supporting materials for building primary/secondary schools and teacher`s houses since 1998 - training
Health status	- building of dispensaries - providing medical equipments to hospitals - HIV and malaria training
Housing	Better economic conditions for villagers have impacted their housing; building bricks, furniture etc.
Women	Improved the female status by employment and giving equal opportunities within GRL
Infrastructure	- Improved accessibility by bridges and road constructions/improvements
Environment	- Soil moisture conservation - Training on pests and diseases, and environmental awareness - Providing free seedlings

In addition to the support given to the communities described above, 10% of the revenues from the carbon credits will be given to support community projects once carbon credits are commercialized; this shall further ameliorate socio-economic conditions among other things. Tree planting and education campaigns shall raise awareness amongst the communities to protect their environment against fires (communities shall not start fires as they also have their own woodlots to protect). Education shall be disseminated to the communities to protect vulnerable species identified during the study.

Socioeconomic benefits are brought to the native rural poor: through project activity villagers have been provided with regular “around-the-year” employment. Training on farming machineries and techniques, land-use planning, management and conservation is provided. The project has also contributed to the development of infrastructure (roads, buildings, and water supply and communication systems).

Environmental benefits are delivered through creating consciousness among the villagers about effective utilization of their land, and reduction of land degradation through fire. The project inspires and provides resources for villagers to create their own community woodlots on their land. The project also promotes 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 species and fruits.

Fire Risk

Fire has been assessed to be one of the main threats to the Uchindile and Mapanda Forest Projects; however, there are established strategies for preventing and fighting fire in plantations, which are being applied at Green Resources Ltd's operations. The fire season extends from July to December, which is the dry period of the year. UFP has recorded 8 fire incidences and MFP 2 since their inception in 1997 and 1998 respectively.

Details of the incidences are indicated in table 4-6 and table 4-7 below.

Table 4-6 Fire occurrence data for UFP

Year	Description of event	Area of forest damaged (ha)
1997	Year of first planting with no incidence	-
September 1998	Fire got out of control from a child of the Village preparing farm on village land	55
October 1999	During controlled burning, fire crew unable to control the fire	54
January 2000	Lightening	59.93
2001	No incidence	-
2002	No incidence	-
October 2003	Arson	115
August 2004	During controlled burning, fire crew unable to control the fire	661.05
2005	No incidence	-
2006	Arson	1.5
December 2007	Unknown	22
December 2007	Lightening	11

2008	No incidence	-
2009	No incidence as yet	-
Total		979.48

Table 4-7 Fire occurrence data for MFP

Year	Description of event	Area of forest damaged (ha)
1998	No incidence	
1999	No incidence	
2000	No incidence	
2001	No incidence	
2002	No incidence	
2003	No incidence	
2004	No incidence	
November 2005	Fire got out of control from neighboring farmer preparing his farm	188
December 2005	Fire got out of control from by farmer preparing his farm	198
2006	No incidence	
2007	No incidence	
2008	No incidence	
2009	No incidence as yet	
Total		386

Strategies for mitigating fire risk

Green Resources is implementing a comprehensive fire prevention strategy, which is multifaceted.

The prevention plans take into account traditional uses of fire, based on laws or regulations restricting fires and involve local community leaders and organizations. It also includes an emergency plan in case of fire outbreak, to eliminatingand containing fire outbreaks. The following strategies are currently employed for the two plantations:

1. *Compartmentation and sub Compartmentation*

Plantations is divided into compartments and sub compartments of manageable sizes where sufficient buffers(7.5 – 8m) are maintained to isolate operations and problems associated with each polygon.

2. Roads

In addition to the compartment and sub-compartment land marks, adequate road networks within the plantations also provide accessibility and easy mobilization of resources and equipment in the event of fire.

3. Fire breaks

Fire lines are put in place to either separate or bisect compartments. Some fire lines coincide with roads and when they do not, they are graded, and/ or hand screefed and burnt to about 15m wide for internal fire lines. For external boundaries the firebreak varies from 30 to 60 m depending on the vulnerability of the area.

Fire Lookouts and Fire towers

UFP has two fire towers and one lookout which are inter-visible with some of Sao Hill Forest plantations and plans to construct one more fire towers as planting advances. MFP has one fire tower and plans to construct one more as planting proceeds. These points are manned for 24 hours per day in 8 hours shifts i.e., 3 persons a day. The lookouts and fire towers are provided with the communication systems such as base radios (for fire towers), walkie talkie radios and fire fighting equipments.

Fire Patrolling

A man is always kept on duty at the plantation office, fire towers, lookout and Kitete range (in the case of Uchindile). Fire patrolmen are set as follows: At UFP 6 people in the plantation which will be increased as planting increases, and at MFP 4 patrolmen which will be increased as planting expands. The patrol team are provided with bicycles and/or motor bikes, walkie-talkie radios, back pack pumps, machetes, etc. and are on duty for 8 hours.

4. Mapping

The preparation of effective fire plan maps covering all firebreaks, fire towers, lookouts and natural features is underway for all company plantations. Maps have strategic and tactical use in helping to locate fire occurrences so as to know the convenient route to access and the best approach to tackle them.

5. Community involvement in fire reporting and fighting

A good cooperation is maintained between the villager community around the project areas and the forest workers/staff. Chains of command have been established so as to provide quick responses to fire messages. In GRL, communication has been made easy through radio calls and walkie-talkie receivers. Sirens will be installed at the project offices and others mounted in fire vehicles. Relevant village government offices will also have sirens to alert communities. Villagers will be asked to report fire incidents to responsible persons.

6. Training fire fighters

Volunteer fire fighters, standby crews, fire tower men and any potential groups are given some training about fire prevention/fighting. Trainings are conducted before the dry season usually around April. Controlled burning is also another opportunity for training standby crew and other workers, which has been identified as a major cause of fire in plantations if poorly managed.

7. Fire fighting tools and equipment

Fire fighting tools and equipments have been put in place. These include back pack pumps, fire beaters, walkie-talkie radios, binoculars, water tanks, motor grader, water bowsers and tractors to pull bowsers, trucks to transporter fire fighters, etc. In case of large fires, more people involved will mean more tools and equipment have to be deployed.

8. Recording and replanting of damaged area

All fire incidences are properly recorded with detailed information regarding the incidence including cause/source of fire, species affected, areas destroyed, etc. In addition, plans are immediately put in place to replant all damaged areas if 30% or more of the area is destroyed.

9. Working with Local Community to Reduce Fire Risk

GRL has been working with community to provide training on the risk of fire, and encourage them to reduce their practices of starting fires for hunting purposes. This is also in their best interests as it puts not only the GRL plantations at risk, but also their own community woodlots.

Management system.

UFP and MFP projects have in place a documented management system, capable of identifying risk with and established targets for reducing them. Procedures have been developed and responsibilities are well assigned with internal auditing, reviews and training in place.

Internal Audit Procedures for fire prevention and management:

Fire training is conducted annually by the fire brigades from Iringa. The plantation managers conduct routine inspections of the fire crew regarding the training that was given by the brigade. He also inspects the fire fighting tools and equipments and checks the fire lookouts are being properly manned. The manager inspects early controlled burning – to check that roads (when roads also serve as fire breaks) and other fire breaks are managed in a proper and timely manner as described in the management plan. He also inspects the standby fire crew and working tools and equipments are in proper working condition.

The GRL planning manager conducts internal audits as he visits the plantation to check what is written in the fire control plan does take place.

The fire plan has been reviewed to include new fire detection and reporting technique that uses compass direction translated into local language for easy communication. The fire crew can tell the direction and distance of where fire is burning and so help to direct resources to the right direction quickly.

Conclusion

Based on the above analysis and in light of our rapidly advancing fire fighting capability over the last three years, which virtually saw no incidence of fire, it is evident that fire risk likelihood is likely to be reduced in the future. The expected risk class for the project, in terms of risk fire, is therefore deemed medium.

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Natural Disturbances: Pest and Diseases

Description of the possible pest/diseases for plantations in the region.

The following aphids are found in Kilimbero and Mufindi regions and pose risk to plantation: Pine Needle Aphids (PNA), Pine Wooly Aphids (PWA) and Black Pine Aphids (BPA). Since planting started at UFP and MPF, aphids have only been observed at UFP, which was in 2004 in some of the pine stands. At MPF Black pine aphid were observed but there has been no damage to the stand observed up until the end of the monitoring period.

Description of pest/disease outbreak and how they were managed:

Uchindile Forest Project.

Giant Conifer aphids were observed in some of the pine plantations in July 2004. An expert was invited from Kenya Forestry Reserch Institute (KEFRI) and identified the aphids as Pine Needle Aphids (PNA), Pine Wooly Aphids (PWA) and Black Pine Aphids (BPA). In his report the expert advised that the aphids be checked again at the peak of drought in September/October. However, there was rain in August of the same year and during inspection in October, the aphids were not seen. Symptoms of Pine Needle Aphids (yellowish ring on different parts of leaves) were observed again in March 2006 but neither infestations nor aphids were observed. Monitoring of the aphids in the plantation is continuing on a daily basis by using plantation patrolmen and during PSP measurements. Whenever a situation is noticed, an external expert is invited for assessment to appraise and give advice.

Mapanda Forest Project.

Since the project started, only symptoms of Giant conifer aphids namely; Pine Needle Aphids (PNA), Pine Wooly Aphids (PWA) and Black Pine Aphids (BPA) were observed in 2006 without any damage to the plantations. Field check ups show that in some areas of the young eucalyptus plantation there is stunted growth in *E. saligna* especially on hilltops and flat lands. In such areas the trees' heights range from 0.7 to 1.8 or 2.0 m. This might be due to hardpans in the area or poor nutrient absorption caused by

immobility of the soil nutrients due to hardpans. In *E.globulus* plantations the trees have leaf damage. The damage might be caused by fungus leading to botching. These are circular dry spots on the leaves. In the *P. patula* stand symptoms of black pine aphids were seen although there were no disease infestations. Monitoring at MFP is also continuing in the same vane as at UFP.

Measures in place to minimize/mitigate disease attack and pest outbreak.

Forest health is being monitored constantly through the following procedure:

The monitoring team that is responsible for data collection in the Permanent Sample Plots (PSPs) is also responsible for observation and detection of symptoms of pests and diseases as one of the monitoring parameters. Patrolmen are used to check the forest diseases and pests during the normal or routine works. When diseases or pests are detected, they are reported immediately to the Project Manager and the following is the chain of response:

The Patrol Men report the incidence to Project Manager

The Project Manager checks the situation and reports it to the Head Office

From head office the Research Manager goes to the field to assess the situation of the infestations and informs Management of the steps to be taken

If the infestations are not severe, the research manager informs management while more follow up of the disease is conducted

If the infestation is severe the Research Manager reports to Management of the effect of the infestation and external expertise is sought as remedy to the situation.

Usually Tanzania Forest Research Institute (TAFORI) and/or Kenya Forestry Research Institute (KEFRI) experts (Entomologists or pathologists) are contracted to check the diseases or pests attacks.

To report and document disease outbreak, a special form called “Forest Health and Safety Monitoring” designed for that purpose is used. The form is also applicable for fire incidence reporting. Trained patrolmen are used to check the forest health during their routine work. When they sight any abnormality in the forest they report it to the project manager, who also goes to the place of the incident to assess the situation there. If it is found to be a serious case the project manager reports the occurrence to the head office at Mafinga. Then either a team from head office or the research manager goes to the respective project to assess the situation and if it is found to be a serious one he advises management to call in external experts to check the situation. The experts will then assess the situation and advise management accordingly. A document named ‘Disease Control System for GRL Plantations’ has been developed where the protocol for reporting and responding to disease is designed.

Overall the risk category is considered to be low, and the probability of incidents to be 10%. Following 10 years of implementation of the forest project at UFP/MFP there have been no incidences of pest and disease outbreak which has destroyed, or negatively impacted the growth of the forest stands. The only pests/ diseases which are know to occur in the area which effect forest plantations are described above, and none of these have a devasting effect on forest stands, rather they might affect the growth of the forest stand in the short term, until they are identified and treated.

Natural Disturbances: Extreme Climatic Events

In 2001, the Intergovernmental Panel on Climate Change (IPCC) did an assessment on the consequences of climate change and climate variability, namely the Third Assessment Report (TAR). The report stated that Africa is highly vulnerable to the various manifestations of climate change. This vulnerability assessment to climate change is marked by high uncertainty. Table 1 summarizes the impacts of climate change on Africa.

Table 4-8: Summary of the most critical climate change impacts on Africa assessed by IPCC TAR

Affected systems	Impacts
Land degradation	- Arid and semi-arid areas are likely to increase in northern Sahara and southern Africa: by 5 – 8 % - Arid and semi-arid areas are likely to increase (desertification).
Crop yield	- By 2020: yield of rain-fed agriculture could reduce by 50 %
Water	- Increase in runoff and flooding - Increase drought risk - Impacts enhanced by poor water management - Water stress
Natural resource management and biodiversity	- Forest ecosystems: species loss, extinction, dramatic shift or changes in species range and increased fire occurrence - Forest net primary production to decline in the long term
Human health	- Temperature rises: increased vectors of diseases such malaria - Sea level rises: increased cholera epidemics and other waterborne diseases

Source: IPCC Third Assessment Report, ch 10, 2001.

However, these impacts are based on Africa as a whole and are not specifically tailored to each country. The diversity of African climates, high rainfall variability, and a very sparse observational network make precise predictions of future climate change difficult at the sub-regional and local levels. Given the IPCC TAR assessment we do recognize the importance of understanding the risks from climate change impacts to our forest projects. Possibly future climate change impacts to the region: erratic rainfall, prolonged droughts and severe winds etc. might affect growth and performance of trees. However, adaptive measures are always available through well-trained staff.

The probability of an extreme climatic event in the area which is damaging to the forest stands is 10 %. It is anticipated that the species being planted will be able to tolerate the range of predicted changes anticipated by the IPCC[18] due to wide genetic base. The pine and eucalyptus species which are being planted are quite resilient to probably changes in rainfall and temperature. The project is planting species which are robust in terms of adaptability and will be tolerant to changes in temperature and precipitation. The plantations are located in areas classified as dry forest with rainfall less than 1500 mm per annum. Most of these areas have short rainy season and long dry season with erratic rainfall patterns. The soil in these areas are mostly deep and fairly well drained but with good water holding capacity. The Eucalyptus species are known to have a deep root system. The species have survived in the environment for many decades. The species have also shown ability to withstand a long dry season of 2-3 years[19]. Hence, the potential to resist non-permanent drought at maturity is high, while the chance of permanent drought under the present climate change impact trend is unlikely in the next 20 years.

Natural Disturbances: Probability of geological risks

The African Plate is a tectonic plate which includes the continent of Africa, as well as oceanic crust which lies between the continent and various surrounding ocean ridges. This plate is rifting in the eastern interior along the East African Rift. This rift is a part of the larger Great Rift Valley – extending from Lebanon in the north to Mozambique in the southeast.

The East African Rift zone includes a number of active as well as dormant volcanoes[20]. As far as Tanzania is concerned the country is geographically located in a seismic zone and earthquakes occur periodically. The Ol Doinyo Lengai volcano is the only active volcano in Tanzania, and is located in the north close to Arusha (Geo Science World 2002).

There is no record of earthquake incidents, volcanic eruptions or landslides in the southern highlands of Tanzania during the last 100 years. However, minor mudslides on steep slopes as a consequence from heavy rains at the start of the rain season are anticipated but not of any major importance for the project activities.

Project Longevity and Commitment Period

The project has a long term commitment to reforestation. Reforestation and maintenance of productive and healthy plantations will take place at the UFP and MFP Forest Projects over 99 years which is the length of the lease for the land. As such covers the entire length of the carbon project It is possible Green Resources will even be able to renew its lease beyond 99 years to keep the land reforested in perpetuity. Green Resources will reforest following harvesting, which will take place on after 11 years for pine and 13 years for eucalyptus.

Land ownership type

A summary of the land acquisition procedures in Tanzania as set out by government through the ministry of lands and human settlements, Tanzania

Mainland Tanzania is divided into 22 regions. Each region is administered under districts, responsible for developing a District Investment Profile, which is made available to investors. The District is in charge of managing the Wards and Villages within its district boundaries.

All land is owned by the villages, divided into two main categories: general land, which is land that can be transferred for investment and; village land for own use. Each village is now required by the government to have its own Land Use Plan to ensure that all activities are allocated enough area and to ensure security of land tenure.

General Village Land can be given out for investment but should not be more than 33% of the total village land area. The following steps are followed in the acquisition of land by investors.

STEPS USED BY AN INVESTOR WHEN ACQUIRING LAND IN TANZANIA:

1. The investor sends an introductory letter to the District Commissioner (showing the company name, registration, total area requested in the district and land use). Copies of the letter are given to the District Executive Director, District Land Officer, District Land Surveyor, District Natural Resources Officer, District Agricultural Officer and the District Planning Officer (DPO) (has copies of the District Investment Profile). From the District Profile, the DPO will advise the investor of suitable land as per request.

2. The investor further submits an application letter to the Village Government Authority (VGA) through the Village Executive Officer (VEO). The letter will clearly state the total amount of land requested, company name, land use plan, etc.

3. The VGA will respond with comments/suggestions on the land use plan, area available and issues of community development. A discussion at this stage is initiated and an agreement reached on the suggested comments. Following this, the investor is invited to the Village General Assembly.

4. The Village General Assembly meeting has to be attended by the District Land Officer, Natural Resources Officer, District Land Surveyor, District Agricultural Officer, Ward Councilor, Ward Executive Officer, Division Secretary. A meeting is considered to have a quorum if 50% or more of all adults above 18yrs living in the village attends the meeting. (NB: Population figures are available at the DED office): The following are addressed in the Village General Assembly meeting:

i) The VEO reads the application letter,

ii) Minutes of the VGA meeting are read outlining the conditions/suggestions accepted by the would-be investor as well as how the project and community projects will be implemented,

iii) Discussions and/or amendments as the case may be, development priorities setting, etc., are carried by the assembly,

iv) If an agreement is reached, a Village Land Allocation Committee (VLAC) is formed consisting of a maximum of 8 people, who will show the investor the land boundaries,

v) Minutes signed by all the villagers/participants and submitted to the DED and a copy to the investor.

5. A visit is then made to the area and an initial survey done producing a Sketch map and a rough estimate of the area. The visit is made by members of the VLAC, District Land Surveyor & the investors own Land Surveyor.

6. Following this initial survey, a District Valuer (DV) is sent by the District Land Officer to do a valuation of the land for compensation purposes. The visit is normally done in collaboration with the VLAC, who will confirm ownership of any properties in the land by the villagers. A valuation report will be given to the investor, who will be required to make payment to the District Land Office. The DC and DV in cooperation with the VLAC will then pay compensation to the displaced villagers/properties/crops. A receipt is then given to the investor as proof of compensation.

7. Following this, the investor then submits a letter to the DED copied to the DC, requesting that the District Land Acquisition Committee (DLAC) meet to discuss the application. (Minutes of all the above meetings as well as the sketch map and valuation report should be attached)

8. Following the DLAC meeting, a letter is written to the investor allowing for a full land survey. For land areas of more than 500ha, an approval has to be sought from the Commissioner of Lands requesting for a permission to survey the area. The letter has to be certified by the DED and District Land Officer, with attachments of the District Land Use Plan, business plan by the investor, a sketch map as well as minutes from all the above meetings.

9. Once permission to survey is granted, the job is given to a government registered land surveyor, who will after the survey, produce an approved survey plan (boundary map showing all the boundaries, beacons, etc.). NB: Following this, the investor can at this stage i) commission an ENVIRONMENTAL IMPACT ASSESSMENT, ii) start using the land as per the business plan.

10. The approved plan is then taken to the Land Officer for approval who then forwards it to the Commissioner of Lands to issue an offer. A letter of offer is issued and countersigned by the company Director or Lawyer. NB: The letter of offer should reflect the application and approved plan.

11. The last stage of the process is the submission of the offer to the Commissioner for Lands for a title deed. For forestry activities a title deed is normally valid for 99 years.

The main reference to this document is the Village Land Acts No.5 of 1999.

GRAS and its subsidiaries are receiving a substantial loan from the International Finance Co-operation (IFC) to fund expansion of industrial and energy operations in Tanzania. GRAS and its subsidiaries have agreed to give UFP/MFP land title as collateral against the IFC loan. The acceptance by the IFC, and set up a ‘mortgage of right to occupancy’ for the land at UFP/MFP demonstrates the strength of the land title agreement held by GRAS.

In conclusion Green Resources feels that aspects of the ownership type imply a low risk - because of the complex, and thorough land acquisition process that must be followed, by both the district, national government, community and Greenresources Ltd to acquire the 99 year lease - however, the risk classification in relationship to land ownership type for this project, inline with the VCS' risk tool, is medium based on the fact that the land is tenant operated.

Financial Capacity

Due to equity private placements, the company is currently enjoying good solvency, guaranteeing that its long-term expansion plans and targets can be accomplished.

The following equity investments have been made during 2008 and 2009:

5.12.2008 equity private placement $ 22.7 millions by Phaunos Timber Fund

5.12.2008 convertible loan of 9.7 million by Phaunos Timber Fund

30.1. 2009 $2.18 m equity private placement

Please see enclosed press releases for further information, and also confirmation document from Price Waterhouse Coopers, the company auditors.

Equity capital of the company in March 2009 stands at: NOK 844 million. (see page 68 of company annual report) This shows last year's shareholders and equity and include that as well.

In addition the company has secured a loan from the International Finance Corporation (IFC) and is in the latter stages of discussions with Norfund to secure further investment.

Management Capacity

Green Resources has a well qualified and experienced management team in place to ensure that the UFP and MFP are implemented effectively. The company has senior local management with a track record in planting, forestry and carbon operations which are also supported by the management team at GRAS, who interact with them remotely, and visit the plantations every few months.

Below are the details of GRAS and local management team in place to run UFP and MFP.

Table 4-9 GRAS and GRL Project Management Team

Name and Job Title	**Summary of responsibilities, education and experience**
Mads Asprem *Managing Director GRAS*	Responsibilities Founder of Green Resources in 1995. Chairman 2004-6, Vice Chairman since 2006. Took over as Managing Director of Green Resources in 2006. Education: BSc in Economics Wharton School, USA, 1982. MBA University of Chicago, 1987. Work Experience: First VP, equity analyst and head of the global forest products and paper research team at Merrill Lynch 2000-2005. Managing Director and head of forest products and paper global research team of Morgan Stanley 1991-2000. Equity analyst CSFB 1990-1991.
Olav Bjella, Director *Forest Resource Management GRAS*	Responsibilities: In charge of the technical plantation development including support functions as seed procurement, nursery development, research, mapping, inventories and monitoring. Also in charge of FSC Certification, biological assets valuation and plantation reporting to the CEO and Board of Directors. Education: M.Sc. from the University Life Science in Norway from 1990 Work Experience: 20 years management and consultancy experience from Norway and East Africa.
Jenny Henman *Carbon Certification Manager GRAS*	Responsibilities: Oversees the carbon certification process for GRAS. This includes managing the research and writing of PDs, the validation process, implementation of monitoring plans and reporting, and verification. Education: Jenny holds a Masters in Environmental Studies from Brown University, USA, and a BA (Hons) in Geography from Durham University, UK. Work Experience: 5 years experience in development of forestry carbon projects and certification.

	Joined GRAS in June 2008 Sustainable Forestry Management (SFM) - Sustainable Development Programme Manager 2007-2008. The Nature Conservancy – Climate Change Associate 2004-2006 Research Institute of the Peruvian Amazon – 2003.
Maria Spink *Carbon Markets Manager GRAS*	Responsibilities: Joined GRAS June 2007 with responsibility for the Carbon Certification team, and sale of carbon credits. Education: MSc in Economics and Politics at the School of Economics, Helsinki Post Graduate Diploma in Geneva Work Experience: 1983-85 Assistant Lecturer at the School of Economics in the Department of Economics 1985-1990 capital markets group at Union Bank of Finland, Helsinki 1990 -2007 worked in capital markets and investment banking in London, mainly in positions related to Nordic client coverage
Jakob Sandven *Inventory and Monitoring Manager GRAS*	Responsibilities: Inventory and monitoring (costs, growth, etc,) of all our GRAS plantations in East Africa. Education: Msc in forestry science form the Norwegian University of Life Sciences. Masters research into plantations and growth and yield models in the Southern Highlands of Tanzania. Work Experience: 4 years in the Norwegian Army as an officer
Moses S. Ngegba *Carbon Manager GRL*	Responsibilities: Coordinates and supervises carbon certification processes for Green Resources in Tanzania including CDM, CCBA and VCS. Activities involve preparation of documentations relating to carbon certification including compilation PDs, preparation of PINs and general management of staff. Education: PhD Forestry, majoring in agroforestry and sustainable agriculture and MSc Forest influence and productivity- Sokoine University of Agriculture, Tanzania; BSc Agriculture- University of

	Sierra Leone Work experience Joined GRL- Tanzania- January 2008 Director of Community Development: Assemblies of God Church, Tanzania, 2006 -2007 Research Fellow: Sokoine University of Agriculture, Tanzania (1999 – 2005) Conservator of Forest: Division of Forestry, Ministry of Agriculture and Forestry, Government of Sierra Leone (1994 – 1998) Project Manager:- Bread of Life Project, Freetown, Sierra Leone (1992 – 1994)
Aloyce Kimaryo *Project Manager* *Uchindile Forest Project, GRL*	Responsibilities: Manages human resource and coordinates project operations and preparation of documentations pertaining to forest management of UFP. Education: BSc Forestry- University of Dar Es Salaam and M.Ph from Bangor, University of Wales. Work Experience: Joined GRL July 2007 Programmes Manager, DANIDA –Mount Uluguru Biodiversity Programme- 2005 – 2007 Monitoring and Evaluation Officer and Development Officer DANIDA Refugee Project, Tanzania- 2001 – 2005 Project Coordinator- GTZ, Tanzania- 1998 – 2001 Forest Manager in various projects in Tanzania, 1979 – 1998
Vincent Nambombe *Planning Manager, GRL, Tanzania*	Responsibilities: Planning and monitoring of project operations including the preparation of forest management plans for GRL and implementation of mini EIA (environmental impacts assessment); participates in land acquisition processes and community support and development activities of projects communities. Education: BSc Forestry (Hons)- University of Dar Es Salaam;

	Diploma in Training/Research in Agroforestry, ICRAF, Nairobi; Certificate in Planning and Implementation of Forest Projects for Developing Countries- Helsinki, Finland; Certificate of Training Techniques Course in London, UK Work experience Join GRL in 2004 Consultant:- in Energy, Environment and Land Use activities (2002-2003) Plantation Manager:- Escarpment Forestry CO. Ltd (1997-2002) Technical Advisor/Specialist:- in agroforestry and forest conservation:- Lushoto District, Tanga Region and Mbinga district, Ruvuma Region (1987-1994) Forest Planning Officer: - Forest Department, Ministry of Natural Resources and Tourism, Dar Es Salaam (1983-1986) Lecturer:- in Forest Management and Wood Technology:- Forestry Training Institute, Olmotonyi, Arusha (1977-1983
Sangito Sumari *Managing Director, GRL*	Responsibilities:- Overall in-charge of GRAS operations in Tanzania, managing human and material resources Education:- MSc Community Economic Development-Southern New Hampshire University, USA; BSc Forestry, Sokoine University of Agriculture; Diploma in Beekeeping, Tabora, Tanzania Work experience: Join GRL in August 2008 as Managing Director Manager Director- Sao Hill Forest Plantation, Tanzania (2 years) Project Manager- Kilimajaro Forest Plantation, Tanzania (10 years) Lecturer- Forest Training Institute, Olmotonyi, Tanzania (7 years)
Sylvester Luwagila Project Manager, GRL	Responsibilities:- Overall management of project operations and human resources including planning, implementation overall supervision of activities. Education:- MSc Forestry for Sustainable Development, ITC College,

	The Netherlands (2004), BSc Forestry- Sokoine University of Agriculture (1996) Work experience Joined GRL 10 years ago and held various positions Project Manager, Escarpment Forest Limited, Tanzania (1997 – 1999)
Mwaniki Gibuini *Group Development Director, GRL*	Responsibilities:- Leads the process of identifying and implementing new projects in the Group companies including acquisition of new areas for forestry projects, implementation of on going and new company projects as well as community development projects. Education:- MSc Forestry Dar es Salaam University; BSc Forestry Makerere University and several professional courses and training Work experience Managing Director of Sao Hill Industries Ltd and Green Resources Ltd (2004 – 2008) Private Consultant in forestry especially in the field of renewable energy (2000 – 2004) Director of the largest wood industrial processing and marketing company in East Africa, a private company (1985 – 1999). Forester in the Ministry of Environment and Natural Resources in Kenya. 1973 - 1985 - Responsibilities included conservation of forests, watersheds and wild life, establishment and management of industrial plantations, fire protection, establishment and maintenance of infrastructure and training of personnel.
Peter Mussami *Forest Plantations Research Manager*, *GRL*	Responsibilities:- Designs, manages and reports on all biophysical research projects pertaining to the plantations of GRL, including monitoring and inventory works. Education: Ph. D. in Plant Sciences at University of Budapest, Hungary; M. Sc Forestry, University of Forestry and Timber Industry, Sopron, Hungary.

	Work experience 6 years working in plantation forest as Plantation Research Manager (2003 to date) 19 years working in senior management positions in forest industries in Tanzania (1983 – 2002).
Peter Myegeta *Chief GIS & Mapping Officer: GRAS*	Responsibilities: Group-wide leader in GIS and Mapping operations for Tanzania, Uganda and Mozambique. Technical duties include developing and managing GIS in Forest Management, undertake land acquisitions for forest plantations in Tanzania and managing spatial manipulations for climate change Projects. Education:- BSc (Hons) Geomatics, University of Dar Es Salaam (1996 – 2000), with extensive knowledge of ESRI products, remote sensing techniques, spatial modeling, GPS surveying and computations and land information systems Work experience Joined GRAS in May 2007 GIS and Laboratory Manager: African Mining Consultancy – DR Congo: Dec 06 – Aug 07 MIT Spatial Data Specialist: Barrick Gold Corporation, Tanzania, Dec, 2005 – Dec 2006 GIS & Database Administrator: Geita Gold Mining Ltd, Tanzania: July20 01 to Sept 2005 GIS Officer: Green Growth Ltd, Dar Es salaam, Tanzania Date: June, 2000 to July 2001

Future Income

GRL has management plans in place for Uchindile and Mapanda Forest Projects, namely:

Forest Management Plan for Uchindile Forest Project, Revised Edition 2007

Forest Management Plan for Mapanda Forest Project, Revised Edition 2007.

These are both being implemented, and have both been reviewed as part of the FSC certification process.

Future/ current opportunity costs - summary of baseline study for Uchindile/Mapanda

The past, current and likely alternative uses are unmanaged grassland – with no related income. The baseline assessment found two main alternative future land use scenarios:

a) Leaving the unmanaged grasslands undisturbed or;
b) Reforestation without carbon funding

The lands to be reforested within the project boundary are unmanaged grasslands occupied by scattered trees and shrubs. As elaborated in the VCS PD (see section C.5), due to the barriers in finance, technique and institutional barriers, the only realistic and credible alternative available to is to continue the current land use as grassland. No natural regeneration potential for trees or shrubs is identified within the project activity boundary. This is principally because of the continuous fire regimes which stop trees from regenerating, coupled with the degraded nature of the soil, and aggressive grasses which prevent trees from growing. As such there is no natural tree regeneration being experienced at Uchindile and Mapanda.

As described in Section C.5 of the PD, the project lands are located in remote areas which are not attractive for timber markets especially for small scale ARR CDM project activity. The technical capability and economies of scale does not permit small farmers/individuals to carry out reforestation themselves. As described in Section C.5.2 of the PD it is difficult to secure commercial loans from commercial banks for reforestation activities due to a long moratorium period until harvesting. As such, the continuation of the current situation as unmanaged grassland is seen as the most likely alternative land use in the absence of the project.

Stakeholder Participation

As documented in the UFP/MFP PD there has been extensive stakeholder consultation. This is also discussed in the section on land acquisition, as this itself is a process which involves considerable community consultation.

The villagers have been involved since the early stages of the project development, and are continuously informed about project activities and plans. The project has followed the FSC procedures for stakeholder consultation, and additional monitoring is also being put in place in accordance with the CCBA PD Community Monitoring Plan.

Stakeholders have the opportunity to have their say and give suggestions. The project has carried out extensive stakeholder consultation21 which has shaped the projects design. Stakeholders were consulted through meetings, semi-structured interviews, and focus group discussions to capture information pertaining to the project. Participatory Rural Appraisals were carried out in the villages to identify the problems, views and concerns of local stakeholders and incorporated into the project design and management plan. Villagers employed by GRL are trained on environmental conservation, diseases, pests and other risks.

Table 4-10 Overview of Consulted Stakeholders.

Stakeholders at local level:	Name:
Uchindile Village Chairman	Humphrey Matimbwi
Uchindile Station Master	Mr. James
Uchindile Dispensary	
Mapanda Primary School Head Teacher	Calvin George
Lutheran Church Priest	Ole Kimaia
Chogo Primary School Assistants	Joseph Kinyunyu Robinson Lufyagile
Chogo Dispensary	Dr. Sanga
Chogo Village Chairman	Mr. Kitinusa
Chogo Village Executive Officer	Ayubu Kiwelu
Stakeholders at National and District level:	
Tanzania Tree Seed Agency (TTSA)	
Regional Water Supply Office	
Regional Forest Officer – Iringa	
Tanzania Electricity Supply Company (TANESCO) – Mafinga	
National Social Security Fund (NSSF) – Mafinga	
Tanzania Revenue Authority (TRA) – Mafinga	
District Commissioner – Mufindi	
District Executive Director (DED) – Mufindi	
Natural Resources Office – Mafinga	
Land Development Officer - Mafinga	
Mufindi Environmental Trust – Mafinga	
Sao Hill Forest Project (SHFP) - Mafinga	

In conclusion, based on the evidence above, the project's risk is defined as medium and assigned a risk buffer of 40%.

5 Glossary

A/R – Afforestation/Reforestation

GIS – Geographic Information System

GPS – Global Positioning System

GRAS – Green Resources AS, Norway

GRL – Green Resources Ltd, Tanzania

6 List of Annexes

1. Calculation Worksheets
2. Compartment Folders
3. Community Support
4. FSC Surveillance Report
5. Sale of Timber Records
6. GRAS Inventory and Monitoring Guidelines
7. Company Standard Operating Procedures (SOPs) and Staff Training Programmes
8. Forest Management Plans
9. Company Registration
10. PSP Database
11. Non-CO2 Fire Emission Calculations