**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) Version 04**

CONTENTS

Annexes

SECTION A. General description of the proposed A/R CDM project activity:

A.1. Title of the proposed A/R CDM project activity:

Title : Ibi Batéké degraded savannah afforestation project for fuelwood production (Democratic Republic of Congo)
Version : PCI-B#1
Date : August, 7, 2009

A.2. Description of the proposed A/R CDM project activity:

The proposed A/R CDM project activity, "Ibi Batéké degraded savannah afforestation for fuelwood production", is to be implemented on the Batéké plateau in the Democratic Republic of Congo (DRC). The Batéké plateau is comprised of 90% grassland and shrubby savannah subject to repeated annual burning and 10 % forest gallery subject to progressive degradation and deforestation for subsistence farming (maize, cassava) and charcoal production.

The specific objectives of the project are as follows:

- sequester CO_2 through fast growing forest plantations on savannah grassland with occasional scattered shrubs (please refer to section A5 for a detailed technical description of plantation establishment) ;
- supply the capital city of Kinshasa (8-10 million inhabitants) with charcoal through sustainable fuelwood production ;
- reduce soil erosion and water loss through runoff;
- reduce degradation and deforestation of remaining forest galleries ;
- alleviate poverty through the introduction of long term income enhancement mechanisms for local communities.

To achieve these objectives, the A/R CDM project activity envisages establishing various types of forest plantation based on the four following silvicultural models:

1. Plots to be harvested : *Acacia sp*, *Eucalyptus sp*. and *Pinus sp*. intercropped with cassava (3106.33 ha);
2. Plots not to be harvested: mixture of local and exotic species intercropped with cassava (465.60 ha);
3. Plots not to be harvested: various local and exotic species (421.80 ha);
4. Enhancement of natural regeneration through fire control (232.80 ha)

Those exotic species selected for the project have already been tried and tested in plantations over the last 20 years or so, around the project zone, or in similar ecological areas.
Within the plots of *Acacia sp., Eucalyptus sp, Pinus sp.* and other local and exotic species, cassava will be intercropped between rows in order to provide a short-term cash-flow for project implementation and assist natural weed control.

The social impacts of the project includes the enhancing of local employment opportunities :

- 55-60 permanent forest management staff (30 of which are to be executive positions);
- Up to 400 temporary positions 4-6 months a year, equivalent to 210-225 fulltime posts;
- Approximately 30 charcoal makers.

Environmental impacts include:

- Reduction of degradation/deforestation of remaining forest galleries thanks to new income generating opportunities for local communities and the alternative supply of biomass for charcoal production;
- Reduction of bushfires and their associated negative impacts on soils and ecosystems;
- In the long-term the plantations will also provide shelter for wildlife.

Public authorities, local traditional groups and other related stakeholders consider this proposed A/R CDM project activity to be an integral part of the local sustainable development strategy. Indeed, different aspects of the project activity offer a range of sustainable solutions at the following levels:

1. **Local level**
- creation of a sustainably managed forest estate, providing resources (timber and Non Timber Forest Products) and permanent environmental services ;
- through the creation (over a relatively short period) of permanent employment opportunities for the establishment and management of the nursery and plantations (maintenance and on-going silvicultural activities) ;
- through the encouraging of entrepreneurship and creation of employment opportunities (in the medium term) in harvesting, timber processing and charcoal production ;

2. **Regional / national levels**
- through substituting unsustainable charcoal production deriving from the degradation/deforestation of native forests and forest galleries, with renewable charcoal sourced from managed plantations. The resulting benefits are important, as biodiversity can be protected, soil erosion reduced and water network supply and quality maintained, etc.;
- through creating a model that can be replicated on the Batéké plateau, and with necessary silviculture adapted to other savannah areas within the country ;

3. **Global level**
- through sequestering CO_2 and contributing positively towards addressing the issue of climate change.

A.3. Project participants:

Table 1 – Project participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Indicate if the Party involved wishes to be considered as a project participant (Yes/No)
Democratic Republic of Congo (host country)	• NOVACEL sprl	No
France	• ORBEO	No
Government of Spain	• International Bank for Reconstruction and Development as Trustee of the BioCarbon Fund	Yes
(*) In accordance with the CDM A/R modalities and procedures, at the time of making the CDM-AR-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		
Note: When the CDM-AR-PDD is prepared to support a proposed new baseline and monitoring methodology (form CDM-AR-NM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

NOVACEL is a family company founded in 1985 by M. Paul M. Mushiete, originally from the Batéké Plateau. Its original activities focused on agroforestry on the Ibi station. The company employs around 20 people in forestry and agricultural fieldwork activities. Since its creation in 1985, the work undertaken at the Ibi station by NOVACEL has had a direct impact in the raising of public awareness amongst the local population on issues directly related to their everyday needs : housing, education, farming and health. NOVACEL has progressively and incrementally gained valuable experience in the field of agroforestry, forestry and charcoal production. As a result of this experience, it formulated its strategy for a long-term sustainable development program and simultaneously began its search for new investors. Between 1998-2001, NOVACEL renovated local buildings at Ibi station, created the first plantation nursery and planted the first crop. This was followed by further investments including : the establishment of a drinking water network, the implementation of a corn flour mill, training of local farmers and the building of a school and dispensary. Finally, the agroforestry experiment programme implemented from 2001 by NOVACEL on the Ibi Station Agroforestry Pilot Zone (100 ha) was about to provide its first results in 2007 with the completion of a full 7 year rotation of forest fallow.

A.4. Description of location and boundaries of the A/R CDM project activity:

A.4.1. Location of the proposed A/R CDM project activity:

A.4.1.1. Host Party(ies):

The Democratic Republic of Congo

A.4.1.2. Region/State/Province etc.:

Province of Kinshasa

A.4.1.3. City/Town/Community etc:

Municipality of Maluku, Mbankana village, Ibi estate.

A.4.2 Detailed geographic delineation of the project boundary, including information allowing the unique identification(s) of the proposed A/R CDM project activity:

The proposed A/R CDM project activity will be implemented on the Ibi estate, located North of national highway n°1 from Kinshasa to Kenge, between the kilometric points (KP) 128 and 143 (Kinshasa being KP 1).

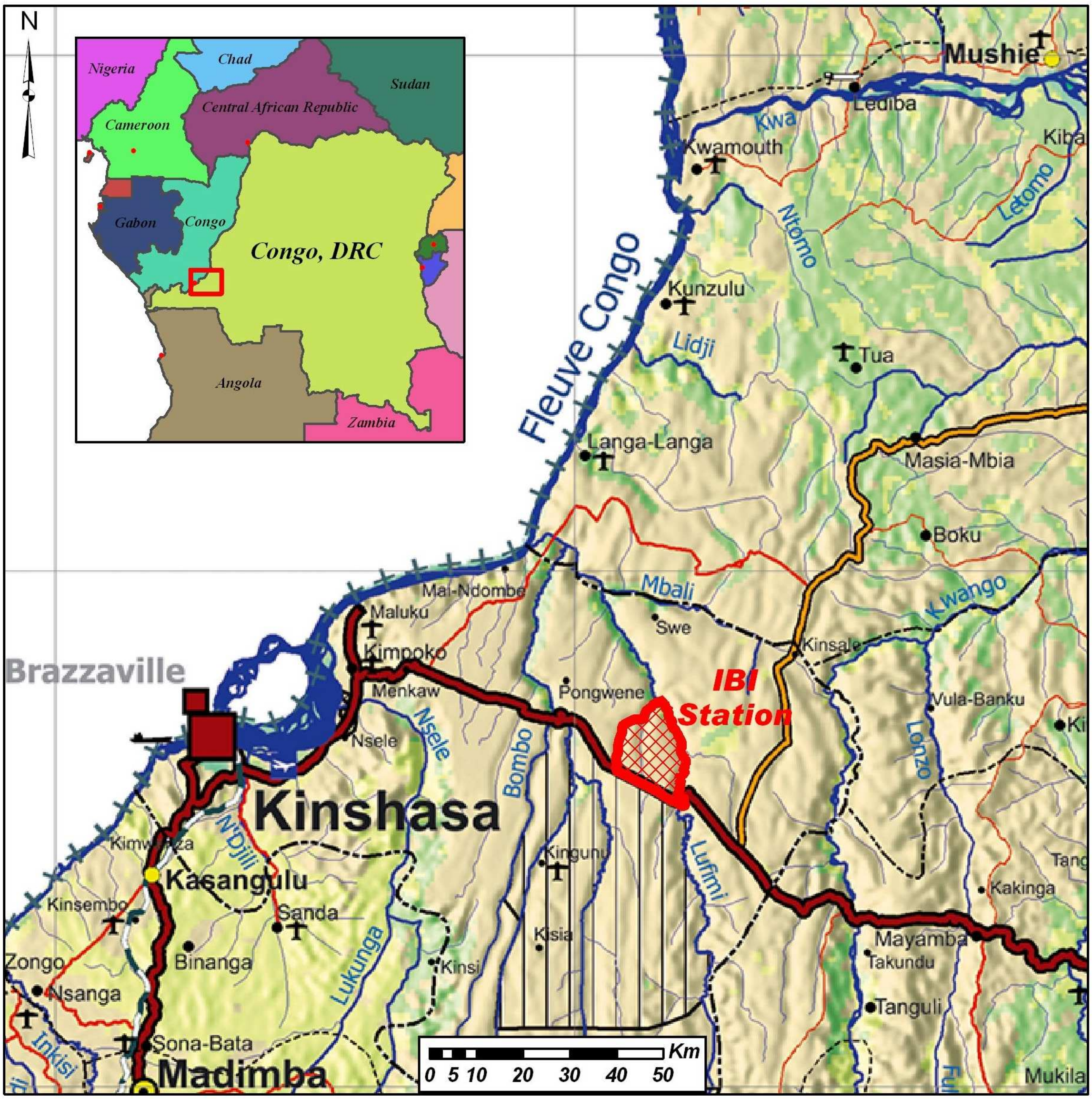

Illustration 1 : Location of the proposed A/R CDM project activity

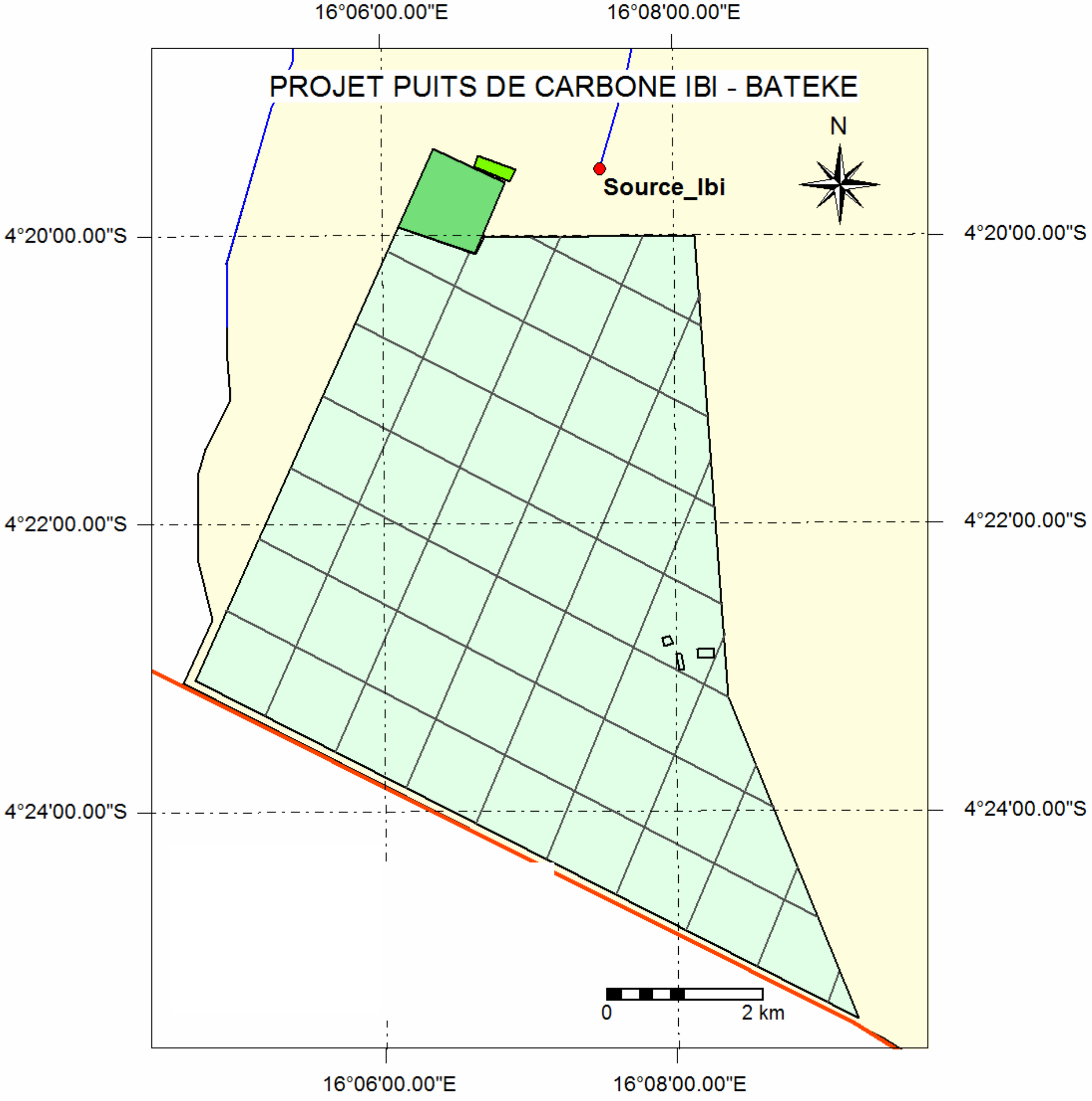

Illustration 2 : Boundaries of the proposed A/R CDM project activity

The geographical coordinates of the boundary corners of the proposed A/R CDM project activity are:

Table 2 - Geographical coordinates of the boundaries of the A/R CDM project activity

Identification of the point	Longitude	Latitude	Position
1	16°6’7’’ East	-4°19’54’’ South	NW corner
2	16°6’37’’ East	-4°20’9’ South	
3	16°6’41’’ East	-4°19’59’’ South	
4	16°7’51’’ East	-4°19’59’’ South	NE corner
5	16°8’18’’ East	-4°22’30’’ South	valley
6	16°9’14’’ East	-4°25’29’’ South	SE corner
7	16°4’36’’ East	-4°23’7’’ South	SW corner

The following areas are excluded from the boundaries of the A/R CDM project:

Table 3 - Geographical coordinates of the areas to be excluded from the boundaries of the A/R CDM project activity

Identification of the point	Longitude	Latitude	Position
I1	16°8’15’’ East	-4°22’56’’ South	Breeding centre
I2	16°8’15’’ East	-4°22’52’’ South	Breeding centre
I3	16°8’8’’ East	-4°22’56’’ South	Breeding centre
I4	16°8’8’’ East	-4°22’52’’ South	Breeding centre
II1	16°8’3’’ East	-4°23’1’’ South	Dipping tank
II2	16°8’2’’ East	-4°22’54’’ South	Dipping tank
II3	16°8’1’’ East	-4°23’1’’ South	Dipping tank
II4	16°8’2’’ East	-4°22’54’’ South	Dipping tank
III1	16°7’57’’ East	-4°22’47’’ South	Veterinary house
III2	16°7’54’’ East	-4°22’48’’ South	Veterinary house
III3	16°7’55’’ East	-4°22’51’’ South	Veterinary house
III4	16°7’58’’ East	-4°22’50’’ South	Veterinary house

A.5. Technical description of the A/R CDM project activity:

A.5.1. Description of the present environmental conditions of the area planned for the proposed A/R CDM project activity, including a concise description of climate, hydrology, soils, ecosystems (including land use):

Geology: The Batéké plateau is composed of ochre sand (Neogene series from the mid-tertiary) and capping polymorphic sandstone (late Cretaceous Paleogene series) from the « Kalahari system ». The Mesozoic base or Precambrian basal complex can be found in the valleys (Ndembo-Longo, 2006[1]).

Soil: Soil studies carried out on eight profiles distributed evenly throughout Ibi savannah to be reforested in the scope of the proposed A/R CDM project activity showed that soil is highly favourable to plantation establishment and wood production. In general soils are deep, loose, permeable and porous with a good proportion of fine elements. However, they have a low cationic capacity and content of exchangeable bases and available phosphorous. The pH value is low being around 4.5. In general, the soil’s chemical

[1] Ndembo-Longo J., 2006. Etude pédologique de la concession du projet. Projet de puits de carbone Ibi-Batéké, 30 pp.

fertility is weak but is not critical for tree species well known for their minimal nutrient requirements (Ndembo-Longo, 2006[2]).

Climate: Ibi station is submitted to a hot and humid tropical climate with four distinct seasons: a long dry season from mid May-mid September; a long rainy season from mid September to end of December; a short dry season in January-February and a short rainy season from March - mid May. Annual rainfall is 1.500 mm over a hundred days. The average monthly temperature is quite constant at around 24-25°C. However, minimum daily temperature during the dry season can drop to 10-12°C and occasionally even lower. The hygrometry is always quite high, around 80% (Boissezon (de)[3]).

Hydrology: The West side of the Ibi estate extends along the Duale river and its East side it along the Lufimi river being crossed by the Ibi river. The Ibi river supplies the whole Ibi station with drinking water and gave its name to the estate. These three rivers have important flows (2 litres per second for Ibi, and more for the others).

Geomorphology: The Batéké plateau is very flat, with a general descending slope from the South (in Angola the height is around 1000 m) to North (around 700 m altitude alongside the Congo River). Many rivers run through the plateau from South to North, with a difference in altitude between the plateau and valleys of approximately 200 m.

Ecosystems: According to Holdridge (1967)[4], the ecosystem is composed of dry forest. Nevertheless, Elenga and *al.* (1994)[5], show that the vegetation of the Batéké plateau reached its present characteristics 3 000 years ago because of an abrupt climatic change towards drier conditions. Today, approximately 90 % of the plateau is covered by more or less wooded savannah. Indeed, the whole Ibi estate is composed of grass or shrubby savannah. The woody density increases from South to North, probably for anthropogenic reasons. Human occupation and fuelwood collection have traditionally been more important near the national highway. In all savannah areas to be reforested, two plant species are currently dominant: *Hyparrhenia diplandra* in the herbaceous layer and *Hymenocardia acida* in the shrub layer. The plateau's valleys are occupied by more or less degraded river margin forests, depending on their accessibility. Nevertheless, as forested areas these valleys are not included within the boundaries of the present project. In the North of the estate, forest goes fairly high up the plateau from the Ibi – Duale – Lufimi confluence; however, it is subject to uncontrolled degradation/deforestation due to charcoal production and subsistence agriculture. Savannah is overrun several times a year by fires, generally originating from anthropogenic causes (accidental or deliberate principally for hunting purposes), such events impede the encroachment and successful growth of woody plants in particular trees (Bwebwe, 2006[6]).

[2] Ndembo-Longo J., 2006. Etude pédologique de la concession du projet. Projet de puits de carbone Ibi-Batéké, 30 pp.

[3] Boissezon (de) P. Les sols de savane des Plateaux Batéké. ORSTOM, p292-298.

[4] Holdridge L.R., 1967. Life Zone Ecology, Tropical Science Center, Costa Rica, 139 pp.

[5] Elenga H., Shwartz D., Vincens D., 1994. Pollen evidence of late Quaternary vegetation and inferred climate changes in Congo. Palaeogeography, Paleoclimatology, Palaeoecology, 109 (1994) : 345-356.

[6] Bwebwe J., 2006. Nature et effets des feux de brousse dans la zone entre les rivières Bombo et Lufimi au plateau des Batéké, Mémoire Faculté des Sciences Agronomiques, Université de Kinshasa, pp 29.

Shrub savannah

Grass savannah

River margin forest

Use of forest galleries to produce charcoal

Illustration 3: Ibi estate land cover

Fauna: In the past, large mammals were fairly common in the region (elephants, buffalos, lions, etc.), but over the years has been decimated by hunting. For example, the last lion was seen (and incidentally shot) on the estate in 1975. Even small herbivores such as duikers and bushbuck are facing extinction because of excessive hunting (Oréade-Brèche, 2007[7]). In the Bombo-Lumene hunting reserve, located on the other side of the road, the following animals can be observed:

- Buffalos (*Syncerus Caffer Aequinoctialis*)
- Harnessed bushbuck (*Tragelaphus scriptus*)
- Bushpig (*Potamochoerus larvatus*)
- Side-striped jackal (*Canis adustus*)
- White-headed Robin-chat (*Cossypha heinrichi*)

Cossypha heinrichi is known from only two small areas : 30 km north-east of Calandula in northern Angola, and from 500 km to the north at Bombo-Lumene Forest Reserve, and nearby Nkiene and Nguma (near Kinshasa) in the western Democratic Republic of Congo. The White-headed Robin-chat is classified as “Vulnerable” by the IUCN[8].

[7] Oréade-Brèche, 2007. Etude d’impact socio-environnemental – Puits de carbone d’Ibi – Plateau des Batéké. pp 93.

[8] www.iucnredlist.org

Illustration 4: Ibi fauna[9]

A.5.2. Description of the presence, if any, of rare or endangered species and their habitats:

The same ecological conditions (savannahs with river margin forest) are encountered on the whole Batéké plateau covering several thousand km^2 throughout Angola, Gabon, Congo and DRC. In most places there is fairly low demographic pressure. Several protected areas representing these same

[9] www.nyati-safari.com ; www.google.fr ; http:/en.wikipedia.org

ecological conditions have been established in some of the countries mentioned above. For example, in Gabon, the Batéké plateau National Park covers 2.050 km^2. In Congo, the Léfini reserve covers 6.300 km^2 and the Bambana – Lékana – Zanaga protected area project covers 5.300 km^2. In the DRC the 3.500 km^2 Bombo Lumene hunting reserve neighbours the Ibi estate.

As mentioned in section A.5.1., the White-headed Robin-chat (*Cossypha heinrichi)* has been observed at Bombo-Lumene Forest Reserve. The White-headed Robin-chat is classified as "Vulnerable" by the IUCN. It is insectivorous, feeding especially on driver ants. In the DRC, the breeding season is September-November, coincident with the start of the rainy season. His habitat is made of forest patches in the savannah. This kind of habitat does not occur in the A/R CDM project boundaries as only grassy and shrubby savannah will be afforested.

A.5.3. Species and varieties selected for the proposed A/R CDM project activity:

The following native tree species will be used:

Timber species
- *Millettia laurentii* - Wenge
- *Ceiba pentandra* – Fromager
- *Rhodognaphalon brevicuspe* – Kondroti
- *Terminalia superba* – Limba

Other species
- *Millettia drastica*
- *Cleistopholis glauca*
- *Dacryodes edulis*
- *Pentaclethra macrophylla*
- *Pentaclethra eetveldeana*
- *Irvingia gabonensis*
- *Treculia africana*

These species have been selected for the following reasons:

- their high growth rates;
- they were encountered during the botanical surveying of the existing river margin forest;
- they have been identified as interesting by and for local populations;
- they grow well in savannahs and produce numerous sprouts after the passage of fires;
- some of them can produce high quality timber.

The following exotic species will also be used:

- *Eucalyptus urophylla*
- *Eucalyptus deglupta*
- *Eucalyptus alba*
- *Eucalyptus pellita*
- *Eucalyptus resinifera*
- *Eucalyptus torelliana*
- *Eucalyptus cloeziana*
- *Eucalyptus brassiana*

- *Eucalyptus teriticornis*
- *Eucalyptus camaldulensis*
- *Eucalyptus grandis*
- *Eucalyptus citriodora*
- *Eucalyptus maculata*
- *Acacia mangium*
- *Acacia auriculiformis*
- *Acacia crassicarpa*
- *Pinus caribea*
- *Pinus oocarpa*
- *Pinus tecunumanii*
- *Cordia alliodora*
- *Glyciridia sepium*
- *Azadirachta indica*
- *Spondias monbin*
- *Dialium guineense*
- *Vitex doniana*

The selected exotic species have been tried and tested for over 20 years around the project area, therefore extensive knowledge and feedback is available from Pointe Noire in Congo or Mampu in DRC. They are characterised by:

- High yields ;
- Very important use in tropical plantations and absence of contamination risk beyond project area[10]
- Ability to source and trace genetic material from project start and master vegetative propagation in the nursery;
- Performances are known and have been evaluated in DRC as part of project design for the majority of exotic species.

Moreover, *Acacias sp*. enhance soil fertility by fixing nitrogen in their roots[11]. Hybridization and genetic improvement of *Acacia sp* has been carried out since the first introductions some 20 years ago on the Batéké plateau, for example, 8 000 ha in Mampu. The species genetic basis is developed by carrying out provenance testing using seeds made available by the Australian research services. The first phase of the test (8 ha), seedling production, was carried out in October 2006 using 47 *Acacia mangium*, 21 *A. auriculiformis* and 24 *A. crassicarpa* provenances.

For experimental purposes, new species or varieties will be tested as they may give good results for future afforestation or for the development of different forestry techniques.

[10] Oréade-Brèche, 2007. Etude d'impact socio-environnemental – Puits de carbone d'Ibi – Plateau des Batéké. pp 93.

[11] The Executive Board of CDM in its 44th meeting report agreed that the GHG emissions from nitrous oxide emissions from decomposition of litter and fine roots from N-fixing trees are insignificant in A/R CDM project activities and may therefore be neglected in A/R baseline and monitoring methodologies.

Illustration 5: Provenance test plot for *Acacia sp*.

A.5.4. Technology to be employed by the proposed A/R CDM project activity:

Site and soil preparation: The total project area will be divided into 37 square blocks of 100 ha and 20 polygonal blocks of variying surface. Each block will be surrounded by a 5m-wide road and a 10m-wide firebreak. The remaining inner blocks (975 m wide) will be divided into four sub-blocks (482.5 m wide of 23.28 ha) separated by two 10m wide intra-block roads.

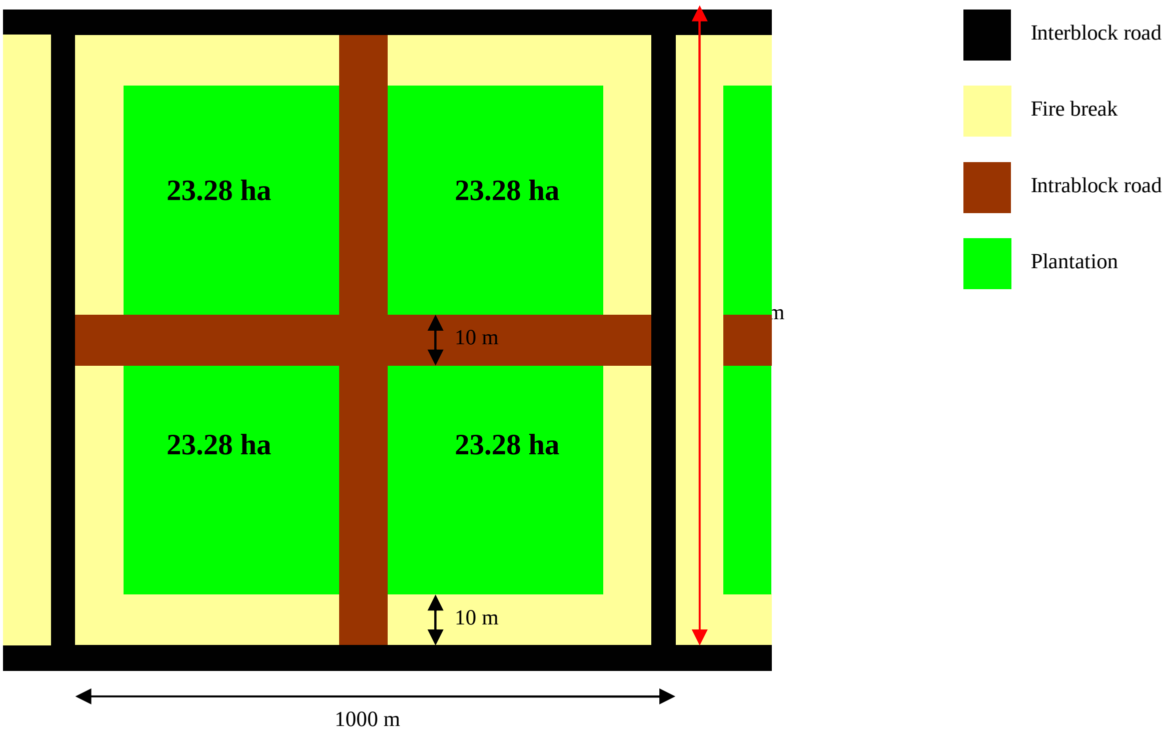

Figure 4 : Description of a square block

Site and soil preparation will be carried out by manpower supported by light mechanical force. It will be different for the agroforestry and pure stands

Concerning the agroforestry stands (*Acacia sp*., *Eucalyptus sp*., *Pinus sp*., local and exotic species intercropped with cassava), ligneous re-growth resulting from the passage of the last savannah fire will firstly be removed manually. Stumps will also be removed. This will be followed by ploughing and finally the passage of a disc harrow.
For pure stands only vegetation immediately around the planting pit (circle of $1m^2$) will be removed[12]. No other site preparation will be carried out.
For both type of stands, bamboo sticks will be used before planting to physically position planting holes within the plantation. No site preparation is planned for the stand where natural regeneration is to be enhanced through fire control.

Species and model arrangements
For species choice see section A.5.3. Trees will be planted following a planting scheme adapted to each plot. Schemes are to differ depending on the vocation of individual areas. Planting will be done, during the rainy season, at a mean density of 900-1111 plants/ha (3 x 3m to 3.33 m x 3.33 m spacing). These initial densities could be re-evaluated depending on the results obtained.

[12] For detailed calculations, please refer to file “SitePreparation_RoadCreation.xls”, spreadsheet “SitePreparation”.

Table 4 – Species and model arrangements

	Type of stand	*Spacing (m x m)*	*Density (plants/ha)*	*TOTAL*
Agroforestry stands (all intercropped with cassava)	*Acacia sp.*	3 x 3	1111	2.617,45 ha
	Eucalyptus sp.	3,33 x 3,33	900	349,20 ha
	Pinus sp.	3,33 x 3	1000	139,68 ha
	Local species	3,33 x 3,33	900	302,64 ha
	Other exotic species	3,33 x 3,33	900	162,96 ha
			Total for agroforestry stands	**3571,93 ha**
Pure stands	*Acacia sp.*	3 x 3	1111	119.15 ha
	Eucalyptus sp.	3,33 x 3,33	900	69,84 ha
	Pinus sp.	3,33 x 3	1000	69,84 ha
	Local species	3,33 x 3,33	900	116,41 ha
	Other exotic species	3,33 x 3,33	900	46,56 ha
			Total for pure stands	**421,80 ha**
Natural regeneration stand			**Total for natural regeneration stand**	**232,80 ha**
	TOTAL			**4.226,53 ha**

Nursery

Seedlings will be grown in nurseries using appropriate techniques. Seeds will be harvested from locally selected trees, either on the Ibi site (especially for acacia), or the surrounding area (especially Mampu for *Eucalyptus urophylla*).

For eucalyptus seeding will be carried out on a seed tray and seedlings transplanted into plastic bags.

For acacias, pines and other and exotic and local species, seeding will be done directly in plastic bags filled with an equal mix of organic savannah surface sand and clayed sand extracted from deep pits mixed with composted vegetal residues. This technique ensures the control of growing conditions in the initial stages after planting, therefore increasing survival rate and early growth.

Illustration 6: Nursery for *Acacia auriculiformis*

Plantation management

The *Acacia* agroforestry stands will be managed for wood production, mainly for charcoal. Harvesting is planned between 5-21 years, depending on the stand. *Acacia* is to be regenerated through natural regeneration. Seedlings will be selected in order to obtain a density of 1100 trees/ha. Stumps will not be removed after harvesting. The pure Acacia stand will not be harvested.

Eucalyptus and Pine agroforestry stands will be run on a rotation of 18 years. Regeneration of is to be carried out through replanting. Stumps will not be removed after harvesting. Pure stands of Eucalyptus and Pine will not be harvested.

The planting and harvesting cycle is shown below in Table 5. Harvesting will be done manually with the use of chainsaws. Logs will be cut on site and gathered for charcoal production.

Intercropped cassava will grow during a maximum of 18 months after the planting of seedlings before canopy closure becomes a limiting factor. Cassava will be harvested and replanted only at the end of each stand rotation. The collecting of cassava will be done manually however, its transportation from the stands to the processing unit will be done with the aid of a tractor.

For stands of other local and exotic species (agroforestry and pure stands), a single harvest is planned after 30 years.

No harvesting is planned for the natural regeneration stand.

Type of stand	**Tree species**	**Area (ha)**	**Age when harvested (years)**
Agroforestry	*Acacia sp.*	2.617,45 ha	Between 5 and 21
Agroforestry	*Eucalyptus sp.*	349,20 ha	18
Agroforestry	*Pinus sp.*	139,68 ha	18
Agroforestry	Local species	302,64 ha	> 30
Agroforestry	Other exotic species	162,96 ha	> 30
Pure plantation	*Acacia sp.*	119,15 ha	No harvest
Pure plantation	*Eucalyptus sp.*	69,84 ha	No harvest
Pure plantation	*Pinus sp.*	69,84 ha	No harvest
Pure plantation	Local species	116,41 ha	> 30
Pure plantation	Other exotic species	46,56 ha	> 30
Enhancement of natural regeneration	-	232,80 ha	No harvest
	TOTAL (ha)	**4.226,53 ha**	

Plantation maintenance

Thanks to intercropping with cassava, only a light weeding will be needed during the first 18 months following the establishment of agroforestry stands. The maintenance of cassava will be done mechanically twice yearly between plantation rows. After 18 months no particular maintenance will be needed for these stands.

Beating-up will be carried out in the early stages of plantation development (1-2 years) the degree of which will depend directly on the survival rate of seedlings

In natural regeneration stands, herbaceous weeds will be cut mechanically twice a year – at the end of the long rainy season and the middle of the long dry season - in order to avoid wild fires and to enhance seedling growth. No other operation is planned for these stands.

Plantation protection
In order to protect plantations from the important threat of fire, living firebreaks will be installed.

These firebreaks will be 25m wide (including a 5 m wide road and 10m wide firebreak on either side of the road), positioned around every annual planting bloc with a 5 m wide access road between individual plots. The living firebreaks will consist of fire resistant herbaceous species and will be cut mechanically twice a year.

Besides, a program will be implemented to raise public awareness on site and around. Vehicles will be made available with full water tanks to fight fire, and if necessary, water storage points distributed in the field will be created.

No fencing is planned. Human pressure for fuelwood is likely to be minimal due to the area's low population density (<1 inhabitant/km^2) and its remoteness (the closest village is 6 km away).

Table 5 – Planting and harvesting cycle for agroforestry and pure plantation stands

Year n°	Year	Planting (ha)	Existing vegetation	Type of stand	Tree species	Initial Id	Harvest (ha)	Id harvested	Remaining (ha)	Replanting (ha)	New Id after harvest and replanting
		755.05	Savannah	agroforestry	Acacia	S_Ag_Ac_08					
1	2008	105	Savannah	pure plantation	Acacia	S_Pp_Ac_08					
		582	Savannah	agroforestry	Acacia	S_Ag_Ac_09					
		46.56	Savannah	agroforestry	Eucalyptus	S_Ag_Eu_09					
		46.56	Savannah	agroforestry	Pinus	S_Ag_Pin_09					
		46.56	Savannah	agroforestry	Local species	S_Ag_LS_09					
2	2009	46.56	Savannah	agroforestry	Other exotic species	S_Ag_OES_09					
		46.56	Savannah	pure plantation	Eucalyptus	S_Pp_Eu_09					
		46.56	Savannah	pure plantation	Local species	S_Pp_LS_09					
		582	Savannah	agroforestry	Acacia	S_Ag_Ac_10					
		93.12	Savannah	agroforestry	Eucalyptus	S_Ag_Eu_10					
		93.12	Savannah	agroforestry	Local species	S_Ag_LS_10					
3	2010	46.56	Savannah	pure plantation	Pinus	S_Pp_Pin_10					
		46.56	Savannah	pure plantation	Other exotic species	S_Pp_OES_10					

Year n°	Year	Planting (ha)	Existing vegetation	Type of stand	Tree species	Initial Id	Harvest (ha)	Id harvested	Remaining (ha)	Replanting (ha)	New Id after harvest and replanting
4	2011	582	Savannah	agroforestry	Acacia	S_Ag_Ac_11					
		93.12	Savannah	agroforestry	Eucalyptus	S_Ag_Eu_11					
		46.56	Savannah	agroforestry	Pinus	S_Ag_Pin_11					
		46.56	Savannah	agroforestry	Local species	S_Ag_LS_11					
		46.56	Savannah	agroforestry	Other exotic species	S_Ag_OES_11					
		46.56	Savannah	pure plantation	Local species	S_Pp_LS_11					
5	2012	116.40	Savannah	agroforestry	Acacia	S_Ag_Ac_12					
		116.40	Savannah	agroforestry	Eucalyptus	S_Ag_Eu_12					
		46.56	Savannah	agroforestry	Pinus	S_Ag_Pin_12					
		116.40	Savannah	agroforestry	Local species	S_Ag_LS_12					
		69.84	Savannah	agroforestry	Other exotic species	S_Ag_OES_12					
		14.15	Savannah	pure plantation	Acacia	S_Pp_Ac_12					
		23.28	Savannah	pure plantation	Eucalyptus	S_Pp_Eu_12					
		23.28	Savannah	pure plantation	Pinus	S_Pp_Pin_12					
		23.28	Savannah	pure plantation	Local species	S_Pp_LS_12					
6	2013						395.76	S_Ag_Ac_08	359.29 (S_Ag_Ac_08)	395.76	R_Ag_Ac_13
7	2014						405.85	S_Ag_Ac_08 + S_Ag_Ac_09	535.44 (S_Ag_Ac_09)	405.85	R_Ag_Ac_14
8	2015						395.76	S_Ag_Ac_09	139.68 (S_Ag_Ac_09/C1)	395.76	R_Ag_Ac_15
9	2016										
10	2017										
11	2018										
12	2019										

Year n°	Year	Planting (ha)	Existing vegetation	Type of stand	Tree species	Initial Id	Harvest (ha)	Id harvested	Remaining (ha)	Replanting (ha)	New Id after harvest and replanting
13	2020						**395.76**	**S_Ag_Ac_09 + S_Ag_Ac_10**	**325.92 (S_Ag_Ac_10)**	**395.76**	**R_Ag_Ac_20**
14	2021						**395.76**	**S_Ag_Ac_10 + S_Ag_Ac_11**	**512.16 (S_Ag_Ac_11)**	**395.76**	**R_Ag_Ac_21**
15	2022						**395.76**	**S_Ag_Ac_11**	**116.40 (S_Ag_Ac_11)**	**395.76**	**R_Ag_Ac_22**
16	2023										
17	2024										
18	2025										
19	2026										
20	2027						**209.52**	**S_Ag_Ac_11 + S_Ag_Eu_09 + S_Ag_Pin_09**	**0**	**116.40 46.56 46.56**	**R_Ag_Ac_27 R_Ag_Eu_27 R_Ag_Pin_27**
21	2028						**209.52**	**S_Ag_Ac_12 + S_Ag_Eu_10**	**0**	**116.40 93.12**	**R_Ag_Ac_28 R_Ag_Eu_28**
22	2029						**209.52**	**R_Ag_Ac_13 + S_Ag_Eu_11 + S_Ag_Pin_11**	**325.92 (R_Ag_Ac_13)**	**69.84 93.12 46.56**	**R_Ag_Ac_29 R_Ag_Eu_29 R_Ag_Pin_29**
23	2030						**209.52**	**R_Ag_Ac_13 + S_Ag_Eu_12 + S_Ag_Pin_12**	**279.36 (R_Ag_Ac_13)**	**46.56 116.40 46.56**	**R_Ag_Ac_30 R_Ag_Eu_30 R_Ag_Pin_30**
24	2031						**209.52**	**R_Ag_Ac_13**	**69.84 (R_Ag_Ac_13)**	**209.52**	**R_Ag_Ac_31**
25	2032						**209.52**	**R_Ag_Ac_13 + R_Ag_Ac_14**	**266.17 (R_Ag_Ac_14)**	**209.52**	**R_Ag_Ac_32**
26	2033						**209.52**	**R_Ag_Ac_14**	**56.65 (R_Ag_Ac_14)**	**209.52**	**R_Ag_Ac_33**
27	2034						**219.61**	**R_Ag_Ac_14 + R_Ag_Ac_15**	**232.80 (R_Ag_Ac_15)**	**219.61**	**R_Ag_Ac_34**
28	2035						**209.52**	**R_Ag_Ac_15**	**23.28 (R_Ag_Ac_15)**	**209.52**	**R_Ag_Ac_35**
29	2036						**209.52**	**R_Ag_Ac_15 + R_Ag_Ac_20**	**209.52 (R_Ag_Ac_20)**	**209.52**	**R_Ag_Ac_36**
30	2037										

A.5.5. Transfer of technology/know-how, if applicable:

Much of the technology to be used in the different activities of the A/R CDM project is innovative and is to be transferred to the host country. For example, as explained in section A.5.3., acacia plantations will benefit from experimental planting of acacia species and provenances (seedlings in nursery) implemented in October 2006, from a seed collection provided by Australian research services.

This collection is composed of seeds from various selected natural provenances. Seeds also come from "artificial" provenances from seed orchards (corresponding to a first level of improvement, Acacia species and provenance list). Thanks to this experiment, a selection of provenances well adapted to local climate and soils can be obtained. In order to obtain hybrid specimens to perform better than their parents, intra and inter-specific crosses can be made. In addition, the results obtained can be transposed outside the Ibi Carbon Sink, even into the station's agroforestry stand.

Other examples of technology transfer to be achieved during the project include:

- regarding plantations :

i) soil preparation techniques and plantation optimisation to accelerate initial growth
ii) reducing of maintenance needs and quick soil coverage due to cassava
iii) optimisation of intensive plantation production

- regarding silviculture :

i) cloned eucalyptus plantation management
ii) cassava with soil improving trees (acacias)

- regarding plantation management :

i) plot organisation, fire protection
ii) early stage planting with regular observations and measurements
iii) computerised plantation management using GIS, developing a unit plot database, compiling all technical and economical data (vegetative material, silvicultural treatments, measurements, events, harvesting and regeneration etc.).

All these techniques and innovations, even though familiar in countries with a more developed forest plantation sector, represent a reference that can be transposed outside the DRC, or even outside "plantations" per se, as the country, due to its history, lacks such latest technologies.

A.5.6. Proposed measures to be implemented to minimize potential leakage:

Agriculture in the region is limited to subsistence, especially for growing cassava. Therefore, in order to minimize potential leakage, cassava will be intercropped between tree rows, will represent more than 8,000 ha (cumulative) and will be sold on local markets.

Villagers use shrubs, grasses and/or deadwood and living branches for cooking and/or heating. Nevertheless, the population density in this region is less than one inhabitant per hectare. Thus, human pressure is low. Moreover, the few local farmers currently present will be able to collect fuel within the project boundary without compromising the tree growth established under the proposed A/R CDM project activity. Such fuelwood includes deadwood, branches and grasses/shrubs growing between the trees during the early stages of establishment. Therefore, as the result of the proposed A/R CDM project activity the few local farmers present will not have to collect fuel outside the project boundary.

A.6. Description of legal title to the land, current land tenure and rights to tCERs / lCERs issued for the proposed A/R CDM project activity:

The Mushiete family has traditional recognized land rights at Ibi station since 1969. Based on this legal traditional entitlement to the land, the Mushiete family signed a long term lease (30 years renewable, from the 01/01/2007) with NOVACEL for the total area of the A/R CDM project activity[13]. Hence, NOVACEL currently possesses the land use rights, including the trees and future emission reductions for the duration of the project. Based on this method of traditional recognized land use rights, the Mushiete family has possessed a renewable 25 year concession since October 2008[14].

A.7. Assessment of the eligibility of the land:

According to the Procedures used to demonstrate the eligibility of lands for CDM afforestation and reforestation project activities[15],

1. Project participants shall provide evidence that the land within the planned project boundary is eligible for an A/R CDM project activity by following the steps outlined below.
   (a) Demonstrate that the land at the moment the project starts does not contain forest by providing transparent information that:
      - Vegetation on the land is below the forest thresholds (tree crown cover or equivalent stocking level, tree height at maturity *in situ*, minimum land area) adopted for the definition of forest by the host country under decisions 16/CMP.1 and 5/CMP.1 as communicated by the respective DNA; and
      - All young natural stands and all plantations on the land are not expected to reach the minimum crown cover and minimum height chosen by the host country to define forest; and
      - The land is not temporarily unstocked, as a result of human intervention such as harvesting or natural causes.

The Designated National Authority (DNA) of the DRC defines forest as:

- a minimum tree crown cover of 30% ;
- a minimum surface area of 0.5 ha ;
- a minimum tree height of 3 m.

The natural vegetation of the project area is edaphic grassy savannah. Illustrations 7, 8 and 9 below provide a typical overview of the project area. In conclusion, none of the selected areas retained for the afforestation project on the Ibi station is in conflict with the forest definition criteria mentioned above. Therefore none of the areas to be used for plantation development can be considered as being forested in the terms of the definition of the DRC's CDM DNA.

[13] Contrat de bail à ferme, 01/01/2008.

[14] Contrats d'emphytéose, 15/10/2008.

[15] CDM Executive Board meeting report n°35, Annex 18.

Illustration 7: Grassy savannah

Illustration 8: Shrubby savannah

Illustration 9: Recently burnt savannah

The local grasslands savannahs are also overrun several times a year by wild fires, generally originating from anthropogenic causes (accidental or deliberate for hunting or other needs) (Bwebwe, 2006[16]) with the consequence that no natural re-growth of tree species on the land is expected to reach the minimum crown cover and minimum height chosen by the DNA of the DRC to define forest. Therefore, natural encroachment and development of forest vegetation cannot occur without fire risk management. This latter will be implemented for the A/R CDM project activity (see section A.5.4.).

Illustrations 10 and 11: Impacts of fire on the soil and the shrubs

Finally, as a natural edaphic grassland savannah, the land is not temporarily un-stocked (Elenga et *al*., 1994).

[16] Bwebwe J., 2006. Nature et effets des feux de brousse dans la zone entre les rivières Bombo et Lufimi au plateau des Batéké, Mémoire Faculté des Sciences Agronomiques, Université de Kinshasa, pp 29.

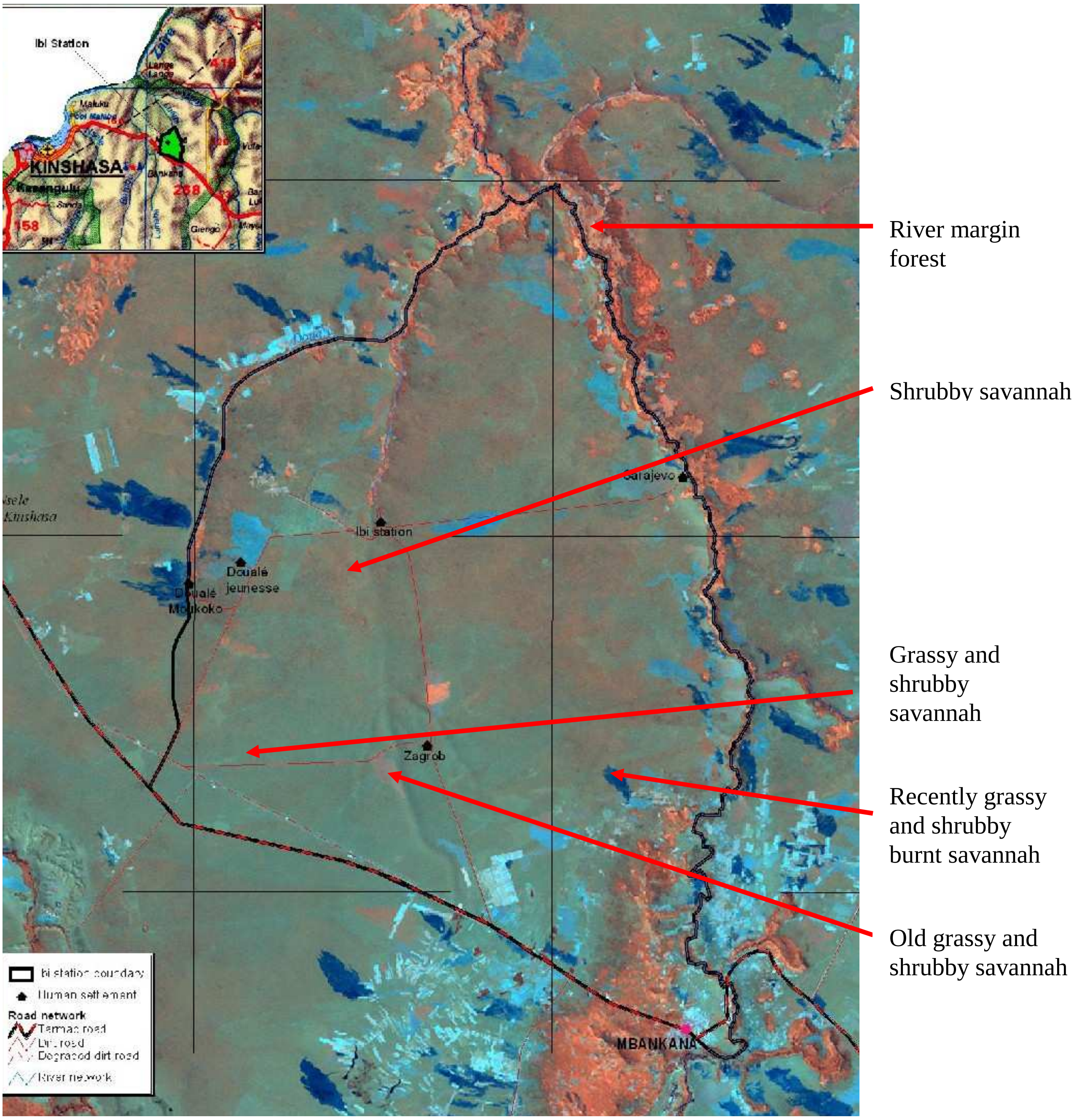

Figure 5 : Landsat ETM image of Ibi estate taken on December, 12, 2005

(b) Demonstrate that the activity is a reforestation or afforestation project activity:

- For reforestation project activities, demonstrate that the land was not forest by demonstrating that the conditions outlined under (a) above also applied to the land on 31 December 1989.
- For afforestation project activities, demonstrate that for at least 50 years vegetation on the land has been below the thresholds adopted by the host country for definition of forest.

The Landsat satellite images taken on the 19th of January 1987, 28th of July 2001 and 12th of December 2005 show that vegetation cover on the Ibi estate was the same as today.

> 2. In order to demonstrate steps 1 (a) and 1 (b), project participants shall provide information that reliably discriminates between forest and non-forest land according to the particular thresholds adopted by the host country, *inter alia*:
>
> (a) Aerial photographs or satellite imagery complemented by ground reference data; or
>
> (b) Land use or land cover information from maps or digital spatial datasets; or
>
> (c) Ground based surveys (land use or land cover information from permits, plans, or information from local registers such as cadastre, owners registers, or other land registers).
>
> If options (a), (b), and (c) are not available/applicable, project participants shall submit a written testimony which was produced by following a Participatory Rural Appraisal (PRA) methodology or a standard Participatory Rural Appraisal (PRA) as practised in the host country.

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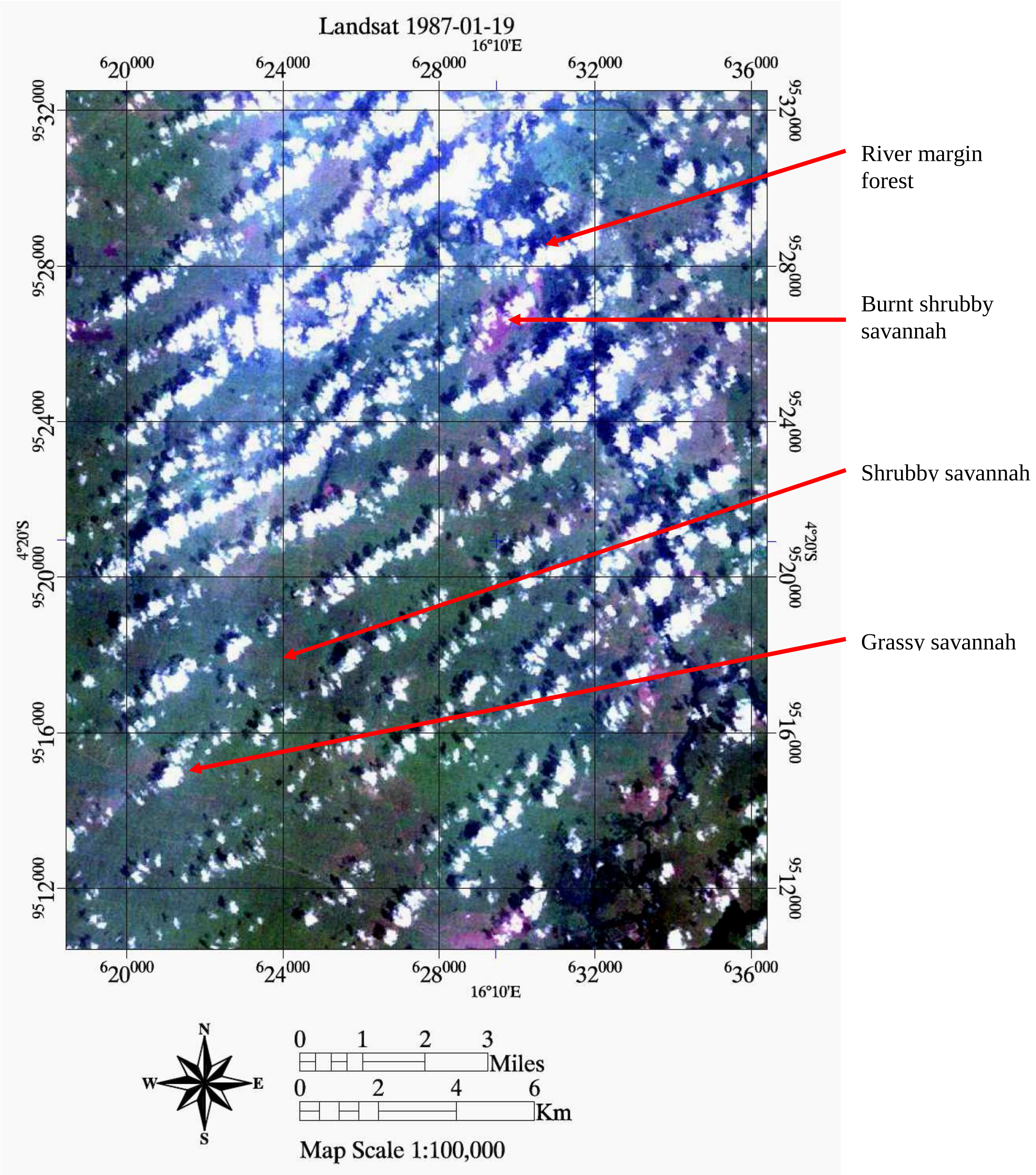

Figure 6 : Landsat ETM image of Ibi estate taken on January, 19, 1987

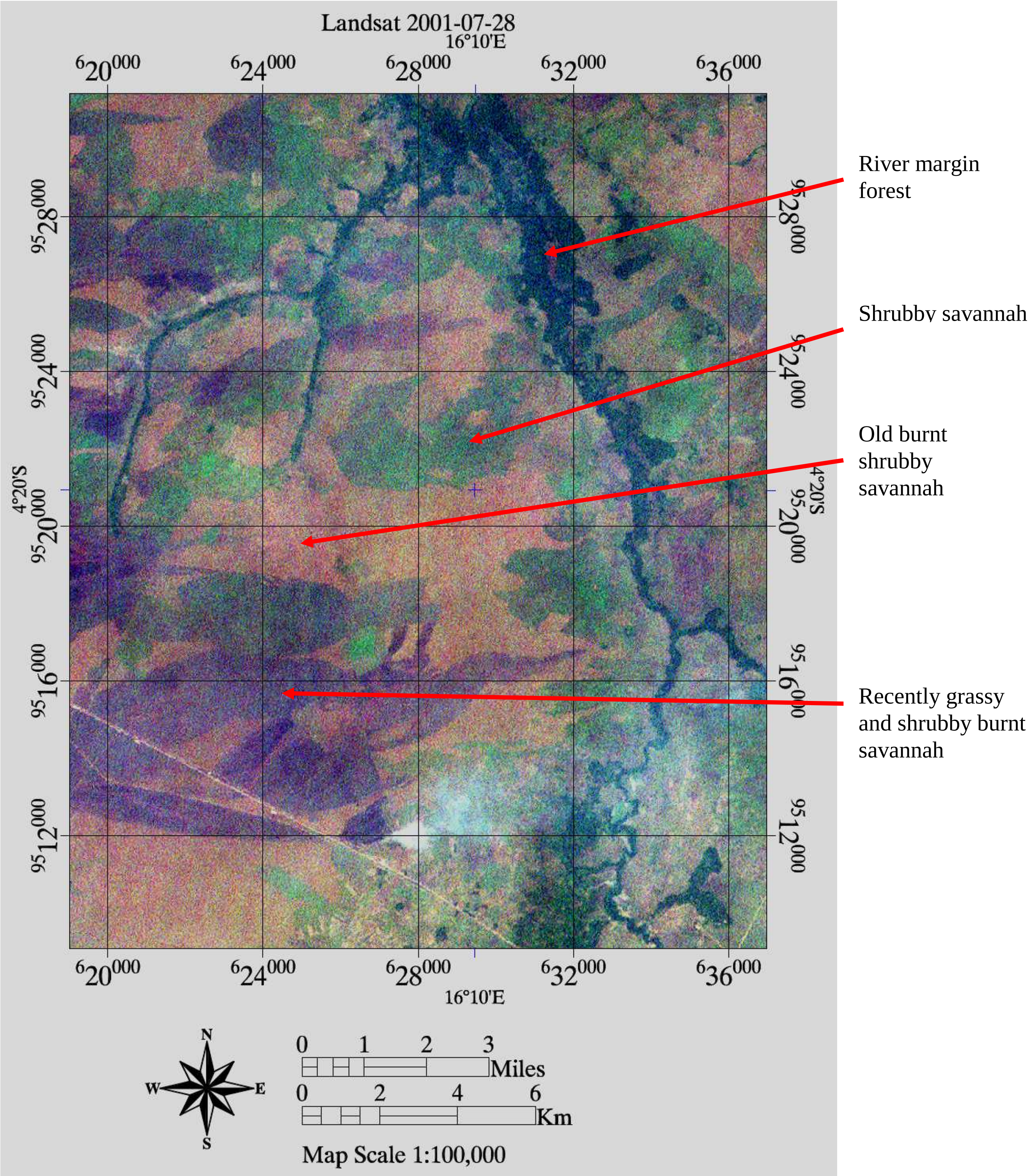

Figure 7 : Landsat ETM image of Ibi estate taken in July, 28, 2001

Therefore, all land within the project boundary is eligible for CDM afforestation activities.

A.8. Approach for addressing non-permanence:

The issuing of tCER for net anthropogenic GHG removals by sinks achieved by the proposed A/R CDM project activity has been chosen.

A.9. Estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period:

Table 6 – Estimated amount of net anthropogenic GHG removals by sinks

Summary of results obtained in Sections C.7., D.1., and D.2.				
Year	**Estimation of baseline net GHG removals by sinks (tonnes of CO_2 e)**	**Estimation of actual net GHG removals by sinks (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of net anthropogenic GHG removals by sinks (tonnes of CO_2 e)**
2008	0	1,109	0	1,109
2009	0	29,013	0	29,013
2010	0	57,222	0	57,222
2011	0	83,878	0	83,878
2012	0	54,076	0	54,076
2013	0	53,663	0	53,663
2014	0	53,305	0	53,305
2015	0	127,498	0	127,498
2016	0	127,490	0	127,490
2017	0	127,458	0	127,458
2018	0	127,518	0	127,518
2019	0	3,243	0	3,243
2020	0	-5,247	0	-5,247
2021	0	-4,524	0	-4,524
2022	0	127,518	0	127,518
2023	0	127,518	0	127,518
2024	0	126,231	0	126,231
2025	0	126,150	0	126,150
2026	0	12,417	0	12,417
2027	0	-12,002	0	-12,002
2028	0	-3,623	0	-3,623
2029	0	-14,584	0	-14,584
2030	0	12,481	0	12,481
2031	0	9,392	0	9,392
2032	0	3,593	0	3,593
2033	0	-2,091	0	-2,091
2034	0	-956	0	-956
2035	0	20,926	0	20,926
2036	0	126,176	0	126,176
2037	0	126,176	0	126,176
Total (tonnes of CO2 e)	**0**	**1,621,022**	**0**	**1,621,022**

A.10. Public funding of the proposed A/R CDM project activity:

None of the funding of the proposed A/R CDM project activity results in a diversion of official development assistance. It is also separated from, and not counted towards, the financial obligation of any Parties of the UNFCCC.

SECTION B. Duration of the project activity / crediting period

B.1 Starting date of the proposed A/R CDM project activity and of the crediting period:

The A/R CDM project activity started on 1st of July 2008 with the site preparation before planting. The starting date of the crediting period is therefore the 1st of July 2008.

B. 2. Expected operational lifetime of the proposed A/R CDM project activity:

Over 30 years

B.3 Choice of crediting period:

B.3.1. Length of the renewable crediting period (in years and months), if selected:

N/A

B.3.2. Length of the fixed crediting period (in years and months), if selected:

Fixed crediting period selected of 30 years

SECTION C. Application of an approved baseline and monitoring methodology

C.1. Title and reference of the approved baseline and monitoring methodology applied to the proposed A/R CDM project activity:

"Consolidated afforestation and reforestation baseline and monitoring methodology" (AR-ACM0001/version 03) "Afforestation and reforestation of degraded land".

In compliance with the applied methodology, the latest versions of the following approved tools are used:

- Procedures to demonstrate the eligibility of lands for afforestation and reforestation CDM project activities ;
- Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities ;
- Tool for identification of degraded or degrading lands for consideration in implementing A/R CDM project activities ;
- Tool for estimation of GHG emissions from clearing, burning and decay of existing vegetation due to implementation of an CDM A/R project activity ;
- Tool for estimation of GHG emissions related to displacement of grazing activities in an A/R CDM project activity ;

- Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities ;
- Calculation of the number of sample plots for measurements within A/R CDM project activities ;
- Tool for testing significance of GHG emissions in A/R CDM project activities.

C.2. Assessment of the applicability of the selected approved methodology to the proposed A/R CDM project activity and justification of the choice of the methodology:

Table 7 – Applicability criteria of the A/R CDM methodology

Applicability condition	Match	Test/Justification
The A/R CDM project activity is implemented on degraded lands, which are expected to remain degraded or to continue to degrade in the absence of the project, and hence the land cannot be expected to revert to a non-degraded state without human intervention;	✓	**The latest version of the "Tool for the identification of degraded or degrading lands for consideration in implementing A/R CDM project activities" is applied for demonstrating that lands are degraded or degrading. Demonstration is done below this table.**
Encroachment of natural tree vegetation that leads to the establishment of forests according to the host country definition of CDM purposes is not expected to occur;	✓	**The recolonization by trees which could lead to the establishment of forest is not expected to occur because of the high frequency of fires in the area, as shown by Illustrations 9 and 10. Furthermore, the Batéké plateau is believed to have remained as a natural edaphic grassy savannah since 900 BC (Elenga and *al.*, 1994)[18] Therefore, encroachment of natural woody vegetation leading to the establishment of forests according to the host country definition of forest for CDM purposes is not expected to occur.**
Flooding irrigation is not applied in the project activity;	✓	**No flooding or irrigation is expected as it is not common practice in the region as such the project will not use this technique.**
If at least a part of the project activity is implemented on organic soils, drainage of these soils is not allowed and not more than 10% their area may be disturbed as result of soil preparation for planting;	**N/A**	**According to pedological studies carried out by M. Ndembo Longo[19], the soils inside the project boundary are not of an organic nature. Moreover, no drainage is planned.**

[18] Elenga H., Shwartz D., Vincens D., 1994. Pollen evidence of late Quaternary vegetation and inferred climate changes in Congo. Palaeogeography, Paleoclimatology, Palaeoecology, 109 (1994) : 345-356.
[19] Ndembo-Longo J., 2006. Etude pédologique de la concession du projet. Projet de puits de carbone Ibi-Batéké, 30 pp.

The establishment of project shall not decrease availability of fuelwood	✓	**As described in section A.5.6., villagers use shrubs, grasses and/or deadwood and living branches for cooking and/or heating. Nevertheless, the population density in this region is less than one inhabitant per km^2. Thus, human pressure is low. The few local farmers present will be able to collect fuel within the project boundary without compromising the growth of trees established under the proposed A/R CDM project activity, including deadwood, branches and grasses/shrubs growing between the trees during the early stages of establishment. Therefore, the establishment of the project will not decrease the availability of fuelwood.**

According to the "Tool for the identification of degraded or degrading lands for consideration in implementing A/R CDM project activities", the presence of one of the following is enough for demonstrating that land is "degraded" and/or "degrading":

(a) Provide documented evidence that the area has been classified as "degraded" under verifiable local, regional, national or international land classification system or peer-review study, participatory rural appraisal, satellite imagery and/or photographic evidence in the last 10 years. If the documented evidence of degradation is older than ten years then:

(i) Provide evidence that the natural or anthropogenic degradation drivers and pressures that led to the land becoming "degraded" are still present and/or that there are no insufficient land management interventions to reverse degradation.

(b) Demonstrate through a comparative study that the candidate lands in the proposed project area have similar or equivalent conditions (e.g. vegetation, soil, climate, topography, altitude, soil class and land use) and socio-economic pressures and drivers of degradation to reference degraded lands elsewhere, verifiably classified and documented as degraded lands. The proof of similarity of lands should be made through verifiable documentation and/or visual field assessment and data sets:

(c) Demonstrate through direct evidence based on selected indicators of land degradation that the area is "degraded" and/or "degrading" through conducting either a visual assessment of the state and condition of the indicators or a verifiable participatory rural appraisal (PRA). The indicators of degradation should be locally relevant and verifiable. Candidate lands shall be declared as "degraded" and/or "degrading" if they show at least one of the following:

(i) The severity and extent of soil compaction and soil erosion, as determined by the presence of: reductions in topsoil depth (as shown by root exposure, presence of pedestals; exposed sub-soil horizons or armour layers); gully, sheet or rill erosion, landslides, or other forms of mass-movement erosion;

(ii) Decline in organic matter content and/or recession of vegetation cover as shown by reduction in plant cover or productivity due to overgrazing or other land management practices, thinning of topsoil organic layer, scarcity of topsoil litter and debris (GPS and photo evidence should be provided);

(iii) Presence of plant species locally known to be related to the condition of degradation of the land or field/lab tests showing nutrient depletion (e.g. reduced growth, leaf loss, dessication, leaf chlorosis), salinity or alkalinity, toxic compounds and heavy metals;

(iv) A reduction in plant cover or productivity due to overgrazing or other land management practices.

The A/R CDM project activity will be implemented on savannah grassland that is subject to repeated annual wildfires. More than 50 fires, with an impact on at least 100 ha of savannah, were recorded between 2001 and 2005 at the Ibi station (Bwebwe, 2006[21]). This main factor of degradation greatly reduces existing natural vegetation cover. Grasses and ferns partially cover the soil again shortly after wildfire events, but trees and shrubs cannot recover with such a high frequency of wildfires.
Therefore, in compliance with condition (c) (iv), the A/R CDM project will be implemented on degraded lands.

Therefore, the A/R CDM project activity respects the conditions of applicability of methodology AR-ACM0001/version 03.

Illustrations 12 and 13 : Wild fire and shrubby savannah two weeks after the passage of a fire

[21] Bwebwe J., 2006. Nature et effets des feux de brousse dans la zone entre les rivières Bombo et Lufimi au plateau des Batéké, Mémoire Faculté des Sciences Agronomiques, Université de Kinshasa, pp 29.

C.3. Assessment of the selected carbon pools and emission sources of the approved methodology to the proposed CDM project activity:

The carbon pools included in or excluded from the project boundary are shown in the following table.

Table 8 – Carbon pools

Carbon pools	Yes/No	Justification / Explanation of choice
Above-ground biomass	**Yes**	**Major carbon pool subjected to the project activity.**
Below-ground biomass	**Yes**	**Major carbon pool subjected to the project activity.**
Dead wood	**No**	**As a conservative measure, this pool is not accounted.**
Litter	**No**	**As a conservative measure, this pool is not accounted.**
Soil organic carbon	**Yes**	**Major carbon pool subjected to the project activity due to the soil preparation (ploughing).**

As there are no significant pre-project living trees and the lands to be planted are degraded/degrading or in a low-level steady state, carbon stocks in dead wood and litter in the baseline scenario can be expected to decrease more or increase less, relative to the project scenario. Therefore, based on applied methodology, these pools can be conservatively omitted.

Table 9 – Emissions sources

Emission sources	Gas	Included/Excluded
Burning of woody biomass	**CO_2**	**Excluded**
	CH_4	**Included**
(i.e. excluding herbaceous biomass)	**N_2O**	**Excluded**

C.4. Description of strata identified using the *ex ante* stratification:

C.4.1. Stratification under ex-ante baseline scenario

Lands selected for planting are homogeneous and composed of grassy savannah, without any woody vegetation, in addition to a few shrubby savannahs. Thus, selected lands represent a single *ex ante* baseline stratum.

C.4.2. Stratification under ex ante project scenario

The construction of the *ex-ante* stratification is based on type of stands, planted species and their expected tree biomass. Therefore, stands planted with local species and other exotic species are considered as together. We have the following *ex-ante* stratification for the project scenario:

Type of stand	Tree species	Area (ha)	Stratum Id
Agroforestry	*Acacia sp.*	2.617,45 ha	1
Agroforestry	*Eucalyptus sp.*	349,20 ha	2
Agroforestry	*Pinus sp.*	139,68 ha	3
Agroforestry	Local species and other exotic species	465.60 ha	4
Pure plantation	*Acacia sp.*	119.15 ha	5
Pure plantation	*Eucalyptus sp.*	69,84 ha	6
Pure plantation	*Pinus sp.*	69,84 ha	7
Pure plantation	Local species and other exotic species	162.97 ha	8
Enhancement of natural regeneration	-	232,80 ha	9
	TOTAL (ha)	**4.226,53 ha**	

Thus, 9 different strata can be defined.

C.5. Identification of the baseline scenario:

C.5.1. Description of the application of the procedure to identify the most plausible baseline scenario (separately for each stratum defined in C.4.):

The most recent version of the "*Combined tool to identify the baseline scenario and demonstrate the additionality in A/R CDM project activities"* has been used in accordance with the A/R CDM baseline and monitoring methodology.

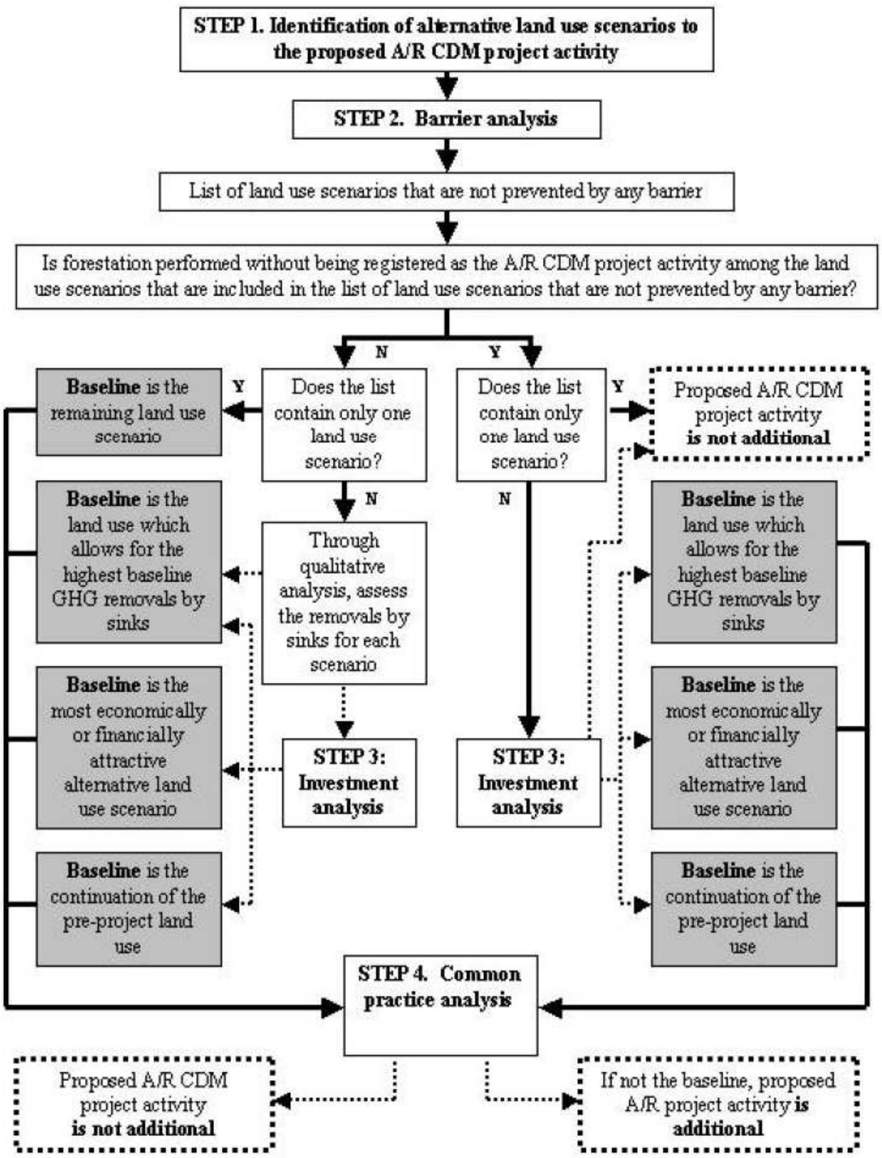

Figure 8: Indicative flowchart of the combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities (Combined tool to identify the baseline scenario and demonstrate the additionality in A/R CDM project activities)

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

If project participants claim that the afforestation or reforestation CDM project activity has a starting date after 31 December 1999 but before the date of its registration, then the project participants shall:

- Provide evidence that the starting date of the A/R CDM project activity was after 31 December 1999, and

The starting date of the A/R CDM project activity is the 1st of July 2008.

- Provide evidence that the incentive from the planned sale of CERs was seriously considered in the decision to proceed with the project activity. This evidence shall be based on (preferably official, legal and/or other corporate) documentation that was available to third parties at, or prior to, the start of the project activity.

A project identification note was written before the project start, thus clearly demonstrating that CDM incentives were accounted for in the project planning process.

Moreover, advanced contacts were made between Novacel and the World Bank's BioCarbon Fund. Those contacts show that the incentive from the planned sale of CERs was seriously considered[22].

STEP 1. Identification of alternative land use scenarios to the proposed A/R CDM project activity

This step serves to identify alternative land use scenarios to the proposed CDM project activity that could be the baseline scenario, through the following sub-steps:

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

The use of the area by the project entity as forest land is limited by a combination of natural conditions (sandy soils, grassy/shrubby savannahs) as well as the sectoral and local economic situation (dominated by subsistence farming), national policy (the area is not part of forest policy priorities) and international interests (to date aid programmes have only ventured into meeting local fuelwood needs with pilot plantations).

Given this reality, the possible land use options and possibilities within the project boundary are:

- ***Scenario 1** - Unmanaged grassland with wildfire-dominated ecological conditions and natural succession regrowth dynamics (business as usual*)
- ***Scenario 2** - Fire control without introducing agricultural activities*
- ***Scenario 3** - Slow agricultural and cattle breeding development through conventional activities*
- ***Scenario 4** - Savannah conversion into a managed forest (acacia, eucalyptus and local species planted), with fuel wood harvest and other management activities substituted for fire as the predominant disturbance process (corresponding to the project scenario but with no CDM support*)

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

No laws and regulations actually prevent or enforce any of the land use scenarios identified above. Indeed, prescriptions aiming at limiting burning practices by growers and hunters are not enforced and non-compliance with these requirements is widespread in the country.
Besides, laws and regulations do not prevent or prescribe agriculture and cattle breeding in the project area, nor forest conversion. Therefore, all the scenarii listed in step 1.a are credible alternative land uses.

STEP 2. Barrier analysis

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

- Investment barriers / lack of access to credit: the payback period for fuelwood is long (first harvest after 6 years). Therefore growers need access to long term credit. But accessible banks offered loans with mean rates of 17 % in 2008 (World Bank, 2008[23]). So, growers can not get access to affordable credits.

- Technological barriers / prevailing practice: the land use scenario as harvested plots for fuelwood is the first of its kind on the Batéké plateau. The only similar experience dates back to the 1990s and was supported by ODA.

[22] See "Letter of Intent: Potential Purchase of Emission Reductions, NOVACEL: Congo Bateke Fuelwood and Timber Plantation", 20/09/2005.

[23] World Bank, 2008. Democratic Republic of Congo. Economic Report Fall 2008, 20 p.

[25] See Letter of Intent from Umicore, 17/10/2007.

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

The unique land use scenario not prevented by any barrier is Scenario 1 (business as usual). Here is why other scenarios are prevented by these barriers in the absence of CDM support:

***Scenario 2** - Fire control without introducing agricultural activities*

- Technological barriers / prevailing practice: there is no experience of wildfire prevention in an area of land free of any settlement or farming project on it.
- Investment barriers: in the absence of significant fuelwood harvests (such as those that plantations can provide), there would be no noticeable revenue against which fire control and management costs could be met. There is no chance of obtaining financial investments through this scenario.
- Institutional barriers: fire fighting is traditionally undertaken either directly by the government or by private operators under contract with the government. Public funding for fire control in an area with little available timber or other economic resources would be under continued pressure from other budgetary requirements. Fire control costs would be expected to rise as fuel loads increased. This management approach would not meet government objectives for rural fuelwood supply from sustainable sources.

***Scenario 3** - Slow agricultural and cattle breeding development through conventional activities*

- Investment barriers: Existing activities similar to this Scenario show low returns on investment. Indeed, agricultural development on such a large area would require the application of fertilizers, as soils are poor. Fertilization would be prohibitive considering the remoteness of the area.
- Institutional barriers: Public funding for agricultural development is low and under continual pressure from other budgetary requirements.
- Technological barriers / prevailing practice: The prevailing practice in the region is subsistence farming. Livestock rearing is not common.

***Scenario 4** - Savannah conversion into a managed forest (acacia, eucalyptus and local species planted), with fuel wood harvest and other management activities substituted for fire as the predominant disturbance process (corresponding to the project scenario but without CDM support*)

- Investment barriers: Capital expenses are high and financial returns are long-term. The country risk profile is very high according to international index (mark "D" by COFACE, www.trading-safely.com). No such projects exist apart from similar acacia plantations from the 1990s in Mampu that were technically and financially supported by European Community development assistance. Moreover, the financial support of UMICORE[25] and SUEZ[26] to the present project is conditioned on CDM eligibility in order to make the whole project viable, according to their agreements with NOVACEL.
- Institutional barriers: This area is outside national forestry priorities and savannah conversion is outside the scope of public forest services.
- Technological barriers / prevailing practice: Lack of common awareness on the environmental impact of wildfire, damage to soil and inhibiting local communities to actively participate in the management of savannah conversion. Successful afforestation of savannah grassland on the Batéké plateau on large areas requires sound silvicultural expertise and practices, as well as trained personnel to grow and tend forest plantations on poor soils. Such capacities are presently

[26] See the financing agreement between Novacel and Suez, 21/02/2008.

lacking in DRC. Moreover, individuals or domestic private enterprises are too weak to successfully manipulate the chain from investment, production to market especially for ligneous forest products as such chains are much longer than for food products. Indeed, the land use scenario of agroforestry (cassava intercropped with *Acacia sp*., or *Eucalyptus sp*. or *Pinus sp*.) for fuelwood is the first of its kind on the Batéké plateau this century.

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

Is forestation without being registered as an A/R CDM project activity included in the list of land use scenarios that are not prevented by any barrier?

No

If no, then, does the list contain only one land use scenario?

Yes

If yes, then the remaining land use is the baseline scenario. Continue with Step 4: Common practice test

According to the decision tree of the "*Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities*", Scenario 1 is the baseline scenario.

STEP 4. Common practice analysis

As mentioned previously, the activity implemented by the project is the first of its kind in the Batéké plateau. The project participant is a private company and the land use scenario as a short rotation coppice for fuelwood from mixed *Acacia sp* and *Eucalyptus sp* plantations has never been implemented in the region. Therefore, Step 4 is not satisfied. The A/R CDM project activity is additional.

C.5.2. Description of the identified baseline scenario (separately for each stratum defined in Section C.4.):

Currently those areas to be afforested in the project boundary are mostly uncultivated lands occupied by grasses and shrubs. They conform to the general physical and natural characteristics of the Batéké plateau. In the long term, maintaining of unmanaged conditions would lead to the perpetuation of the cycle of fire and grass re-growth. As a consequence, vegetation dynamics is seriously disturbed. The development of shrubs is limited to annual ramification from the lower buds of branches, as the observation of their morphology reveals. Tree seedlings are destroyed by wildfires and annual herbaceous area quickly colonize the whole space between shrubs and trees. This herbaceous stratum, mainly composed of *Hyparrhenia diplandra*, is very competitive and thus, does not allow for natural regeneration of trees. Besides, this strata is highly inflammable during the dry season, therefore enhancing the occurrence of wildfires in the project area.

C.6. Assessment and demonstration of additionality:

See chapter C.5.1., step 4.

C.7. Estimation of the *ex ante* baseline net GHG removals by sinks:

Under the applicability conditions of the methodology AR-ACM001 :

- Changes in carbon stock of above-ground and below-ground biomass of non tree vegetation may be conservatively assumed to be zero for all strata in the baseline scenario;
- It is expected that the baseline dead wood and litter carbon pools will not show a permanent net increase. It is therefore conservative to assume that the sum of the changes in the carbon stocks of dead wood and litter carbon pools is zero for all strata in the baseline scenario;
- Changes in carbon stock in soil organic carbon may be conservatively assumed to be zero for all strata in the baseline scenario.

Therefore the baseline net GHG removals by sinks will be determined as:

$$\Delta C_{BSL} = \Delta C_{BSL,tree}$$ **Equation (1)**

where:

ΔC_{BSL}	Baseline net greenhouse gas removals by sinks; t CO_2-e
$\Delta C_{BSL,tree}$	Sum of the carbon stock changes in above-ground and below-ground biomass of trees in the baseline; t CO_2-e

According to the methodology applied, the baseline net GHG removals by sinks, if greater than zero, shall be assumed to be constant until steady state is reached under the baseline conditions.

Under steady state:

$$\Delta C_{BSL} = 0$$

The frequency of fires is very high in the project area. Indeed, between 2001 and 2005, more than 50 fires occurred (Bwebwe, 2006[27]). This repetition of fires leads to the degradation of the natural environment: some species gradually disappear, and growth and development of others are seriously restricted (Bwebwe, 2006). Moreover, the biological activity of soils drops because of high temperatures during fires. Population density is gradually increasing in the Batéké region and it seems that there is a positive correlation between human density and the occurrence of fires (Bwebwe, 2006). Thus, it seems realistic to consider that under the conditions of the baseline scenario, a steady-state is reached.

Therefore, $\Delta C_{BSL} = 0$

[27] Bwebwe J., 2006. Nature et effets des feux de brousse dans la zone entre les rivières Bombo et Lufimi au plateau des Batéké, Mémoire Faculté des Sciences Agronomiques, Université de Kinshasa, pp 29.

Table 10 - Estimation of the *ex ante* baseline net GHG removals by sinks

Please present final results of your calculations using the following tabular format.	
Year	**Annual estimation of baseline net anthropogenic GHG removals by sinks in tonnes of CO_2 e**
2008	**0**
2009	**0**
2010	**0**
2011	**0**
2012	**0**
2013	**0**
2014	**0**
2015	**0**
2016	**0**
2017	**0**
2018	**0**
2019	**0**
2020	**0**
2021	**0**
2022	**0**
2023	**0**
2024	**0**
2025	**0**
2026	**0**
2027	**0**
2028	**0**
2029	**0**
2030	**0**
2031	**0**
2032	**0**
2033	**0**
2034	**0**
2035	**0**
2036	**0**
2037	**0**
Total estimated baseline net GHG removals by sinks (tonnes of CO2 e)	0
Total number of crediting years	30
Annual average over the crediting period of estimated baseline net GHG removals by sinks (tonnes of CO2 e)	0

C.8. Date of completion of the baseline study and the name of person(s)/entity(ies) determining the baseline:

17/12/2008

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Field operations supervisors: Pr. Constantin LUBINI AYINGWEU, botanist and engineer ; Jean NDEMBO, Pedologist, teaching at the University of Kinshasa.
Field operators: Jules MITASHI, Kis MINGU KISEKA, Giscard TANGI, Cécile DIAKA PIKA, Congolese agronomy engineers.

SECTION D. Estimation of *ex ante* actual net GHG removals by sinks, leakage and estimated amount of net anthropogenic GHG removals by sinks over the chosen crediting period

D.1. Estimate of the *ex ante* actual net GHG removals by sinks:

According to the applied methodology :

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

Equation (12)

Where :

ΔC_{ACTUAL}	Actual net greenhouse gas removals by sinks; t CO_2-e
ΔC_P	Sum of the changes in above-ground and below-ground biomass, dead wood, litter and soil organic carbon stocks in the project scenario; t CO_2-e
GHG_E	Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; t CO_2-e

a. Changes in the carbon stock

The calculations for the changes in carbon stock are done with TARAM, version 1.3.., in four different files[28].

The verifiable changes in the carbon stock in tree above-ground biomass and below-ground biomass and soil organic carbon within the project boundary are estimated using the following approach :

[28] "TARAM V.1.3_BATEKE_R.D.CONGO_200709_1.xls", [28] "TARAM V.1.3_BATEKE_R.D.CONGO_200709_2.xls", [28] "TARAM V.1.3_BATEKE_R.D.CONGO_200709_3.xls", [28] "TARAM V.1.3_BATEKE_R.D.CONGO_200709_4.xls"

$$\Delta C_P = \sum_{t=1}^{t*} \Delta C_t * \frac{44}{12} * 1year - E_{BiomassLoss}$$

Equation (13)

Where :

ΔC_P	Sum of the changes in carbon pools in above-ground and below-ground tree biomass, dead wood, litter and soil organic carbon in the project scenario; t CO_2-e
ΔC_t	Annual change in carbon stock in all selected carbon pools for year *t*; t C yr^{-1}
$E_{BiomassLoss}$	Increase in CO_2 emissions from loss of existing woody biomass due to site-preparation (including burning), and/or to competition from forest (or other vegetation) planted as part of the A/R CDM project activity; t CO_2-e
t	*1, 2, 3, …t*** years elapsed since the start of the A/R project activity; yr
44/12	Ratio of molecular weights of CO_2 and carbon; t CO_2-e $(t\ C)^{-1}$

EBiomassLoss shall be estimated using the most recent version of the approved methodological tool : "Estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of an A/R CDM project activity".

In compliance with the tool mentioned above, its applicability conditions are :

Table 11 – Applicability conditions for the tool "Estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of an A/R CDM project activity".

Applicability condition	Match	Test/Justification
A. If the use of fire for site preparation is not specifically excluded, and the methodology within which this tool is applied does not include accounting of leakage emissions due to the spread of fire beyond the project boundary, then add the following applicability condition: • **If fire is used during site preparation then fire control measures such as installation of firebreaks or back-burning shall be taken to ensure fire does not spread outside the project boundary : that is, no biomass burning shall be permitted to occur beyond the project boundary due to site preparation activities.**	✓	**The use of fire is specifically excluded for site preparation.**
B. Calculation of emissions can be simplified, and project emissions reduced, if trees existing at the time the project commences are not removed or damaged as part of site preparation. If emissions from clearance of existing tree biomass are not to be accounted, add the following applicability condition: • **Site preparation shall be restricted to clearance of non-tree vegetation, with any biomass burning (if applicable) carried out in such a way as to avoid damage to existing trees within the project boundary.**	✓	**Emissions from clearance of existing trees are accounted for in agroforestry and pure plantation stands.** **Emissions from clearance of existing trees are not accounted for natural regeneration stands. Only non-tree vegetation will be cleared. The existing trees will not be damaged as the aim of this stand is to enhance their growth through protection**

		against fire.
C. Unless changes in the soil carbon pool are explicitly accounted, add the following applicability condition to ensure site preparation activities do not result either in significant emissions from oxidation of soil carbon or in significant accountable losses due to erosion: • **Site preparation shall be carried out in a manner consistent with the conditions in the *Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM A/R project activities*; EB 33 Meeting Report, Annex 15.**	**N/A**	**Changes in soil carbon pool are accounted for.**

Thus, this tool can be used.

According to Equations (1), (2), (3) of the tool mentioned above :

$$E_{BiomassLoss} = \left(L_{SP,\,tree} + L_{SP,\,shrub}\right) \frac{44}{12}$$

Equation (1)

and

$$L_{SP,\,tree} = A_S\ B_{AB,\,tree}\ \left(1 + R_{tree}\right)\ CF_{tree}$$

$$L_{SP,\,shrub} = A_S\ B_{AB,\,shrub}\ \left(1 + R_{shrub}\right)\ CF_{shrub}$$

Equations (2), (3)

where :

$E_{BiomassLoss}$	Increase in CO_2 emissions from loss of biomass in existing vegetation as a result of site preparation; *t* CO_2
L_{SP}	Carbon stock loss in existing tree or shrub vegetation (as indicated by subscripts in equations) as a result of site preparation; *t C*
A_S	Area of the stratum; *ha*
B_{AB}	Average above-ground biomass stock of tree or shrub vegetation (as indicated by subscripts in equations); $t\ d.m.\ ha^{-1}$
R	Average root:shoot ratio appropriate for biomass stocks, for tree or shrub vegetation (as indicated by subscripts in equations); $t\ d.m.\ ha^{-1}\ (t\ d.m.\ ha^{-1})^{-1}$.
CF	Average carbon fraction of biomass for tree or shrub vegetation (as indicated by subscripts in equations); $t\ C\ (t\ d.m.)^{-1}$. IPCC default values for tree and shrub vegetation, respectively, are: 0.50, 0.49
$\frac{44}{12}$	Conversion factor: ratio of molecular weights of CO_2 and C; $mol\ mol^{-1}$

Loss of biomass is due to the site preparation, including the creation of roads inside the A/R CDM project boundaries.

Table 12 – Values to be used for the *ex-ante* estimation of Ebiomass Loss

Data	**Value**	**Source**
A_S	According to file "SitePreparation_RoadCreation.xls", spreadsheets "SitePreparation" and "RoadCreation"	
R_{tree} and R_{shrub}	0.54	Table 4.4, IPCC 2006 and Annex 17, EB 46
CF_{tree} and CF_{shrub}	0.50 tC/tdm	IPCC default value
BEF_2	6.2	Table 3.A.1.10. IPCC 2003, tropical broadleaf and Annex 17, EB 46

$$E_{biomassLoss} = A_S \bullet (1 + R) \bullet CF \bullet 44/12 \bullet (B_{AB,tree} + B_{AB,\ shrub})$$

To assess, we refer to IPPC 2006, Guidelines for National Greenhouse Gas inventories, Volume 4, Chapter 2, Tables 2.4. and 2.6.

We make the conservative assumption that :

$$B_{AB,tree} + B_{AB,\ shrub} = M_B$$

with M_B : mass of fuel available for combustion, tonnes ha^{-1}. This includes biomass, ground litter and dead wood.

This assumption is conservative as M_B includes other pools than Above-Ground Biomass.

According to Table 2.4. of IPCC 2006, for Savannah woodland, early dry season burns (see section A.5.1.) :

$$M_B \bullet C_f = 2.5 \text{ tdm / ha}$$

According to Table 2.6. of IPCC 2006, for Savannah woodland, early dry season burns (see section A.5.1.) :

$$C_f = 0.22$$

Thus,

$$B_{AB,tree} + B_{AB,\ shrub} = M_B = 11.36 \text{ tdm / ha}$$

Besides,

$$V = M_B / (W_D \times BEF_2) = 3.66 \text{ m}^3\text{/ha}$$ with V : stand volume

Thus, in compliance with the tool "Estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of a CDM A/R project activity" E biomass Loss can be conservatively estimated:

$$\mathbf{E_{biomassLoss} = 1.54 . 0.5 . 44/12 . 11.36 . A_S}$$

$\mathbf{E_{biomassLoss} = 32.07\ A_S}$

ΔC_t shall be estimated using the following equation :

$$\Delta C_t = \sum_{i=1}^{M_{PS}} (\Delta C_{AG,i,t} + \Delta C_{BG,i,t} + \Delta C_{DW,i,t} + \Delta C_{LI,i,t} + \Delta C_{SOC,i,t})$$

Equation (14)

Where :

ΔC_t	Annual change in carbon stock in all carbon pools for *year t*; t C yr^{-1}
$\Delta C_{AG,i,t}$	Annual carbon stock change in above-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); t C yr^{-1}
$\Delta C_{BG,i,t}$	Annual carbon stock change in below-ground biomass of trees for stratum *i*, (possibly average over a monitoring period); t C yr^{-1}
$\Delta C_{DW,i,t}$	Annual change in the dead wood carbon pool in stratum *i*, (possibly averaged over a monitoring period); t C yr^{-1}
$\Delta C_{LI,i,t}$	Annual change in the litter carbon pool in stratum *i*, (possibly averaged over a monitoring period); t C yr^{-1}
$\Delta C_{SOC,i,t}$	Annual carbon stock change in the soil organic carbon pool[6]-for stratum *i*, time *t*; t C yr^{-1}
i	*1, 2, 3, … M_{PS}* strata in the project scenario
t	*1, 2, 3, … t^** years elapsed since the start of the A/R CDM project activity

According to the applied methodology, changes in the carbon pools that are conservatively excluded from accounting shall be set equal to zero.

In compliance with table 8,

$$\Delta C_{DW\,i\,t} = 0$$
$$\Delta C_{LI\,i\,t} = 0$$

Therefore,

$$\Delta C_t = \sum_i (\Delta C_{AG\,i\,t} + \Delta C_{BG\,i\,t} + \Delta C_{SOC\,i\,t})$$

Tree Biomass

According to the applied methodology :

$$\Delta C_{AG,i,t} + \Delta C_{BG,i,t} = \frac{C_{tree,i,t2} - C_{tree,i,t1}}{T}$$

Equation (22)

where :

$\Delta C_{AG,i,t}$	Annual carbon stock change in above-ground biomass of trees for stratum *i*; t C yr^{-1}
$\Delta C_{BG,i,t}$	Annual carbon stock change in below-ground biomass of trees for stratum *i*; t C yr^{-1}
$C_{tree,i,t}$	Carbon stock in trees in stratum *i*, at time *t*; t C
T	Number of years between monitoring time t_2 and t_1 ($T = t_2 - t_1$); yr
i	*1, 2, 3, …* M_{PS} strata in the project scenario
t	*1, 2, 3, …* t^* years elapsed since the start of the A/R CDM project activity

The *ex ante* mean carbon stock in above- and below-ground biomass per unit area is estimated based on the Biomass Expansion Factors (*BEF*) method.

$$C_{AB\_tree,l,j,i,sp,t} = V_{l,j,i,sp,t} * D_j * BEF_{2,j} * CF_j \quad \text{Equation (15)}$$

Where :

$C_{AB\_tree,l,j,i,sp,t}$	Carbon stock in above-ground biomass of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*; t C tree^{-1}
$V_{l,j,i,sp,t}$	Stem volume of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*; m^3 tree^{-1}
D_j	Basic wood density of species *j*; t d.m. m^{-3}
$BEF_{2,j}$	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for species *j*; dimensionless
CF_j	Carbon fraction of biomass for tree species *j*; t C t^{-1} d.m. (IPCC default value = 0.5 t C t^{-1} d.m.)
l	Sequence number of trees on plot *sp*
i	*1, 2, 3, …* M_{PS} strata in the project scenario
j	*1, 2, 3, …* S_{PS} tree species in the project scenario
t	*1, 2, 3, …* t^* years elapsed since the start of the A/R CDM project activity

and :

$$C_{BB\_tree,l,j,i,sp,t} = C_{AB\_tree,l,j,i,sp,t} * R_j \quad \text{Equation (16)}$$

Where :

$C_{BB\_tree,l,j,i,sp,t}$	Carbon stock in below-ground biomass of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*, t C tree^{-1}
$C_{AB\_tree,l,j,i,sp,t}$	Carbon stock in above-ground biomass of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*, t C tree^{-1}
R_j	Root-shoot ratio appropriate for biomass stock, for species *j*; dimensionless

Finally,

$$C_{tree,i,sp,t} = \sum_{j=1}^{S_{PS}} \sum_{l=1}^{N_{j,i,sp,t}} (C_{AB\_tree,l,j,i,sp,t} + C_{BB\_tree,l,j,i,sp,t})$$

Equation (17)

where:

$C_{tree,i,sp,t}$	Carbon stock in trees on plot *sp* of stratum *i* at time *t*; t C
$C_{AB\_tree,l,j,i,sp,t}$	Carbon stock in above-ground biomass of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*; t C $tree^{-1}$
$C_{BB\_tree,l,j,i,sp,t}$	Carbon stock in below-ground biomass of tree *l* of species *j* in plot *sp* in stratum *i* at time *t*; t C $tree^{-1}$
$N_{j,i,sp,t}$	Number of trees of species *j* on plot *sp* of stratum *i* at time *t*
l	Sequence number of trees on plot *sp*
i	*1, 2, 3, …* M_{PS} strata in the project scenario
j	*1, 2, 3, …* S_{PS} tree species in the project scenario
t	*1, 2, 3, …* t^* years elapsed since the start of the A/R CDM project activity

Table 13 – Values to be used for the *ex-ante* estimation of Tree Biomass

Data	Value	Source
Acacia sp		
V_{Acacia}	**9.5 m^3/ha/year**	**Table 3.A.1.7. IPCC 2003 + EB46 –annex 17**
D_{Acacia}	**0.50 tdm/m^3**	**IPCC default value**
$BEF_{2Acacia}$	**2.7**	**Table 3.A.1.10. IPCC 2003, tropical broadleaf + EB46 –annex 17**
CF_{Acacia}	**0.50 tC/tdm**	**IPCC default value**
R_{Acacia}	**0.29**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**
	Eucalyptus sp	
$V_{Eucalyptus}$	**17.5 m^3/ha/year**	**Table 3.A.1.7. IPCC 2003 + EB46 –annex 17**
$D_{Eucalyptus}$	**0.50 tdm/m^3**	**IPCC default value**
$BEF_{2Eucalyptus}$	**2.7**	**Table 3.A.1.10. IPCC 2003, tropical broadleaf + EB46 –annex 17**
$CF_{Eucalyptus}$	**0.50 tC/tdm**	**IPCC default value**
$R_{Eucalyptus}$	**0.3**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**

	Pinus sp	
V_{Pinus}	**14.5 m^3/ha/year**	**Table 3.A.1.7. IPCC 2003 + EB46 –annex 17**
D_{Pinus}	**0.50 tdm/m^3**	**IPCC default value**
BEF_{2Pinus}	**1.3**	**Table 3.A.1.10. IPCC 2003, tropical pines + EB46 –annex 17**
CF_{Pinus}	**0.50 tC/tdm**	**IPCC default value**
R_{Pinus}	**0.25**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**
	Local species	
$V_{LocalSpecies}$	**8.57 m^3/ha/year[30]**	**Calculated through equation 3.2.5 IPCC 2003 with data from Tables 3.A.1.6. and 3.A.1.10., IPCC 2003 + EB46 –annex 17**
$D_{LocalSpecies}$	**0.50 tdm/m^3**	**IPCC default value**
$BEF_{2LocalSpecies}$	**2.7**	**Table 3.A.1.10. IPCC 2003, tropical broadleaf + EB46 –annex 17**
$CF_{LocalSpecies}$	**0.50 tC/tdm**	**IPCC default value**
$R_{LocalSpecies}$	**0.29**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**
	Other Exotic Species	
$V_{OtherExoticSpecies}$	**8.57 m^3/ha/year[30]**	**Calculated through equation 3.2.5 IPCC 2003 with data from Tables 3.A.1.6. and 3.A.1.10., IPCC 2003 + EB46 –annex 17**
$D_{OtherExoticSpecies}$	**0.50 tdm/m^3**	**IPCC default value**
$BEF_{2OtherExoticSpecies}$	**2.7**	**Table 3.A.1.10. IPCC 2003, tropical broadleaf + EB46 –annex 17**
$CF_{OtherExoticSpecies}$	**0.50 tC/tdm**	**IPCC default value**
$R_{OtherExoticSpecies}$	**0.29**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**
	Natural regeneration stand	
$V_{RegenerationStands}$	**3.36 m^3/ha/year [30] (≤20 years) 1.71 m^3/ha/year [30] (>20 years)**	**Calculated through equation 3.2.5 IPCC 2003 with data from Tables 3.A.1.5. and 3.A.1.10., IPCC 2003[29] + EB46 –annex 17**
$D_{RegenerationStands}$	**0.50 tdm/m^3**	**IPCC default value**
$BEF_{2RegenerationStands}$	**2.7**	**Table 3.A.1.10. IPCC 2003, tropical broadleaf + EB46 –annex 17**
$CF_{RegenerationStands}$	**0.50 tC/tdm**	**IPCC default value**
$R_{RegenerationStands}$	**0.29**	**Table 3.A.1.8. IPCC 2003 + EB46 –annex 17**

Soil Carbon

According to the applied methodology, for *ex ante* estimations, the changes in stocks of soil organic carbon may be assessed using the default method or the changes shall be conservatively neglected. Here, they are conservatively neglected.

Therefore,

[29] For detailed calculations, please refer to file "calcul.xls", speadsheet "BiomassGrowth"

$$\Delta C_{SOC\,i\,t} = 0$$

b. Estimation of GHG emissions within the project boundary

The increase in GHG emissions as a result of the implementation of the proposed AR CDM project activity within the project boundary can be estimated as:

$$GHG_E = \sum_{t=1}^{t^*} E_{BiomassBurn,t}$$

Equation (30)

Where :

GHG_E	Increase in GHG emissions as a result of the implementation of the proposed A/R CDM project activity within the project boundary; t CO_2-e
$E_{BiomassBurn,t}$	Non-CO_2 emissions due to biomass burning of existing woody vegetation as part of site preparation during the year *t*; t CO_2-e
t	*1, 2, 3, … t** years elapsed since the start of the A/R CDM project activity

As described in section A.5.4, no burning of the existing vegetation is planned as part of site preparation. Therefore :

$$E_{BiomassBurn,t} = 0$$

Table 14 – Ex-ante estimation of actual net GHG removals by sinks[30]

Year	ΔC_{Actual} tCO2e
2008	1,109
2009	29,013
2010	57,222
2011	83,878
2012	54,076
2013	53,663
2014	53,305
2015	127,498
2016	127,490
2017	127,458
2018	127,518
2019	3,243
2020	-5,247
2021	-4,524
2022	127,518
2023	127,518
2024	126,231
2025	126,150
2026	12,417
2027	-12,002
2028	-3,623
2029	-14,584
2030	12,481
2031	9,392
2032	3,593
2033	-2,091
2034	-956
2035	20,926
2036	126,176
2037	126,176

D.2. Estimate of the *ex ante* leakage:

Under applicability conditions of this methodology the following types of leakage emissions are allowed : GHG emissions due to activity displacement and GHG emissions due to increase in use of wood posts for fencing.

Leakage shall be estimated as follows :

$$LK = LK_{ActivityDisplacement}$$ **Equation (31)**

Where :

[30] For detailed calculations, please refer to the file "CERs_TOTAL_200709.xls"

LK	Total GHG emissions due to leakage; t CO_2-e
$LK_{ActivityDisplacement}$	Leakage due to activity displacement; t CO_2-e

Besides :

$$LK_{ActiviyDisplacement} = LK_{Conversion}$$ **Equation (32)**

Where :

$LK_{ActiviyDisplacement}$	Leakage due to activity displacement; t CO_2-e
$LK_{Conversion}$	Leakage due to conversion of land to grazing land; t CO_2-e

The savannahs of the Batéké plateau have a very low feeding value for cattle. There is no breeding in the project area. As such, the A/R CDM project activity is unlikely to result in the displacement of grazing activity. Therefore:

$$LK_{Conversion} = 0$$

Therefore :

$$LK = 0$$

Table 15 – *Ex-ante* estimation of leakages

Year	LK tCO2e
2008	0
2009	0
2010	0
2011	0
2012	0
2013	0
2014	0
2015	0
2016	0
2017	0
2018	0
2019	0
2020	0
2021	0
2022	0
2023	0
2024	0
2025	0
2026	0
2027	0
2028	0
2029	0
2030	0
2031	0
2032	0
2033	0
2034	0
2035	0
2036	0
2037	0

SECTION E. Monitoring plan

E.1. Monitoring of project implementation:

E.1.1. Monitoring of forest establishment and management:

a. Monitoring of the boundary

This is meant to demonstrate that the actual area afforested conforms to the afforestation area outlined in the project plan. The following activities are foreseen:

- Field surveys concerning the actual project boundary within which A/R activity has occurred, site by site;
- Measuring geographical positions (latitude and longitude of each corner polygon sites) using GPS;
- Checking whether the actual boundary is consistent with the description given in section A.4.2. ;
- Input the measured geographical positions that are in conformity with the description given in section A.4.2. into the GIS system and calculate the area of each stratum and stand;
- The project boundary will be monitored periodically throughout the crediting period. If the forest area changes during the crediting period, for instance, because deforestation occurs on the project area, the specific location and area of the deforested land will be identified. Similarly, if the planting on certain lands within the project boundary fails these lands will be documented;
- Personnel involved in the monitoring will be trained to identify the changes in the boundary and to record changes in the project database for reporting of project verification.

b. Monitoring of forest establishment

The monitoring of the forest establishment will cover site preparation, planting and establishment of the forest.

- The monitoring of site preparation activities covers the identification and recording of the area under site preparation. The area affected by site preparation will be assessed using the GPS. These data form the basis for calculation of project emissions from the loss of biomass in site preparation;
- Information on planting schedule, location, area, species planted, spacing will be recorded in plot journals and archived in the project database;
- Survival rates of planted trees are counted during the three months of the planting and replanting is done to fill the gaps. The area and location of supplemental plantings undertaken to fill the gaps and recorded in the project database are identified on the strata maps. Re-planting will be conducted if the survival rate is lower than 90 percent of the final planting density expected.

c. Monitoring of forest management

The monitoring of forest management will cover silvilcultural management, maintenance of plantation, and firebreaks, harvesting of trees and replanting or sowing actions.

- Date, location and type of weeding actions in pure plantation will be recorded and archived in the project database;
- Date, location and type of maintenance actions in cassava plantations will be recorded and archived in the project database;
- Date, location and type of maintenance actions for firebreaks will be recorded and archived in the project database;
- Date, location, volume of tree harvesting will be recorded and archived in the project database ;
- Date, location of cassava harvesting will be recorded and archived in the project database ;
- Re-planting and re-sowing actions will be checked. Date, location and type of stand will be recorded and archived in the database ;

- Deviations in the forest management activities implemented in the field and the ones outlined in section A.4.2 will be monitored, and reasons for deviations will be recorded.

Table16 – Monitoring of project implementation

ID number[31]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[32]	Recording frequency	Number of data points / Other measure or number of collected data.	Comments
1.1.1	*Project boundary*	*ddmmss*	*m*	*After the start of the project and at 5 years interval*	*All strata*	
1.1.2	*Area of slash and burn*	*ha*	*m*	*Once before planting*	*All strata*	*To confirm there is slash but no burning*
1.1.3	*Proportion of soil disturbance*	*%*	*c*	*annually*	*All strata*	
1.1.4	*Area planted*	*ha*	*m*	*annually*	*All strata and species*	*Record location, species and area*
1.1.5	*Survival rate for planting*	*%*	*m*	*annually during 3 years after planting*	*All species and strata*	*Using temporary sample plots*
1.1.6	*Harvest area*	*ha*	*m*	*annually*	*All strata and species*	*Record location, species and area*
1.1.7	*Harvested volume*	*m^3/ha*	*m*	*annually*	*All strata and species*	
1.1.8	*Disturbance*	*ha*	*m*	*annually*	*All strata and species*	*Location, area, species and type of disturbance, volume or biomass loss, changes strata/project boundary due to the disturbance*

E.1.2. If required by the selected approved methodology, describe or provide reference to, SOPs and quality control/quality assurance (QA/QC) procedures applied.

To develop a credible plan for measuring and monitoring carbon on the afforestation sites, steps must be taken to control for errors in sampling and data analysis. To provide confidence to all stakeholders that the reported carbon credits are reliable and meet minimum measurement standards, a quality assurance and quality control (QA/QC) plan is necessary. This plan includes formal procedures to verify methods used to collect field data and the techniques to enter and analyze data. To ensure continuity it is important that all data collected use the same procedures during the project life. Adhering to these procedures will ensure that in the event there is a change in personnel at NOVACEL, or if any of the people involved are questioned about any aspect of the project, all will be well informed. In addition to following the procedures outlined below, it is also important that a record be maintained to demonstrate that the steps are being followed; this needs to be done by developing a series of check sheets for each step.

For this purpose, procedures have been developed for:

- collecting reliable field measurements

[31] Please provide ID number for cross-referencing in the PDD.

[32] Please provide full reference to data source.

- verifying methods used to collect field data
- verifying data entry and analysis techniques
- data maintenance and archiving

a) Procedures to ensure reliable field measurements

Collecting reliable field measurement data is an important step in the quality assurance plan. Those responsible for the measurement work shall be fully trained in all aspects of the field data collection and data analyses. Standard operating procedures for each step of the field measurements will be adhered to at all times so that future field personnel can check past results and repeat the measurements in a consistent fashion.

- Field-team members are fully cognisant of all procedures and the importance of collecting data as accurately as possible; Before field measurements all procedures are reviewed with the whole monitoring team
- All field measurements are properly supervised by a project coordinator fully aware of all monitoring procedures, and any errors in techniques are corrected;
- The field forms are filed in accordance with the standard operating procedures. The document will list all names of the field team and the project leader will certify that the team is trained;
- New staff is adequately trained by its homologue fully aware of all procedures.

b) Verification of field data collection

To verify that plots have been installed and the measurements taken correctly:

- All measurements are observed by two persons for cross-checking
- At the end of the field works, 10% of the measurements will be independently checked by different personnel. Field data collected at this stage will be compared with the original data. Any errors found will be corrected and recorded. Any errors discovered will be expressed as a percentage of all plots that have been rechecked to provide an estimate of the measurement error.

c) Verification of data entry and analysis

Surveys data are entered into a computer-based information system especially designed for the project.

Reliable estimates require proper entry of data into the data analysis spreadsheets. Possible errors are minimised by reviewing entries using expert judgement and, where necessary, comparison with independent data to ensure that the data are realistic. Communication between all personnel involved in measuring and analysing data allow resolving any apparent anomalies before the final analysis of the monitoring data is completed. If there are any problems with the monitoring plot data that cannot be resolved, the plot is not used in the analysis.

- data entry is made by two trained persons for cross-checking
- final analysis is made by the person who prepared the monitoring
- minimum files shall be used in order to avoid losses of data in time and to facilitate data analysis

The following elements shall be particularly considered:

- Stratum ID: cross-check with previous monitoring and management plans
- Age of plantations: shall be integrated into GIS
- Number of trees: shall be integrated into the GIS for initial plantations and for natural regeneration
- Diameter at breast height (DBH): circumference shall be preferred. Measurements shall be cross-checked by two trained persons
- Wood density shall be updated by the project coordinator based on scientific studies on wood density
- Biomass expansion factor (BEF) shall be updated by the project coordinator based on scientific studies on BEF

- Carbon fraction shall be updated by the project coordinator based on scientific studies on carbon fraction
- Root:shoot ratio shall be updated by the project coordinator based on scientific studies on root:shoot ratio

Analysis of soil samples for carbon should be preceded by calibration with standards of known carbon concentration. All calibration results should be documented and archived along with sample analysis results. Likewise all balances for measuring dry weights should periodically be calibrated against known weights. Where possible, 10-20 % of samples should be reanalyzed and reweighed to produce an error estimate.

d) Data maintenance and archiving

Data will be archived in both electronic and paper forms, and conserved at least two years after the end of the crediting period. All electronic data and reports will be copied on durable media and update format, such as compact discs (CDs), and copies of the CDs will be stored in multiple locations. The archives include:

- Copies of all original field measurement data, laboratory data, data analysis spreadsheets;
- Estimates of the carbon stock changes in all chosen carbon pools and non-CO_2 GHG sources and corresponding calculation spreadsheets;
- GIS products and update software ;
- Copies of the measurement and monitoring reports.

In choosing key parameters or making important assumptions based on information that is not specific to the project circumstances, such as in use of default data, values will be selected to lead to an accurate estimation of net GHG removals by sinks, taking into account uncertainties. If uncertainty is significant, data will be chosen in order to under-estimate, rather than over-estimate, net GHG removals by sinks.

The uncertainty for each species in each stratum can be estimated from re-measurement of randomly selected plots and/or from the measurement of replicate plots. Uncertainties will be estimated and expressed as half the 95% confidence interval width divided by the estimated value,

$$U_s(\%) = \frac{\frac{1}{2}(95\%ConfidenceIntervalWith)}{\mu} \cdot 100$$

$$= \frac{\frac{1}{2}(4\sigma)}{\mu} \cdot 100$$

Where :

U_s = percentage uncertainty of each species within sub-stratum, %

μ = mean value

σ = standard deviation

If the default parameters are used, uncertainty will be higher than if locally measured parameters are used, and can be only roughly estimated with expert judgment. The percentage uncertainties on quantities that are the product of several terms are then estimated using the following equation :

$$U_S = \sqrt{U_1^2 + U_2^2 + \cdots U_n^2}$$

Where :

U_S percentage uncertainty of product (emission by sources or removal by sinks);

U_i percentage uncertainties associated with each term of the product (parameters and activity data),$i = 1,2,\ldots,n$

The percentage uncertainty on quantities that are the sum or difference of several terms can be estimated using following simple error propagation equation

$$U_c = \frac{\sqrt{(U_{s1} \cdot C_{s1})^2 + (U_{s2} \cdot C_{s2})^2 + \cdots + (U_{sn} \cdot C_{sn})^2}}{|C_{s1} + C_{s2} + \cdots + C_{sn}|}$$

Where :
U_c = combined percentage uncertainty of sub-stratum, %
U_{si} = percentage uncertainty of species *i* in the sub-stratum, %
C_{si} = mean carbon stock of species *i* in the sub-stratum
The stratum and total percentage uncertainties are further combined in the same way as above.

Table 17 – QA/QC undertaken

Data ***(Indicate ID number)***	Uncertainty level of data (High/Medium/Low)	**Explain QA/QC procedures planned for these data, or why such procedures are not necessary.**
1.1.1. Plot location	*Low*	*Random plot verification using GPS to ensure the consistent measuring and monitoring of the carbon stock change over time*
2.1.15. Tree species	*Low*	*Random verification over the project area to ensure the area of each tree species is correctly measured*
2.1.16. Age of plantation	*Low*	*Random verification over the project area to ensure the area in terms of plantation age is correctly measured*
2.1.17. Diameter at breast height	*Low*	*Random plot verification*
2.1.18. Eucalyptus height	*Low*	*Random plot verification*
2.1.20. Wood density of species j	*Low*	*Data that differs significantly from IPCC default value shall be verified*
2.1.21. Carbon fraction of species j	*Low*	*Data that differs significantly from IPCC default value shall be verified*
2.1.23. Root-shoot ratio	*Low*	*Data that differs significantly from IPCC default value shall be verified*

E.2. Sampling design and stratification

The stratification of the project is based on the type of stands (agroforestry, pure plantation) and the species groups used in the project. The need for *ex post* stratification will be evaluated at each monitoring event based on expected disturbance, management activities that are different from the one described in section A.5.4. or variation in carbon stock change for each stratum. Changes in the strata will be reported to the DOE for verification. A stratification map is prepared outlining the project boundaries, species composition. The physical features relating to the project boundary and management variables will be represented on the stratification map. The carbon stock changes in each stratum shall be monitored by adopting the sampling strategy outlined below.

a. Monitoring of strata

The *ex post* project stratification presented will be used as a basis for monitoring. The updating of *ex ante* stratification will be conducted on the basis of :

- Unexpected disturbances occurring during the crediting period (e.g. due to fire, pests or disease outbreaks), affecting different parts of an originally homogeneous stratum in a different way;
- Forest establishment and management (clearing, planting, harvesting, replanting) may be implemented at slightly different intensities and spatial locations than originally planned in section A.5.4. ;
- Two different strata may be similar enough to allow merging into one stratum.

b. Sampling size and plot allocation among strata

A stratified sampling design is used to estimate the verifiable changes in carbon stocks in the carbon pools of the project and the corresponding sampling error. The monitoring data are based on the record of field measurements at each monitoring interval as per the monitoring frequency adopted for the pool. The plot markers of permanent plots will not be prominently displayed to ensure that the sample plots do not receive differential treatment. The GPS coordinates would also be used to identify the plots.

Above-ground tree vegetation: Considering the large covariance between the observations at successive sampling events, permanent sample plots are used to estimate the changes in the biomass pool. Permanent sample plots facilitate the development of plot and management histories as the tree vegetation grows.

Soil: Considering the slow changes in the soil carbon, monitoring of changes in the soil carbon will be done at the first verification and at the last verification of the first crediting period and in the end of any subsequent crediting period.

The methodological tool "Calculation of the number of sample plots for measurements within A/R CDM project activities" (version 02) is used to calculate the number of plots for each stratum for the vegetation[33]. In compliance with the applied methodology, the targeted precision level for biomass estimation within each stratum is +/- 10% of the mean at a 95 % confidence level. The sample size for subsequent monitoring interval will be modified if variation observed in carbon stock changes after the first monitoring event based on *n* samples.

A sample size of 127 permanent sample plots is estimated as the sample size required for monitoring the aboveground biomass. The project designs square sampling plots of 250 m^2. The sample size estimation assumes a standard deviation of 50% of the mean value for *Acacia sp*., *Eucalyptus sp*. and *Pinus sp*. (the major species of the project), other species (local and exotic) and for the stand where natural regeneration is enhanced. Taking into account lack of local specific data on biomass estimates in the early stages of the species, this assumption is reasonable and conservative[34] – especially because seeds of *Acacia sp*., *Eucalyptus sp*. and *Pinus sp*. will be procured from certified source to avoid variability in growing stock, which is expected to minimize the intra-species variability in growth rates and the resulting variability in the carbon stocks of stands. Table 18 presents the number of sample plots calculated for monitoring the carbon stock changes in the above ground biomass. The sample size calculations will be revised further based on the availability of the species composition data of the major species groups.

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[33] See "sample_plots_070809.xls" file for calculation details.

[34] "Guidelines on conservative choice of data when estimating biomass stocks and change in woody vegetation (EB 46, annex 17, version 01)" recommend a standard deviation equal to 50 % of the mean value for above-ground volume increment of existing woody vegetation.

Table 18 – Number of sample plots for measuring the changes in living tree biomass

Id stratum	*Project stratum*	*Number of sample plots*
1	*Acacia sp. + cassava*	63
2	*Eucalyptus sp. + cassava*	5
3	*Pinus sp. + cassava*	2
4	*Other species + cassava*	12
5	*Acacia sp.*	3
6	*Eucalyptus sp.*	1
7	*Pinus sp.*	1
8	*Other species*	4
9	*Enhancement of natural regeneration*	36
		127

For *ex-post* estimation of soil carbon pool, 5 samples will be collected in each sample plot used for biomass estimation. In each sample plot, all samples will be collected at 30 cm depth throughout the entire crediting period.

c. Monitoring frequency
To avoid the coincidence with peaks in carbon stocks, the first monitoring (for above-ground and belowground biomass) and verification is expected to be conducted in the year 2011, with a subsequent monitoring (for above-ground and belowground biomass) and verification interval of 5 years, i.e., in 2016, 2021, 2026, 2031 and 2036 respectively. The soil carbon pool will be monitored at the first verification and at the last verification of the first crediting period and in the end of any subsequent crediting period

E.3. Monitoring of the baseline net GHG removals by sinks, if required by the selected approved methodology:

N/A

E.4. Monitoring of the actual net GHG removals by sinks:

a. Above-ground and below-ground biomass
Permanent sample plots located in the plantation plots will be located systematically with a random start. All data (location, stratum, sub-stratum) and coordinates will be recorded and archived. Those sampling plots to be located by GPS, will not display signs of sample plots to avoid discriminating treatment.

The project proposes to use square sampling plots of 250 m^2. The growth of individual trees in sample plots will be measured at each monitoring event. Non-tree vegetation such as herbaceous plants, grasses, and shrubs will not be measured and accounted as per the guidance of the methodology.

Step-wise procedures for implementing allometric method; and equations (19)-(21) in the Section II.5.1.1 of the approved baseline and monitoring methodology (AR-ACM0001/version 03) will be followed to monitor the verifiable carbon stock changes in the above-ground and below-ground living biomass within the project boundary.

Diameter at breast height (DBH, 1.3 m above ground) of all the trees within each permanent sample plot above a minimum DBH (2 cm) will be measured. Height will be measured for *Eucalyptus sp*. The carbon stock in above-ground biomass ($C_{AB\_tree,j,i,sp,t}$) in equation (19) of the methodology will be estimated using the following equations for the above-ground biomass :

***Acacia mangium*[35].** $\mathbf{AGB = 3.57 \times 10^{-4} \times (DBH \times \pi)^3 + 19.2 + 2.69 \times 10^{-5} \times (DBH \times \pi)^3 + 0.25}$
and BGB = 0.159 x AGB

***Acacia auriculiformis*[36].** $\mathbf{AGB = 4.16 \times 10^{-4} \times (DBH \times \pi)^3 + 11.22 + 2.02 \times 10^{-5} \times (DBH \times \pi)^3 + 2.36}$
and BGB = 0.132 AGB
with AGB and BGB in kg.d.m and DBH in cm

***Eucalyptus sp.*[37]** $\mathbf{AGB = 2.08 + (150.9 + 0.28\ age) \times (DBH^2 \times H \times 10^{-4})^{(0.87 + 0.0012\ age)}}$

where
AGB : Above-ground biomass in kg.d.m
DBH : Diameter at breast height in cm
H : Height in meter
Age in months from the planting date

***Pinus sp*[38].** $\mathbf{AGB = \exp^{[-1.170 + 2.119 \ln(DBH)]}}$

Other species[39] $\mathbf{AGB = \exp^{[-2.134 + 2.530 \ln(DBH)]}}$
with AGB in t.d.m and DBH in cm.

The above-ground biomass will be then converted to carbon stock in aboveground biomass using the following equation :

$C_{AB\_tree,j,i,sp,t} = AGB_{tree,\ j,\ i,\ sp,\ t} \times CF_j$

Where
CF_j : Carbon fraction of dry matter for species j in tC/tdm

The carbon stock in belowground biomass will be calculated using Equation (20) of the applied methodology and species-specific root-shoot ratio (R_j). These parameters are estimated from published data. IPCC default value (0.5) for the carbon fraction (CF_j) will be used. These values shall be updated every five years if the values from the national inventory are updated in the future.

c. Soil organic carbon

For *ex-post* estimation, the soil carbon pool will be monitored at the first verification and at the last verification of the first crediting period and in the end of any subsequent crediting period. 5 samples will be collected in each sample plot used for biomass estimation. In each sample plot, all samples will be collected at 30 cm depth throughout the entire crediting period.

The mass of carbon per unit volume is calculated by multiplying the carbon concentration ($C_{SOC\ sample\ i,\ p,\ t}$) and bulk density ($g/cm^3$). The bulk density equals the oven dry weight of the soil core divided by the core volume after discounting the volume of coarse fraction of >2 mm.

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[35] Bernhard-Reversat et al., 1993. Biomasse, minéralomasse et productivité en plantation d'*Acacia mangium* et *Acacia auriculiformis* au Congo, Bois et Forêts des Tropiques, 238 : 35-44.

[36] Bernhard-Reversat et al., 1993. Biomasse, minéralomasse et productivité en plantation d'Acacia mangium et Acacia auriculiformis au Congo, Bois et Forêts des Tropiques, 238 : 35-44.

[37] Saint-André L. and al., 2005. Age-related equations for above- and below-ground biomass of a Eucalyptus hybrid in Congo, Forest Ecology and Management 205 (2005) : 199 - 214

[38] Brown, S. 1997. *Estimating biomass and biomass change of tropical forests. A primer*. FAO Forestry Paper 134. Food and Agriculture Organization of the United Nations, Rome, Italy. http://www.fao.org/docrep/W4095E/W4095E00.htm

[39] Brown, S. 1997. *Estimating biomass and biomass change of tropical forests. A primer*. FAO Forestry Paper 134. Food and Agriculture Organization of the United Nations, Rome, Italy.

$$C_{SOC,i,p,t} = C_{SOC_{Sample,i,p,t}} * BD_{i,p,t} * Depth_{i,p,t} * FC_{i,p,t} * M$$

where:

$C_{SOC,i,p,t}$	Carbon stock of soil organic carbon pool of plot *p* in stratum *i*, time *t*; t C ha^{-1}
$C_{SOC_{Sample,i,p,t}}$	Soil organic carbon of the sample in plot *p* in stratum *i*, time *t*; determined in laboratory in g C/100 g soil
$BD_{i,p,t}$	Bulk density (soil mass/volume of sample) of plot *p* in stratum *i*, time *t* determined in laboratory; t m^{-3}
$Depth_{i,p,t}$	Soil depth to which soil sample is collected for plot *p* in stratum *i*, time *t*; m
$FC_{i,p,t}$	1 – (% volume of coarse fragments/100) to adjust the fraction of sample occupied by coarse fragments > 2mm at plot *p* in stratum *i*, time *t*; dimensionless.
M	Multiplier to convert units into t C ha^{-1}; 10000 m^{2}ha^{-1}
i	*1, 2, 3, …* M_{PS} strata in the project scenario
p	*1, 2, 3, …* P_i sample plots in stratum *i* in the project scenario
t	*1, 2, 3, … t* years elapsed since the start of the A/R CDM project activity

$$\Delta C_{SOC,i,p,T} = \frac{C_{SOC,i,p,t_2} - C_{SOC,i,p,t_1}}{T}$$

where:

$\Delta C_{SOC,i,p,T}$	Average annual change in the carbon stock of soil organic carbon pool of plot *p* in stratum *i*, between monitoring periods *t*1 and *t*2; t C ha^{-1} yr^{-1}
C_{SOC,i,p,t_2}	Carbon stock of soil organic carbon pool of plot *p* in stratum *i*, time *t* = *t*2; t C ha^{-1}
C_{SOC,i,p,t_1}	Carbon stock of soil organic carbon pool of plot *p* in stratum *i*, time *t* = *t*1; t C ha^{-1}
T	Number of years between monitoring time *t*2 and *t*1 (*T* = *t*2 – *t*1); yr
i	*1, 2, 3, …* M_{PS} strata in the project scenario
p	*1, 2, 3, …* P_i sample plots in stratum *i* in the project scenario
t	*1, 2, 3, … t* years elapsed since the start of the A/R CDM project activity

As the soil carbon pool will be monitored only at the first verification and at the last verification of the first crediting period and in the end of any subsequent crediting period, the entire change in the soil carbon pool will be credited to the project in the last year of the crediting period.
The mean soil organic carbon accumulation will be calculated by pooling the soil carbon estimates of samples at the monitoring interval.

$$M\Delta C_{SOC,i,p,T} = \frac{\sum_{p=1}^{P_i} \Delta C_{SOC_{i,p,T}}}{P_i}$$

where:

$M\Delta C_{SOC,i,T}$	Mean average annual carbon stock change in the soil organic carbon pool in stratum *i*, between monitoring periods *t*1 and *t*2; t C ha^{-1} yr^{-1}
$\Delta C_{SOC_{i,p,T}}$	Average annual change in the carbon stock of soil organic carbon pool of plot *p* in stratum *i*, between monitoring periods *t*1 and *t*2; t C ha^{-1} yr^{-1}
p	*1, 2, 3, …* P_i sample plots in stratum *i* in the project scenario
i	*1, 2, 3, …* M_{PS} strata in the project scenario
t	*1, 2, 3, … t* years elapsed since the start of the A/R CDM project activity

The average annual change in the carbon stock of soil organic carbon pool in stratum *i*, between monitoring periods t_1 and t_2 will be estimated as :

$$\Delta C_{SOC_{i,t}} = M\Delta C_{SOC,i,T} * A_i$$

where:

$\Delta C_{SOC,i,t}$	Annual carbon stock change in the soil organic carbon pool for stratum *i*, time *t*; t C yr^{-1}
$M\Delta C_{SOC,i,T}$	Mean average annual carbon stock change in the soil organic carbon pool in stratum *i*, between monitoring periods *t*1 and *t*2; t C ha^{-1} yr^{-1}
A_i	Area of stratum *i*; ha
i	*1, 2, 3, …* M_{PS} strata in the project scenario
t	*1, 2, 3, … t* years elapsed since the start of the A/R CDM project activity

d. Monitoring GHG emissions by sources increased as results of the A/R CDM project activity
The GHG emissions that will occur during the implementation of the A/R CDM project activity are :

- CO_2 losses from pre-existing vegetation removal.

Emissions from site preparation activities would be assessed by monitoring the area affected in the site preparation. This monitoring will be done based on field surveys. Amount of biomass lost is calculated by multiplying the area affected in the site preparation with the biomass of the unit area affected by the site preparation and the carbon fraction of the biomass.

E.4.1. Data to be collected in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity:

Data to be collected in order to monitor the verifiable changes in carbon stock in the carbon pools within the project boundary resulting from the proposed A/R CDM project activity

Table 19 - Monitoring of the actual net GHG removals by sinks

ID number[40]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[41]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
2.1.1	*Project stratum*	*Alphanumeric*	*defined*	*At stand establishment*	*100 %*	
2.1.2	*Stand ID*	*Alphanumeric*	*defined*	*At stand establishment*	*100 %*	
2.1.3	*Desired level of precision (p)*	*%*	*defined*	*Before the start of the project*	*100 %*	
2.1.4	*Sample plot ID*	*Alphanumeric*	*defined*	*Before the first monitoring event*	*100 %*	*Numeric series ID will be assigned to each permanent sample plot*
2.1.5	*Total number of sample plots in stratum i*	*dimensionless*	*m*	*5 years*	*100 %*	
2.1.6	*Sample plot area*	*m2*	*m*	*5 years*	*100 %*	
2.1.7	*Total area of sample plots in stratum i*	*ha*	*m*	*5 years*	*100 %*	
2.1.8	*Total area of all strata*	*ha*	*m*	*5 years*	*100 %*	
2.1.9	*Area of stratum i*	*ha*	*m*	*5 years*	*100 %*	
2.1.10	*Maximum possible number of sample plots in the project area*	*dimensionless*	*c*	*5 years*	*100 %*	
2.1.11	*Total number of sample plots in the project area*	*dimensionless*	*c*	*5 years*	*100 %*	
2.1.12	*Maximum possible number of sample plots in stratum i*	*dimensionless*	*c*	*5 years*	*100 %*	
2.1.13	*Plot location*		*m*	*5 years*	*100 %*	*Using GPS to locate before start of each field measurement*
2.1.14	*Tree species*		*m*	*5 years*	*100 %*	
2.1.15	*Age of plantation*	*year*	*m*	*5 years*	*100 %*	*Counted since the planted year*
2.1.16	*Diameter at breast height of living trees*	*cm*	*m*	*5 years*	*100 %*	
2.1.17	*Eucalyptus height*	*m*	*m*	*5 years*	*100 % of Eucalyptus in plots*	
2.1.18	*Above-ground biomass*	m^3	*c*	*5 years*	*100 %*	
2.1.19	*Wood density of species j*	tdm/m^3	*d*	*Before the start of the project*	*100 % of species*	
2.1.20	*Carbon fraction of species j*	*dimensionless*	*d*	*Before the start of the project*	*100 % of species*	
2.1.21	*Carbon stock in above-ground biomass of tree*	*tC*	*c*	*5 years*	*100 %*	

[40] Please provide ID number for cross-referencing in the PDD.

[41] Please provide full reference to data source.

ID number	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)	Recording frequency	Number of sample plots at which the data will be monitored	Comment
2.1.22	*Root-shoot ratio*	*kg.dm.y / kg. dm. y*	*d*	*Before the start of the project*	*100 % of species*	
2.1.23	*Carbon stock in below-ground biomass of tree*	*tC*	*c*	*5 years*	*100 %*	
2.1.24	*Mean carbon stock in above-ground biomass per unit area for stratum i, species j, time t*	*tC/ha*	*c*	*5 years*	*100 %*	
2.1.25	*Mean carbon stock in below-ground biomass per unit area for stratum i, species j, time t*	*tC/ha*	*c*	*5 years*	*100 %*	
2.1.26	*Area of stratum i, species j, at time t*	*ha*	*m*	*5 years*	*100 %*	
2.1.27	*Annual carbon stock change in above-ground biomass for stratum i, species j, time t*	*tC/year*	*c*	*5 years*	*100 %*	
2.1.28	*Annual carbon stock change in below-ground biomass for stratum i, species j, time t*	*tC/year*	*c*	*5 years*	*100 %*	
2.1.29	*Annual carbon stock change in living biomass in the project scenario for stratum i, species j, time t*	*tCO2e/year*	*c*	*5 years*	*100 %*	
2.1.30	*Sum of the carbon stock changes in living biomass in the project scenario*	*tCO2e*	*c*	*5 years*	*100 %*	
2.1.31	*Soil organic carbon of the sample in plot p in stratum i, time t*	*gC/100 g soil*	*m*	*Once at the first verification and once before the end of the crediting period*	*5 samples in all sample plots for biomass*	
2.1.32	*Bulk density of soil sample for plot p in stratum i, time t*	*t/m3*	*m*	*Once at the first verification and once before the end of the crediting period*	*5 samples in all sample plots for biomass*	

ID number	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)	Recording frequency	Number of sample plots at which the data will be monitored	Comment
2.1.33	*Soil depth to which soil sample is collected for plot p in stratum i, time t*	*m*	*m*	*Once at the first verification and once before the end of the crediting period*	*5 samples in all sample plots for biomass*	
2.1.34	*1 – (% volume of coarse fragments/100) to adjust the fraction of sample occupied by coarse fragments > 2 mm at plot p in stratum i, time t*	*dimensionless*	*m*	*Once at the first verification and once before the end of the crediting period*	*5 samples in all sample plots for biomass*	

E.4.2. Data to be collected in order to monitor the GHG emissions by the sources, measured in units of CO_2 equivalent, that are increased as a result of the implementation of the proposed A/R CDM project activity within the project boundary:

According to the methodology, AR ACM0001 version3, there is potentially one emission by sources, i.e., biomass burning.

As explained in Section A.5.4., no biomass burning of existing vegetation will be done as part of site preparation. The project considers the possibilities of biomass burning associated with natural fires and the fire management plan and the provisions of project monitoring address and report on such a risk.

Thus no GHG emissions by the sources are likely to occur as a result of the implementation of the proposed A/R CDM project activity within the project boundary. Nevertheless, the area subject to slash and burn will be monitored during the implementation of the project (ID number 1.1.2., table 17).

As part of site preparation, if biomass burning of existing woody vegetation occurs, the GHG emissions will be estimated using the relevant instructions provided by the most recent version of the methodological tool “Tool for estimation of emissions from clearing, burning and decay of existing vegetation due to implementation of a A/R CDM project activity”.

Table 20 - Monitoring of the actual net GHG emissions by the sources

ID number[42]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[43]	Recording frequency	Number of sample plots at which the data will be monitored	Comment
1.1.2.	*Area of slash and burn*	*ha*	*m*	*Once before planting*	*All strata*	*To confirm there is slash but no burning*

E.5. Leakage:

E.5.1. If applicable, please describe the data and information that will be collected in order to monitor leakage of the proposed A/R CDM project activity:

As per the approved methodology applied, leakage associated with displacement of grazing is relevant. In this context, assessment presented in Section D-2 indicated that leakage from the displacement of grazing is not expected to occur. Therefore, no leakage needs to be monitored in the proposed A/R CDM project activity.

Table 21 - Monitoring of leakage

ID number[44]	Data variable	Data unit	Measured (m), calculated (c) estimated (e) or default (d)[45]	Recording frequency	Number of data points	Comment

E.5.2. Specify the procedures for the periodic review of implementation of activities and measures to minimize leakage, if required by the selected approved methodology:

N/A

E.6. Provide any additional quality control (QC) and quality assurance (QA) procedures undertaken for data monitored not included in section E.1.3:

N/A. See section E.1.2.

[42] Please provide ID number for cross-referencing in the PDD.

[43] Please provide full reference to data source.

[44] Please provide ID number for cross-referencing in the PDD.

[45] Please provide full reference to data source.

E.7. Please describe the operational and management structure(s) that the project operator will implement in order to monitor actual GHG removals by sinks and any leakage generated by the proposed A/R CDM project activity:

The overall implementation and management of the A/R CDM project activity will be carried out by NOVACEL.

The internal structure of NOVACEL is divided into 3 main units:

- general management and control
- research and development unit – « Cellule Qualité et Suivi Statistique » (CQSS)
- technical unit

The research and development unit, ensuring also all monitoring and control activities, is more specifically responsible for the following activities:

- research-development: plantation design, plots follow-up and measurements,
- social and environmental impact assessments and follow-up, design and implementation of corrective measures if needed,
- sustainable management: GIS implementation, sustainable management plan, conservation, eco-certification …,
- carbon evaluation and control: carbon sinks and emission review.

In the field, a monitoring and intervention team, led by an eco-guard will ensure the protection of the plantation. The team will be fully equipped to react quickly in case of fire. External expert teams will monitor impact assessments and carbon reduction, but constant monitoring on site will be carried out by the Research and development unit (CQSS).

E.8. Name of person(s)/entity(ies) applying the monitoring plan:

Following the project flowchart, members of the Follow up and Control unit (Research and Development - CQSS) are also part of the field team in charge of the application of the monitoring plan.

SECTION F. Environmental impacts of the proposed A/R CDM project activity:

F.1. Documentation on the analysis of the environmental impacts, including impacts on biodiversity and natural ecosystems, and impacts outside the project boundary of the proposed A/R CDM project activity:

The environmental benefits for the ecosystem and biodiversity of the afforestation carried out in the A/R CDM project activity can be outlined on two aspects using two points of view[59] :

Direct repercussions, biodiversity and ecosystem protection

As for general characteristics, a forest plantation modifies and improves the local microclimate and hydrology system, by temperature and gas exchange regulation and water retention network improvement.
The Ibi plantation uses different tree species to reduce pest risks, to increase soil nutrients and diversify wood utilization once harvested. A combination of species will be used inter plots and intra plots, following the plantation design plan.

Erosion will be controlled and reduced thanks to the forest root network and to specific management activities. Soil fertility will be maintained and even improved (enrichment in carbon and nitrogen, improvement of root permeability, bio cycles).
Plantation and maintenance techniques are reduced to cause minimum impact on the soil: (i) no fertilizer will be used, (ii) no pesticides will be used, (iii) plantation maintenance, mechanical and manual, will only be carried out during the early years after planting.

Soil fauna diversity will be amplified, as a result of microclimate and soil ecosystem modification.

More specifically, the Batéké region is an open space where wildlife has been over exploited by hunting and larger mammals have disappeared. The enclosed spaces created by the planted forests provide new

[59] Oréade-Brèche, 2007. Etude d'impact socio-environnemental – Puits de carbone d'Ibi – Plateau des Batéké. pp 93.

habitats where wildlife can shelter. Biodiversity habitat and wildlife flow will also increase, as the Ibi station borders the Nature reserve of Bombo Lumene.

Indirect repercussions, environmental protection and income generating activities
The Batéké plateau is subject to annual wildfires of uneven intensity, aggravating biodiversity loss and soil damage. By offering permanent fire control, a patrolling program and also with the help of community awareness raising measures, the A/R CDM project activity will contribute locally to moderate the occurrence of the outbreak of fires.

The wood produced by the A/R CDM project activity, not only plays a role as a carbon sink, but also provides a sustainable alternative to local fuelwood supplies. By doing so, it helps protect the remaining local natural forest corridors which are at present subject to deforestation by providing fuelwood to the local population.

Indirect income generating and sustainable activities will be derived from the A/R CDM project activity as local tree species planted for fuelwood supply will be encouraged in the neighbouring villages. These plantations will also supply Non Timber Forest Products, such as honey within the acacia plantations.

F.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken an environmental impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to support documentation:

Even though the A/R CDM project activity implies a land use change, it does not present significant negative impacts. Nevertheless, an environmental assessment has been carried out and is appended to this document[60].

F.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section F.2. above:

Even though the A/R CDM project activity does not have significant negative impacts, measures to protect the environment are part of the project activity.

The main aspects of these environmental measures are:

- fire control and permanent monitoring,
- wildlife habitat improvement, by forest corridors, shelter for wildlife and connection with a Natural reserve network,
- population awareness raising and environmental education, mainly on fire control knowledge.

SECTION G. Socio-economic impacts of the proposed A/R CDM project activity:

G.1. Documentation on the analysis of the major socio-economic impacts, including impacts outside the project boundary of the proposed A/R CDM project activity:

Surveys made with local populations

[60] Oréade-Brèche, 2007. Etude d'impact socio-environnemental – Puits de carbone d'Ibi – Plateau des Batéké. pp 93.

Three international offices carried out the surveys. 15 pollsters worked in the villages of Mbankana, Mutiene and Mampu in order to set an overview of current living conditions of the population around Ibi and to calculate the available workforce during the operational phase of the project. A brief explanation of the project has been given, in order to collect people's perceptions, expectations and worries regarding the project and to aid in project design and implementation. Two pollsters worked in all the small villages located inside the Ibi station, with the same objectives as the previous teams, but insisted on the specific relations people have with the Ibi domain owners.
Finally, a pollster produced in the same villages, participative mapping of cultivated land, thus completing previous surveys.

Main results of the surveys
Population and local demography:

The total population of the three closest villages is distributed as follow: (sources with uneven value and reliability):

Table 22 – Total population

Villages	Boys	Girls	Children	Men	Women	Adults	Total Men	Total Women	Total
Mbankana	3393	4079	7472	3394	3474	6868	6787	7553	14340
Mutiene			1130	450	720				2300
Mampu									1000
Total									17640

Total population living inside the Ibi station is 472 inhabitants distributed as follow:

Table 23 – Local demography of the population

Villages	Boys Less than 15 years	Girls Less than 15 years	Population Less than 15 years	Men over 15 years	Women over 15 years	Population over 15 years	Total Men	Total Women	Total
Station Ibi	11	12	23	12	20	32	23	32	55
Sarajevo	ND	ND	19	ND	ND	20	ND	ND	39
Limete	17	10	27	12	18	30	29	28	57
Bingingi Loba Lisuzu	2	1	3	10	4	14	12	5	17
Mosali Moko	6	1	7	9	10	19	15	11	26
Lemba	6	2	8	9	6	15	15	8	23
Paradis	10	6	16	12	8	20	22	14	36
Kanisa	31	23	54	17	16	33	48	39	87
Duale Mukoko	13	12	25	11	10	21	24	22	46
Duale Bolingo	5	7	12	12	9	21	17	16	33
Mbempu	16	6	22	10	6	16	26	12	38
Isolated farms									15
TOTAL	117	80	216	114	107	241	231	187	472

Local perception of the project
In conclusion, the surveys show:

- the vast majority of the population knows of the afforestation project and approves it.
- the population wishes that particular attention be given to land problems and foreign-born population flows.

- worries have been expressed regarding fire risks.
- the most often expressed expectations concern job creation and infrastructure maintenance.
- several villages wish to benefit from afforestation projects.
- the installing of a medicinal plants arboretum has also been requested.

Socio–economic impacts of the project

Impacts are analyzed at different levels:

Ibi station and in NOVACEL

The most immediate impact will be the management and executive staff flow (25 during the first 8 years of the project). These staff members will live on site and be permanently present at the station. Some will be locals. They will all benefit from job adapted training and different teams trained for the project will be more effective. For NOVACEL, and for the local economy as well, it is a very important change of scale with consequences which are difficult to assess today.

The flow of seasonal workers will have positive consequences on a local scale (trade, population…).

The region around Mbankana

The inhabitants of this region will benefit from the project in two ways. Some of them will be employed directly by the project at least as temporary workers. 300 jobs are expected to be filled during the peak period (around 6 months), representing around 220 full time positions (over the whole year). These are very high figures for this remote area, which currently presents a very low rate of employment. Moreover, indirectly the project will increase living standards and therefore positively affect local trade.

Several side activities will be created by the project, as described below:

- on a relatively short term, with harvesting and processing of acacias into charcoal
- with the transportation to Kinshasa of this product
- indirectly, the extension of agro-forestry methods will improve and stabilise agricultural production and create new skills (as was the case in Mampu with apiculture for example).
- an important proportion (at least 60 or 70%) of created jobs will be permanent, as the afforested area will be managed sustainably
- the new landscape created will be an opportunity to promote local ecotourism which will be profitable to the Bombo Lumene reserve adjoining Ibi. Partnerships should be found to increase available funds.
- within the framework of the project, the availability of different machines, which are not used all the time, could under certain conditions, improve local population living conditions. However, the project cannot replace local or national authorities.

Some possible negative impacts have been pointed out by pollsters

For example, Mampu inhabitants fear that they will not be able to sell their charcoal because Ibi is closer to Kinshasa (and transport of Ibi charcoal will not require the use of the bad track joining Mampu to Mbankana). Considering the very important demand in Kinshasa for charcoal, this fear does not seem justified.

Consultation on project at different levels

Three project consultations were attended by officials of the DNA and representatives of civil society and local media:

- 15-16 July 2006, local authorities of the whole Mbankana chieftainship, and then the representatives of Mbankana population. These two days were concluded by a text validating the project and taken into account by local authorities.
- 18 July 2006, Kinshasa, for local and international donors and state departments and NGOs concerned by the project.
- 19 July 2006, Kinshasa, to prepare recommendations for the official approval for the Congolese government.

G.2. If any negative impact is considered significant by the project participants or the host Party, a statement that project participants have undertaken a socio-economic impact assessment, in accordance with the procedures required by the host Party, including conclusions and all references to supporting documentation:

No negative socio–economic impact has been identified. An environmental and social impact study was carried out[61].

G.3. Description of planned monitoring and remedial measures to address significant impacts referred to in section G.2 above:

N/A

SECTION H. Stakeholders' comments:

H.1. Brief description of how comments by local stakeholders have been invited and compiled:

A coherent series of three discussion groups/seminars each aimed at a specific public were organised. In total, about 300 people participated providing different levels of information and reflection. Thanks to concise presentations, the objective was to inform people about the implementation of the A/R CDM project activity, and to show impacts and expected benefits. A great deal of time was dedicated for listening to participants and answering their concerns or questions.

Discussion groups took place from 15-19 July 2006 as follows:

- customary rural restitution: 15 and 16 July 2006 in Mbankana ;
- restitution for key development stakeholders: 18 July 2006 in Kinshasa ;
- acceptance of the proposals by officials: 19 July 2006 in Kinshasa.

[61] BERCI, 2006. Analyse d'impact socio-environnemental du projet « Puits carbone station Ibi ». pp 75.


Illustrations 14 and 15 : Stakeholders discussion groups and meetings

The customary rural restitution discussion group took place after the Congolese teams in charge of the socio-economic survey had met the local population on the Ibi site and the three nearest villages: Mbankana, Mutiene and Mampu - Kinzono. On 15 July 2006, a meeting with the customary chiefs and chieftainship notables of Mbankana enabled a brief presentation of the project and to answer questions raised by the presentation. On 16 July 2006, the Mbankana population was invited to attend presentations showing the project in a simplified way in Lingala and Téké and finally in French. The audience was low (around 200) as the presentation took place during the presidential and legislative elections.

The restitution for key development stakeholders discussion group took place on 18 July 2006 in the French Cultural Centre of Gombe / Kinshasa. About 40 key development players, from a wide variety of interested sectors and institutions, participated:

- governmental institutions: Ministry of Environment, Conservation of Nature, Water and Forests : Direction of Sustainable development (Mr Vincent Kasulu Seya MAKONGA, director and Mr François MUBILAYI), National Service of afforestation (Mr Raymond Mompatibi MIZIEMO), Forest inventory and management department, Appointed National Authority (Dr Natoro KANGO, Mr Colin BELAYA), Environment Unit (Mr. Michel NGOMA), Climate Change Unit (Mr Mbuyi KALOMBO) ; Ministry of Finances ;
- diplomatic representation: European Union, French Embassy (Mr Pierre LAYE), Belgian Embassy (Mr Jérôme ROUX) ;
- private wood sector operators (FEC, Federation des Enterprises du Congo).
- international cooperation organisations and United Nations agencies: World Bank (Mr Kankondé MUKADI), FAO (Mr Vangu LUTETE) ;
- national and international NGOs: WWF (Mr François MAKOLOH), CENADEP (Mr Freddy MUMBA), Green Advocates ;
- financial institutions (BCDC, BIAC)
- academic training and research institutes: CIRAD Forêt (Mr Olivier HAMEL), CGEA (Mr Jean Ndembo LONGO), ERAIFT (M. JeanNgog NJE) and UNIKIN ;
- local community representatives: customary chief (Mr Honoré LABI) and Mbankana chieftainship notables;
- press and media (Info environnement, le Potentiel, Global TV).

The acceptance discussion group by officials gathered on 19 July 2006, experts who had taken part in the two other discussion groups. The objective, in the carbon sink sector, new in DRC, is to define the terms of collaboration between the project and the services for joint progress.

A conference was also organised on 2 November 2006, in the French Cultural Centre to enable the project promoter to inform more precisely around 50 participants.

H.2. Summary of the comments received:

The main comments made during these discussion groups were:

- the vast majority of the population knows the afforestation project and approves it.
- populations require that particular attention be given to land related issues and non-batéké migrant settlers.
- worries have been expressed regarding fire risks.
- the most important expectations concern job creation and infrastructure maintenance.
- several villages wish to benefit from afforestation projects.
- the installation of a medicinal plants arboretum has also been requested.

H.3. Report on how due account was taken of any comments received:

The answers which were given are as follows:

- concerning land related issues and possible population flows, the dialogue with the Mbankana chieftainship indicates that project implementation would permit better control of these two factors thanks to the permanent presence on site of people in charge.
- regarding fire risks, the project document has planned the following measures: (i) to raise public awareness both on site and in the surrounding area, (ii) implementation of a network of firebreaks, (iii) availability of vehicles and full water tanks to fight fire, (iv) Population warning plan of action to be implemented as afforestation progresses and which will be adapted to particular cases. (v) if necessary, creation of water storage points sited at various strategic locations.
- the project will create both permanent and temporary jobs. In the beginning priority will be given to local recruitment (young people from Mbankana, for example), but the general policy will be: recruitment, training, selection, in order to set up a team of competent specialists (highly skilled, qualified, ...) in all disciplines.
- infrastructure maintenance is a major concern of the local population. Availability of machines like a grader in the Ibi station will permit the maintenance of tracks leading to the site villages and plantation. Concerning regional tracks (going to Mampu in particular), an agreement could be signed with the Kinshasa region so as to use the project's machines when available.
- to encourage local scale afforestation, it should be possible to give seedlings to people who ask for them individually or preferably collectively. Furthermore, in response to these expectations, the research and development unit planned in the project organization chart will be able to introduce species or to develop appropriate forestry techniques for local species, including medicinal plants.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

Organization:	NOVACEL
Street/P.O.Box:	1 Station Ibi, commune de Maluku
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Represented by:	Olivier Mushiete
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Salutation:	M.
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Middle Name:	Nkolé
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Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

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Title:	President
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Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROPOSED A/R CDM PROJECT ACTIVITY

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Country:	USA
Telephone:	+1 202 473
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E-Mail:	ibrd-carbonfinance@worldbank.org
URL:	www.worldbank.org
Represented by:	Joelle Chassard
Title:	Manager
Salutation:	Ms.
Last Name:	Chassard
Middle Name:	
First Name:	Joelle
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Personal E-Mail:	jchassard@worldbank.org

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding will be used from Official Development Assistance, nor Financial obligation of any Parties of the UNFCCC.

Annex 3

BASELINE INFORMATION

See Section C.5. of the PDD.

Annex 4

MONITORING PLAN

Enclosed as a separate document.

PROJECT DESIGN DOCUMENT FORM
FOR AFFORESTATION AND REFORESTATION PROJECT ACTIVITIES (CDM-AR-PDD) - Version 04

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History of the document

Version	Date	Nature of revision
04	EB35, Annex 20 19 October 2007	• Restructuring of section A; • Section “Monitoring of forest establishment and management” replaces sections: “Monitoring of the project boundary”, and “Monitoring of forest management”; • Introduced a new section allowing for explicit description of SOPs and quality control/quality assurance (QA/QC) procedures if required by the selected approved methodology; • Change in design of the section “Monitoring of the baseline net GHG removals by sinks” allowing for more efficient presentation of data.
03	EB26, Annex 19 29 September 2006	Revisions in different sections to reflect equivalent forms used by the Meth Panel and assist in making more transparent the selection of an approved methodology for a proposed A/R CDM project activity.
02	EB23, Annex 15a/b 24 February 2006	Inclusion of a section on the assessment of the eligibility of land and the Sampling design and stratification during monitoring
01	EB15, Annex 6 03 September 2004	Initial adoption