in association with

MANAGEMENT INVENTORY PROTOCOL

FOR NGUTI COUNCIL FOREST

ELABORATED BY SIMO HUBERT IN THE FRAMEWORK OF A SHORT-TIME MISSION

FOR GFA/DFS CONSULTANTS

PROGRAMME FOR THE SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES CAMEROON – SOUTH WEST PROVINCE (PSMNR-SWP)

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I.C.E.F.S

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INTRODUCTION

PSMNR-SWP is supporting under its result 3, the elaboration of forest management plan for a council forest in a pilot scheme.
No council forest had been foreseen in the indicative zoning plan of 2001, phase V in SWP. Up to now no council forest has been created in SWP. This is due mainly to missing knowledge, and missing financial, organizational and technical capacities of the councils. Nevertheless council forests represent a promising form of sustainable forest management with the potential to enhance development in enclaved rural areas.
With the progressing implementation of decentralization the option of a council forest represents for a council and the villages around the concerned council forest area a big opportunity to create a sustainable source of revenue for investment in development issues and to take over the main stake in the management of their own forest heritage.

Council forests form part of the permanent forest estate and as such have to be gazetted and a forest management plan has to elaborated.

In September 2007 the technical note for the gazettement of Nguti Council Forest has been sent to the Ministry. On November 22nd 2007 the public notice for the gazettement of Nguti Council Forest has been signed by the Minister.
Meanwhile the gazettement process is continuing, other technical studies are undertaken for the elaboration of the management plan.
In this framework CIEFFE has been commissioned by the programme consultants to draw up an inventory management protocol for this council forest.

1. BRIEF DESCRIPTION OF THE AREA

1.1. Location

The proposed council forest of Nguti is situated in Nguti Sub-division, Kupe-Manenguba Division, South-West Province of Cameroon. (cf. map1).

On its western part, the proposed Nguti Council forest will have a common boundary with the Korup National park, along the Bake river. In its northern part it will have a common boundary with proposed Nkwende hill protection forest.

The surface area of the proposed Nguti Council forest is about 12,083 ha.

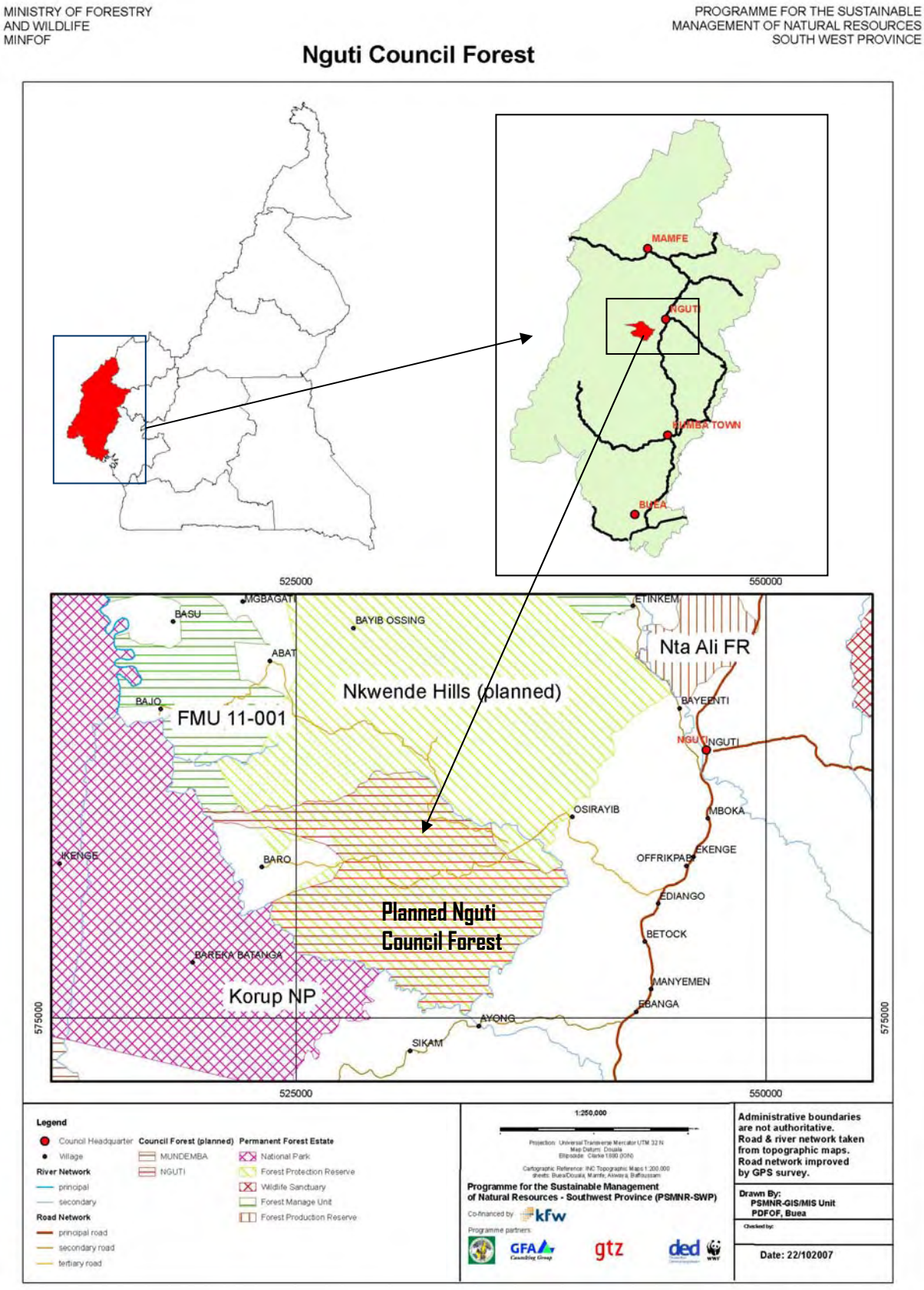
1.2.Ecological factors

1.2.1.Soils

The area is covered by ferralitic soils composed of:

- Red ferralitic soils
- Yellow ferralitic soils on acidic rock
- Yellow ferralitic soils on sediment. Essentially, red ferralitic soils are found on basalt and make up the Nguti region. These reds soils are chemically less fertile than those found on recent volcanic rock.

Map 1: Geographic situation of Nguti Council forest



1.2.2.Topography

The topography of the area is in its whole extension flat to undulating land. The highest point is a hill with 428 m altitude at the northern border of the proposed forest area.

1.2.3.Hydrography

The hydrographic net of the forest area is composed of the Bake River and its affluents. Bake River originates from Nkwende Hills and flows in a southerly direction and starts marking the boundary of the proposed council forest to the south of Osirayib village.

Downstream, Bakebe River joins Bake River near Ayong village, and Bake River continues flowing in a north-westerly direction. The proposed council forest is therefore enclosed by Bake River and some of its affluent.

1.2.4.Vegetation

The forest is part of the Atlantic Biafran Forest as described by Letouzey and as such moist lowland evergreen forest, rich in Cesalpinaceae. It is typically a tropical lowland rainforest.

Lejoly (1996) proposes to nominate the zone Atlantic lower-Guinean domain to stress the influence of the Atlantic Ocean.

Most of the forest is dense forest on firm land. Only on the banks of the river Bake in some places small swampy areas can be found.

Frequently occurring species in the forest include; Azobe (*Lophira alata*), Ekop Naga (*Brachystegia spp*), Dabema (*Pipadeniastrum africanum*), Tali (*Erythrophleum ivorensis*), Okan (*Cycldiscus gabonensis*), Framire (*Terminalia ivorensis*). Others occurring species are Bilinga (*Nauclea diderrichii*), Ilomba (*Pycnanthus angolensis*), Niove (*Staudia stipitata*), Padouk (*Pterocarpus soyauxii*), Moabi (*Baillonella toxisperma*), Movingui (*Distemonanthus benthamianus*), Doussie (*Afzelia spp*), Aiele (*Canarium schweinfurthii*).

1.2.5.Climate

The Nguti council forest is under the equatorial climate of the northern coastal region with:

- an average annual rainfall of about 4,000 millimetres
- monthly distribution with maximum from June to October and minimum from December to February; a long raining season of more than 8 months and a short dry season of about 4 months.

The annual maximum average temperature is 30.2°C and the annual minimum average temperature is 23.7°C.

The mean annual relative humidity is 83%, the mean daily maximum being 98% and the minimum 66%.

1.3. Socio- economic environment

The Nguti Council Area is made up of 54 villages. However, four villages are directly concerned by the proposed council forest (Baro, Osirayip, Sikam,and Ayong) together have a population of about 1,000 inhabitants.

The villages of Baro, Sikam and Ayong are part of the Upper Balong tribe, whereas Osirayib belongs to the Ejagham tribe.

Strangers have settled in Sikam village in the quarter Mokwalibe coming from Itoki in Konye council, belonging to the Bakundu tribe. In Qyong strangers from northwest province are settling.

Social infrastructure development is generally poor in the area. The level of scholarisation in this area is low and this has negative impact on the local village organisation. This not withstanding, the inhabitants still exhibit a strong inclination to their traditional institutions. The traditional councils are at the centre of all development initiatives in the villages. This commitment was especially apparent in Bro, Osirayip and Sikam villages.

Three of the villages (except Osirayib) have primary schools but still under-staffed and under-equipped. The nearest secondary schools are found in Nguti.

For medical attention all these villages depend on the Manyemen and Nguti institutions. The Ayong Health centre remains under-staffed and lacks basic equipment.

None of the villages has pipe-borne water. All villages depend on Manyemen and Nguti markets to sell their forestry and agricultural products. Baro and Osirayip are linked to the Kumba-Nguti road by an abandoned logging road which is only useable seasonably by specially prepared Toyota Hilux 4WD vehicles up to Osirayip.

Baro has not been reached with the vehicle in the last two years as the bridges of the logging road are broken.

Ayong and Sikam are linked to the Kumba-Nguti road also by an abandoned logging road, which is also in very bad condition and only seasonably useable by specially prepared Toyota Hilux vehicles.

A market to farm road had been constructed between Baro qnd Sikam some twenty years ago but has been abandoned.

1.4. History of forest exploitation

Forest license N° 1669 of a surface area of 26 800 ha was granted to the company CTL.
The license covered a big part of the proposed Nguti Council Forest. Timber exploitation took place from around 1987 to 1991. The exploitation is said to have been very selective and not quite systematic.

Some earlier exploitation is said to have taken place in the 1970s by a company named ATC.

2. METHODOLOGY OF MANAGEMENT INVENTORY

2.1 Objectives of management inventory

The main objective of the management inventory consists in the collection of all dendrological and dendrometrical data required for the determination of management parameters in particular possibility and rotation. The specific objectives are:

1. to provide an accurate quantitative and qualitative estimation of first-rotation harvest per species and to make projections for second and third cutting cycles;
2. to refine the stratification obtained from remote sensing;
3. Collect a minimum of environmental data to detect the presence of fragile ecological areas or those with a high biological value.

Two other inventories will be realized at a later stage with a specific protocol:

a) inventory of Non-timber forest products
b) inventory of wildlife, especially large mammals

2.2 General process of the management inventory

Technically, the management inventory can be divided in the following phases:

a) elaboration of a forest stratification map
b) elaboration of the sampling plan;
c) opening of transects;
d) enumeration of trees.
e) data treatment and analysis
f) writing of the inventory report

The control of the inventory activities in the field constitutes a subsidiary activity for which a separate protocol will be elaborated.

The sampling plan has to be approved by MINFOF before starting the inventory in the field.

This protocol refers to field activities c) opening of transects and d) enumeration of trees and is based on the following norms:

-Normes d'inventaries d'aménagement et de préinvestissement, ONADEF, 1991

- Dossier de fiches techniques, MINEF, 2001

2.2 Sampling design

The sampling will be a systematic sampling at 1 degree with sampling plots positioned contiguously on transects which are equidistant and parallel.

The sampling lines shall be as far as possible perpendicular to the general orientation of the river network so that the variability of vegetation types is best represented in the sampling The departure points of transects of enumeration shall be on accessible points situated on a road. If not possible a baseline transect is realized from which all enumeration transects branch off..

The plot as the basic unit of sampling is situated longitudinally on the enumeration transect ; its surface is 0.5 ha with the dimensions of 250 m x 20 m (see Figure 1 below).

The sampling intensity depends on the variability of a required parameter in the whole population and the decision which is taken concerning the precision or error of the estimation of this parameter. The required parameter in our case is the volume of the group of the principal exploited species[1]. The Cameroonian norms argue that due to already realized inventories in the past a number of 500 plots[2] shall be sufficient to obtain a precision of 10% for the volume of the main exploited species on the probability threshold of 95%.Accordingly, the sampling intensity in our case shall be:

250 ha/12.083 ha = 2,07%

The corresponding equidistance (E) of the transects will be:

E=12.083 ha x 20m /250 ha = 967 m

For practical reasons an equidistance of 1000 m is chosen, which will slightly reduce the sampling intensity.

The sampling plan gives a result of 116 km of enumeration transects and 11 km of baseline transects.

All trees with a minimum diameter of 20 cm DBH are enumerated on the plot (250x20 m).

On a sub-plot , on the first 50 m of each plot, also trees with a diameters between 10 cm - 19cm are enumerated[3]. The surface area of this sub-plot is 50 x20 m = 0.1ha. The sampling intensity for this diameter class is 0.4%.

With an average of 2 000 meters per day of opening of transect the inventory will take about 64 days of field work.

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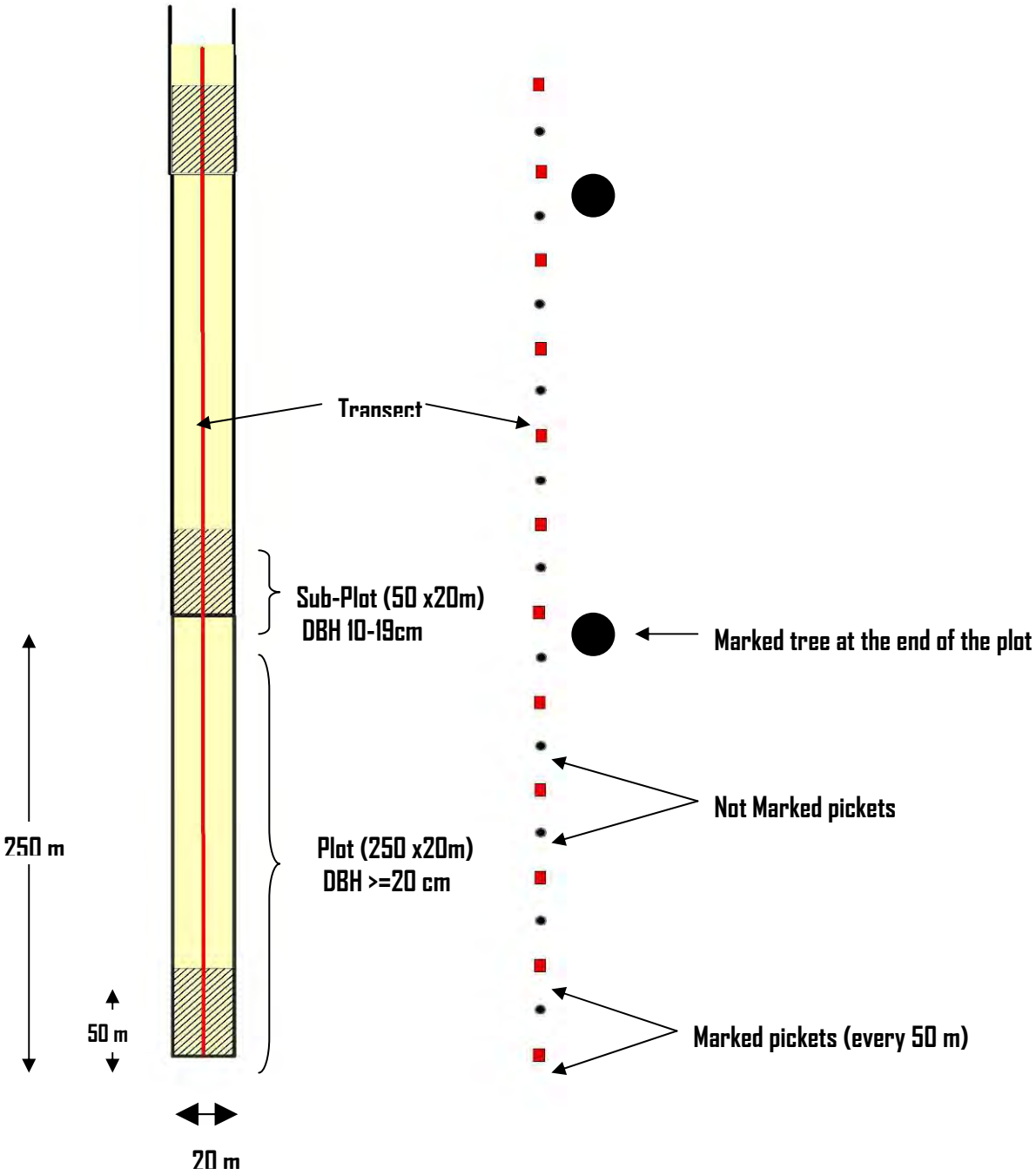
[2] This number of plots is corresponding to a coefficient of variability (CV) of 110-120%

[3] The document « Guide d'élaboration des plans d'aménagement » states that the in the first 50 m of each plot trees with a DBH from 10-19cm shall be enumerated instead only in the fires 5 m of the plot as mentioned in the norms.

Figure 1: sampling plot design



2.3 Transect opening

The transect opening is an operation which materializes the sampling plan in the field. It can be divided in two phases, the opening of the transect itself and the materialization of horizontal distances on the transect (cf. figure 2)

The team leader of the transect opening team need to have the following information, when starting the field work:

- The topographic map at 1/50 000 with the sampling plan,
- The departure points of the transects, by a GPS point or by the indication of the distance on the baseline transect from which the enumeration transect branches off.
- Fixed azimuth of the transect.
- Length of the transect in meters.

The transect opening is realised by a team composed of 7 persons:

- 1 compass holder
- 1 team leader/chain man
- 4 cutlass men
- 1 chaining assistant

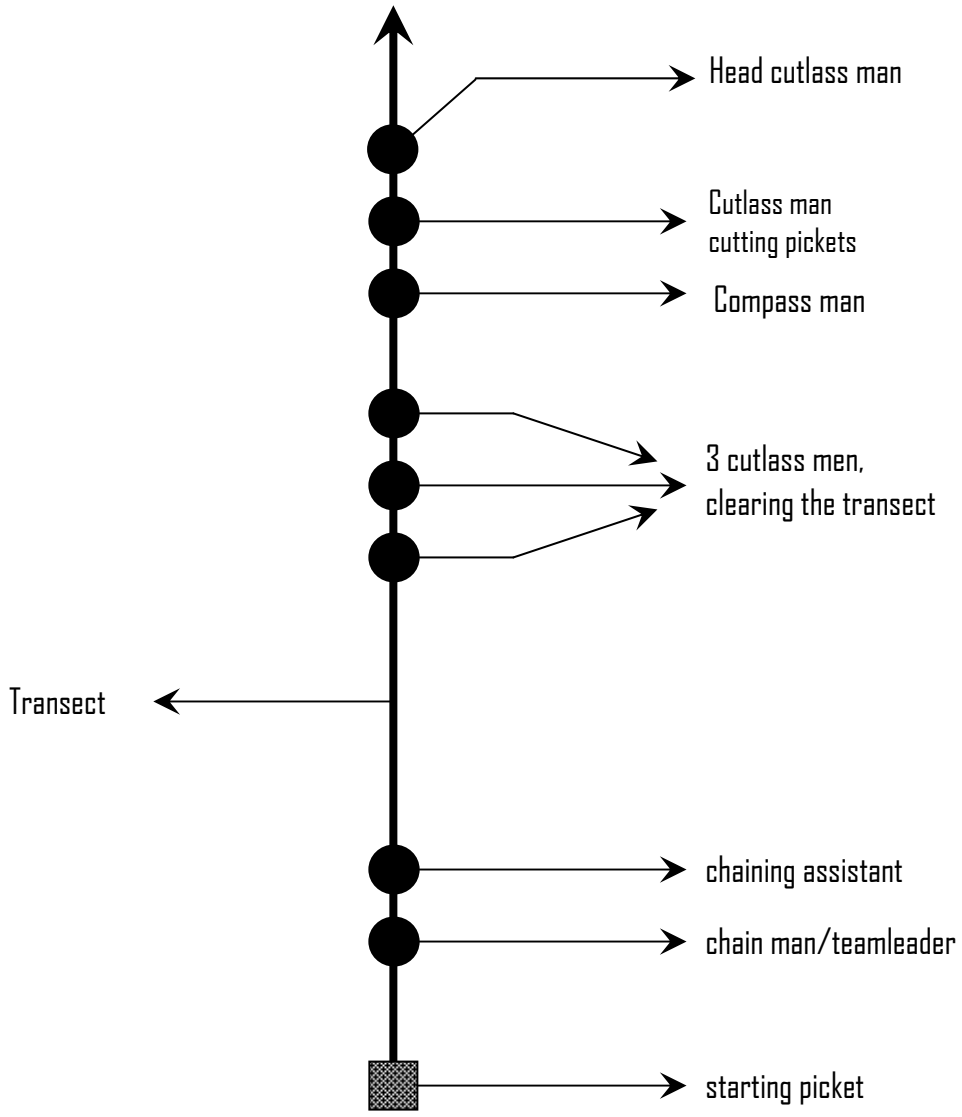
1 phase: Opening of the transect itself:

. At the beginning of the transect, the compass man is placing his compass at the exact place where the picket of the starting point is positioned. The compass is placed on a special manufactured support. The compass man assures that the compass is immobile and perfectly level horizontally. The compass holder indicates the direction of the transect to the head cutlass man in front of him who makes the summary breakthrough in the forest on a defined azimuth. The head cutlass man holds a special marked picket at which the compass man is sighting at. All subsequent sightings are realized in the same manner.

A second cutlass man is following the first, clearing the sighting direction for the compass man and cutting pickets which the head cutlass man is positioning at the exact place where the sighting has been concluded.

The two others following cutlass men clear the transect in order to ensure a good visibility for the the chainman.

Figure 2: progressing of the transect opening team



2nd phase: materialization of horizontal distances on the transect

The chaining assistant and the chainman are following the transect opening team in front of them.

The chainman is directing the chaining assistant 25 m in front of him to align a picket every 25 m on the transect.. The distance of 25 m is measured with a steel cable.

On every second picket, that means every 50 m, is marked with red paint the number of the transect, the cumulative distance on the transect and the number of the plot. All these are written with the red paint (example: T2; 1200m; Pl.5)

At the beginning of each new plot (each 250m), the number of the transect, the cumulative distance on the transect and the number of the plot is marked with red paint on the trunk of the nearest tree.

At the end of the transect a last picket is positioned on which is marked the number of the transect, the cumulative distance, and the word “END”.

2.3.1. Data and observations recorded during transect opening

The teamleader/chainman is filling in the transect description field form (Annex 1). In particular he records the following data:

- *Slope correction:*

The team leader measures the slope in % from one picket to another (25 m) with a clinometer. The chaining aid for this reason is equipped with a picket on which the height of the eyes of the teamleader is marked with red colour. The teamleader is sights this mark with the clinometer and measures the slope in %. He identifies in the slope correction table the corresponding distance to add. He notes the slope correction on the transect description form and it is materialized in the field by the chaining assistant moving the picket in view to obtain the real horizontal distance of 25 m. The additional distance is measured with a 10 m tape.

- *GPS Points:*

The team leader records the GPS points at the beginning of the track, at the end and on the intermediate points, at least once every kilometre. The coordinates are noted on the transect description form. These points allow the real position of the transects to be located on the map.

- *Vegetation type (“strate”)*

He also notes the vegetation type (“strate”) crossed by the transect.. A list of the different vegetation types is found in annex 2.

- *Topographical features*

He indicates on the form the important topographical features (rivers, rocks, transversal slopes) and the forest exploitation signs (roads, skidding tracks) (See Annex 3, list of conventional signs of topographic and hydrographic data).

2.3.2. Equipment of the transect opening team

- 1 compass TOPOCHAIX “Broussarde 235”
- 1 clinometers SUUNTO
- 1 GPS
- A 25m steel cable (3mm)
- A 10 m tape
- A small tin of red paint
- transect description field forms
- Pencils and erasers
- A board of support for fieldforms
- Cutlasses and files

2.4. Enumeration

The objective of the enumeration is to identify and to measure the trees situated in the plots of 250m length and 20m width. The data is recorded on the field form for enumeration (cf.Annex 4)

The enumeration is realized by a team of 7 persons:

- 1 chief prospector, confirmed forest botanist and teamleader
- 2 prospectors/forest botanists
- 2 assistant prospectors
- 1 tally man
- 1 graduated board holder (helps to measure trees with butresses).

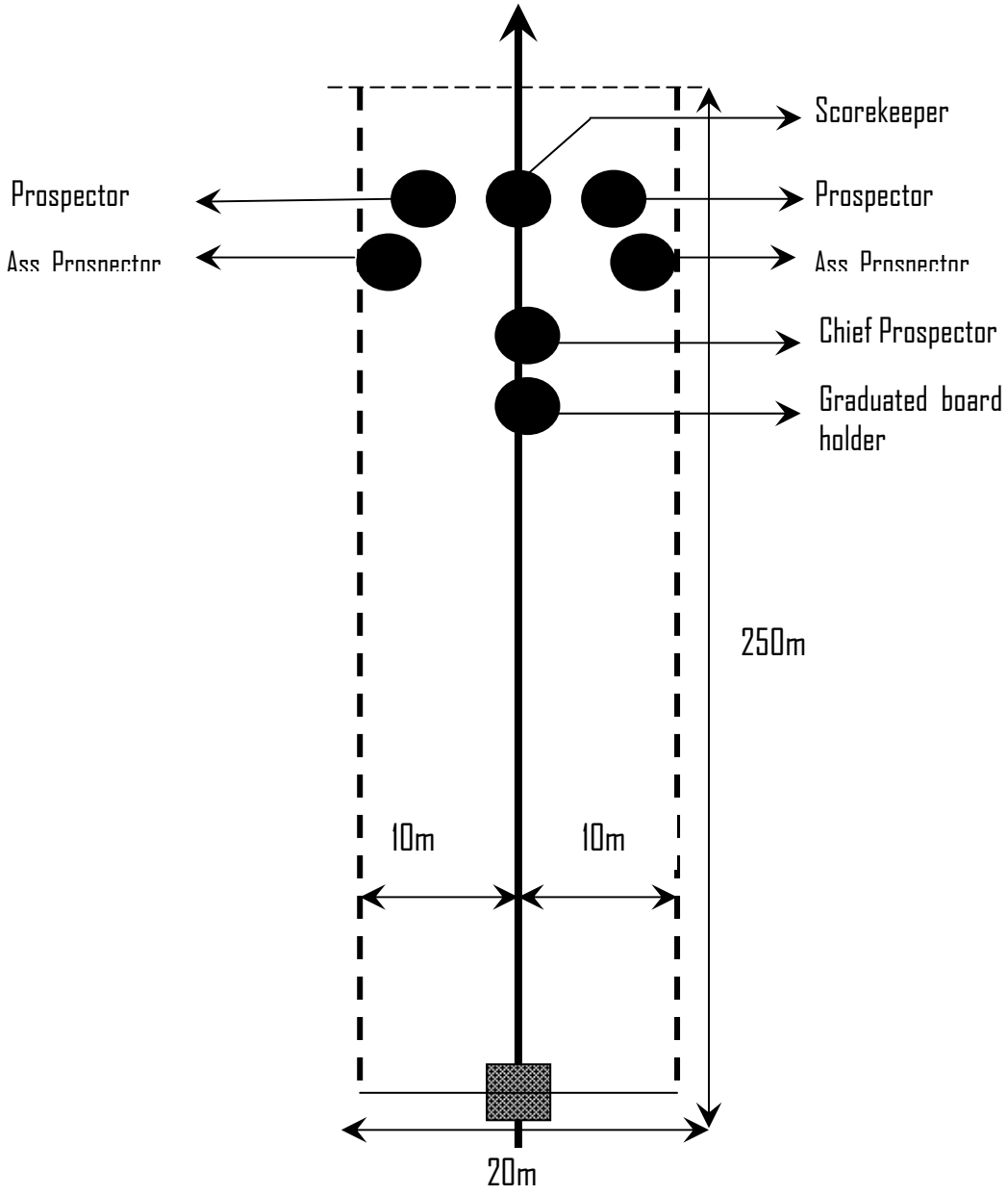
The chief prospector progresses on the transect together with the tally man while the two prospectors move forward on a strip of 10m width on both sides of the transect. The prospectors approach each tree situated in their strip and identify it, measure its DBH and mark it with tree cuts from the cutlass. They announce aloud the tree, its diameter class and if applicable the quality quotation for the bole of the tree. The scorekeeper repeats the announcements aloud to ensure that the prospectors got the right information. If he does not repeat the announcement, the explorers have to announce again the tree with the mention “Repeated “. The assistant prospectors (recruited locally for their good knowledge of the forest and local names) support the work of prospectors. The progress of the enumeration team is illustrated in figure 3.

The team leader verifies the work of the team; supports the prospectors in difficult cases of identification, ensures the respect of the 10m distance in cases of trees situated on the border of the plot and verifies that no tree has been forgotten. In the case of transversal slopes he measures the slope with a clinometer and applies the slope correction out of the corresponding table. (See Annex 5) in order to guarantee a horizontal distance of 10 m of each side of the transect and an identic surface area of 0.5 ha for the plot

The graduated board holder helps to measure trees with buttresses applying the graduated board against the trunk so that the prospectors can sight the diameter class.

On request of the prospectors, the 10 m tape is used to verify the of trees at the border of the plot. This distance is measured between the centre of the tree at felling height and the central axe of the transect. The two assistant prospectors are supporting the prospectors with these measurements.

Figure 3: Progressing of the enumeration team



2.4.1. Detailed description of the data to be recorded during the enumeration

- *Trees to be enumerated in the plot*

All the trees in each plot of 250m of length and 20m of width, with more than 20 cm DBH are enumerated, this means identified and measured. In the field the pilot names are recorded on the enumeration forms. Every evening the scorekeeper completes the column with the code of the trees. The code is used to facilitate the data entry in the "Tiama" programme. The list of the trees to be identified is found in Annex 6. All species not mentioned in the list or which can not be identified are recorded with the code "1999", but their diameter has to be measured.

- *Trees to be enumerated in the sub-plot*

In the sub-plots, in the first 50 m of each plot, additionally all trees between 10 and 19 cm DBH are identified and measured.

- *Diameter measurement*

The trees are measured with diameter tapes at 1,30m at Diameter Breast Height, (DBH) or above buttresses. The particular cases of diameter measurement are illustrated in Annex 7 ..

In the case of trees with high buttresses, the diameter is measured with the graduated board, a graduated rule from which diameter classes can be read from a distance of 10 m. (cf. annex 8).

- *Diameter classes*

The trees are recorded with their diameter class of 10 cm steps. The first class recorded on the whole plot are the trees with 20-29 cm DBH, This diameter class is called class 1, the trees from 30-39 cm DBH are class 2 and so on. Trees with a DBH of 150 cm and more are recorded as class 14 (cf. annex 9).

- *Recording of trees in the enumeration form*

All trees above 20 cm DBH are recorded separately on one line of the enumeration form, with their pilot name, their diameter class and their quality quotation if applicable.

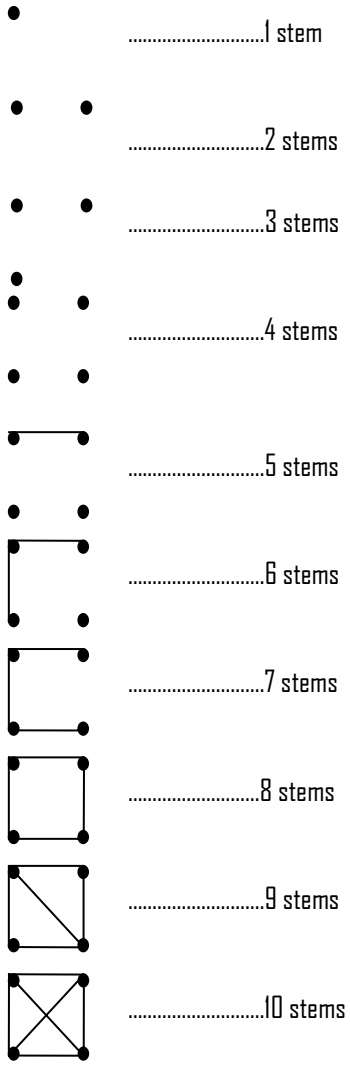
The trees (10cm<=DBH<=19cm) recorded in the sub-plot of 50x50m are called “gaulis” .They are not recorded tree by tree, but the individuals of each species are “counted” and reported on one line of the enumeration form under the chapter “gaulis”.

The method of counting is illustrated in figure 4.

- *Quality Quotation*

The bole quality of trees with an DBH >= 40 cm (diameter class 3) and belonging to the species group 1, 2 and 3 (cf. annex 6) has to be quoted. 4 different quality classes are differentiated. The norms for the quality quotation are found in annex 10.

Figure 4: Method of counting stems with DBH between 10-19 cm



2.4.2. Equipment for the enumeration team

- 5 diameter measuring tapes, graduated in cm
- 1 graduated board to measure the diameter of trees with high butresses
- 1 clinometer SUUNTO
- 1 10 m tape
- binoculars (to compare leafs on the ground which these found on the ground)
- Enumeration field forms
- Manual of Dendrology
- Inventory protocol
- 1 support plate
- 1 map with the sampling plan
- Pencils and erasers
- Cutlasses and files.

Literature

MINEF,1997. Guide d'élaboration des plans d'aménagement des forêts de production du domaine forestier permanent de la République du Cameroun, 24 p. avec annexes.

MINEF, 2001. Arrêté N° 0222 fixant les procédures d'élaboration, d'approbation, de suivi et de contrôle de la mise en œuvre des plans d'aménagement des forêts de production du domaine forestier permanent

MINEF, 2001. Dossier des fichest technique. Procédures d'élaboration, d'approbation, de suivi et de contrôle de la mise en œuvre des plans d'aménagement des forêts de production du domaine forestier permanent.

NGUTI COUNCIL/PSMNR-SWP, 2007. Preliminary technical note for the gazettement of Nguti council forest, 12p.

ONADEF, 1991. Normes d'inventaire d'aménagement et de pré-investissement, 32 p avec annexes.

ANNEXES

ANNEX 1: Transect Description form

NGUTI COUNCIL FOREST ***MANAGEMENT INVENTORY***

TRANSECT DESCRIPTION FORM

Date : / /	**UC: 1**	**TRANSECT N° :**	**Azimuth:**
Team Leader :		**Plot N°:**	**to Plot N°:**

GPS: Waypoint N°	Slope	CARTOGRAPHY Dist.	Strate	Slope %	Correction in m	Slope correction for a distance of 25 m	
						slope in %	m to add
N°:		**000**				10	0.12
X:		975				11	0.15
Y:		950				12	0.18
		925				13	0.21
		900				14	0.24
		875				15	0.28
		850				16	0.32
		825				17	0.36
		800				18	0.40
		775				19	0.45
N°:		**750**				20	0.50
X:		725				21	0.55
Y:		700				22	0.60
		675				23	0.65
		650				24	0.71
		625				25	0.77
		600				26	0.83
		575				27	0.90
		550				28	0.96
		525				29	1.03
N°:		**500**				30	1.10
X:		475				31	1.17
Y:		450				32	1.25
		425				33	1.33
		400				34	1.41
		375				35	1.49
		350				36	1.57
		325				37	1.66
		300				38	1.74
		275				39	1.83
N°:		**250**				40	1.93
X:		225				41	2.02
Y:		200				42	2.12
		175				43	2.21
		150				44	2.31
		125				45	2.41
		100				46	2.52
		75				47	2.62
		50				48	2.73
X:		25				49	2.84
Y:						50	2.95
N°:		**0**				51	3.06
						52	3.18
						53	3.29
						54	3.41
						55	3.53
						56	3.65
						57	3.78
						58	3.90
						59	4.03
						60	4.15
						61	4.28
						62	4.42
						63	4.55
						64	4.68
						65	4.82
						66	4.95
						67	5.09
						68	5.23
						69	5.37
						70	5.52
						71	5.66
						72	5.81
						73	5.95
						74	6.10
						75	6.25
						76	6.40
						77	6.55
						78	6.71
						79	6.86
						80	7.02
						81	7.17
						82	7.33
						83	7.49
						84	7.65
						85	7.81
						86	7.97
						87	8.14
						88	8.30
						89	8.47

Complementary informations: _____

ANNEX 2: Vegetation types ("strates")

Main Types

Primary Forest :

DHS Forêt primaire de basse et moyenne altitude - **Dense Humide Sempervirente** (Closed evergreen lowland forest)

Closed evergreen lowland forest on hydromorphic soils:

Forêt primaire de basse et moyenne altitude de sol hydromorphe :

MIN **Marécageuse Inondable** - (Swampy, liable to flooding)

MIT **Marécageuse inondée temporairement** – (swampy temporarely flooded)

MIP **Marécageuse inondée en permanence** - (swampy permanently flooded)

MRA **Marécageuse à Raphiale** (swampy with raphia)

Secondary Forest:

SR **Forêt secondaire en régénération** (secondary forest in regeneration)

SJ **Forêt secondaire jeune** (Young secondary forest)

SA **Forêt secondaire adulte** (Old secondary forest)

Depending on the **density** of the forest stand the following sign can be added :

d faible (low)

b forte (high)

e.g. DHSb, SAd

If the forest is **inaccessible**, the following sign is added :

In Inaccessible

e.g. DHSbIn, SAdIn

If the forest has been exploited, the following sign is added :

Ct coupe totale (clear cut)

Cp coupe partielle (selective logging)

e.g. DHSbCp

If there is a clearing in the forest, the following sign is added :

Ch Châbis (clearing)

Non woodland terrain :

 **Dénudé et semi-dénudé sec** (bare or semi-bare soil, dry)

 **Dénudé humide** (bare soil humid)

 **Savane herbeuse et/ou arbustive** (grassland savanna and/or shrubby savanna)

Agricultural Area :

CU **Culture itinérante ou vivrière** (subsistence farming)

CI **Culture industrielle** (industrial farms)

PO **Plantation Cacao**

PE **Plantation Elaeis**

PH **Plantation Hevea**

PB **Plantation Banane**

ANNEX 3: Conventional signs for topographic and hydrographic data

SLOPE UP
……..……..……

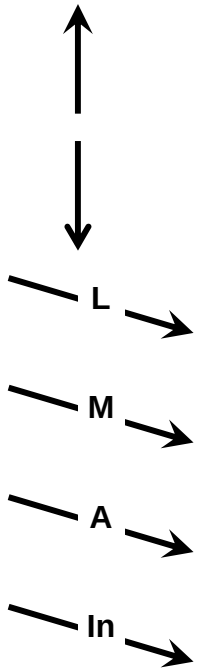
SLOPE DOWN
……..……..……

SLOPE CLASSES SMALL
……..……..……

AVERAGE
……..……

ABRUPT……..……
……

INACESSIBLE……..……
……



LEVEL AREA
……..……..……

STEEP SLOPE
……..……

RIDGE LINE
……..……

ROAD ……..……..……..……

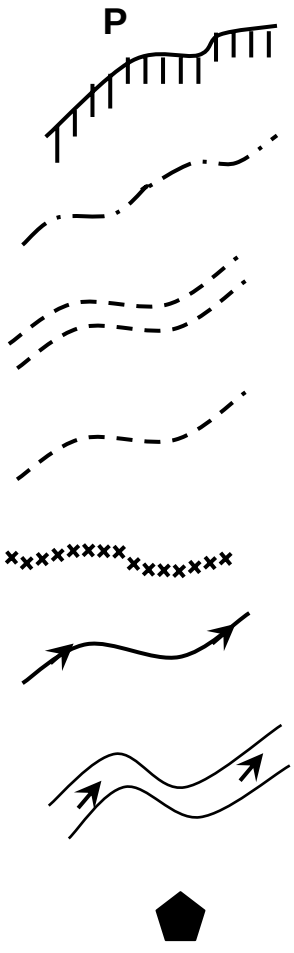
SKIDDING TRACK……..……..……

FOOT PATH
……..……..……

SMALL RIVER OR STREAM LESS THAN 5 METERS WIDTH
…… ……

RIVER OVER 5 METERS WIDTH
……..……

ROCK
……..……..……



ANNEX 4: Enumeration field form

NGUTI COUNCIL FOREST *MANAGEMENT INVENTORY*

ENUMERATION FORM

Date : / /	**Transect N° :**	
Team leader :	**Plot N° :**	**Page N°:**
UC: 1	**Distance start:**	
	Distance end :	

DBH = 10- 19 cm

SPECIES	Code	☒	N
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

STEMS WITH A DBH >= 20cm

SPECIES	Code	CL. ∅	QUAL.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			

STEMS WITH A DBH >= 20cm

SPECIES	Code	CL. ∅	QUAL.
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
51			

Cl.1: 20-29; Cl.2:30-39 cm,Cl. 3: 40-49, Cl.4: 50 -59, Cl.5: 60 -69, Cl.6: 70-79, Cl.7: 80-89cm, Cl.8: 90-99cm, Cl:.9 100-109cm, Cl.:10 110-119cm,Cl.11:120-129cm, Cl.12 130-139cm, Cl.13 140-149cm, Cl.14 >=150cm

ANNEX 5: Transversal Slope correction table for 10 m

SLOPE CLASS (%)	CORRECTION TO ADD IN METERS
10 (7,5%≤ PENTE < 12,5%)	**0,05**
15	**0,11**
20	**0,20**
25	**0,31**
30	**0,44**
35	**0,59**
40	**0,77**
45	**0,97**
50	**1,18**
55	**1,41**
60	**1,66**
65	**1,93**
70	**2,21**
75	**2,50**
80	**2,81**
85	**3,12**
90	**3,45**
95	**3,79**
100	**4,14**

ANNEX 6: LIST OF SPECIES PER GROUP

SPECIES 0F GROUP 1

CODE	PILOTE NAME	SCIENTIPHIC NAME	DME (cm)
1101	Acajou à grandes folioles	Khaya grandifolia	80
1102	Acajou Blanc	Khaya anthotheca	80
1103	Acajou de Bassam	Khaya ivorensis	80
1104	Assamela	Pericopsis elata	80
1105	Ayous	Triplochyton scleroxylon	80
1106	Azobé	Lophira alata	60
1107	Bété	Mansonia altissima	60
1108	Bossé Clair	Guarea cedrata	80
1109	Bossé Foncé	Guarea thompsonii	80
1110	Dibétou	Lovoa trichilioides	80
1111	Doussié Blanc	Afzelia pachyloba	80
1112	Doussié rouge	Afzelia bipindensis	80
1113	Doussié Sanaga	Afzelia africana	80
1114	Ebène	Diospyros crassilfora	60
1115	Framiré	Terminalia ivorensis	60
1116	Iroko	Milicia excelsa	100
1117	Kossipo	Entandrophragma candollei	80
1118	Kotibé	Nesogordonia papaverifera	50
1119	Douka	Tieghemella africana	50/60
1120	Moabi	Baillonnella toxisperma	100
1121	Okoumé	Aucoumea klaineana	80
1122	Sappelli	Entandrophragma cylindricum	100
1123	Sipo	Entandophramagma utile	80
1124	Tiama	Entandrophragma angolense	80
1125	Tiama Congo	Entandrophragma congoense	80
1126	Wengé	Millettia laurentii	50

SPECIES 0F GROUP 2

CODE	NOM PILOTE	SCIENTIFIC NAME	DME (cm)
1201	"Aningré ""A""	Aningeria altissima	60
1202	Aningré "R"	Aningeria robusta	60
1203	Avodiré	Turreaenthus africanus	60
1204	Bahia	Mitragyna ciliata	60
1205	Bongo"H"	Fagara heitzii	60
1206	Bubinga rouge	Guibourtia demeusei	80
1208	Bubinga rose	Guibourtia tessmannii	80
1209	Eyong	Eribroma oblongum	50
1210	Longhi	Gambeya africana	60
1211	Niangon	Heritiera utilis	50
1212	Nkanang	Sterculia rhinopetala	50
1213	Movingui	Distemonanthus benthamianus	60
1214	Ozigo	Dacryodes buettneri	50
1215	Pao rosa	Swartzia fistuloides	50

SPECIES 0F GROUP 3

CODE	PILOTE NAME	SCIENTIFIC NAME	DME (cm)
1301	Aiélé	Canarium schweinfurthli	60
1302	Ako"A"	Antiaris africana	60
1303	Ako"W"	Antiaris welwitchii	50
1304	Alep	Desbordesia glaucescens	50
1305	Andoung Brun	Monopetalanthus microphyllus	60
1306	Andoung rose	Monopetalanthus letestui	60
1307	Angueuk	Ongokea gore	50
1308	Bilinga	Nauclea diderrichii	80
1309	Bodioa	Anopyxis klaineana	50
1310	Dabéma	Piptadeniastrum africanum	60
1311	Diana"Z"	Celtis Zenkeiri	50
1312	Difou	Morus mesozygia	60
1313	Ebiara Edéa	Berlinia bracteosa	50
1314	Ekaba	Tetraberlinia bifoliolata	60
1315	Ekouné	Coelocaryon preussi	50
1316	Emien	Alstonia boonei	50
1317	Etimoé	Copaifera mildbraedii	60
1318	Eyek	Pachyelasma tessmannii	50
1319	Faro	Daniellia ogea	60
1320	Fraké/Limba	Terminallia superba	60
1321	Fromager	Ceiba pentandra	50
1322	Gombé	Didelotia letouzeyi	60
1323	Iatandza	Albizia ferruginea	50
1324	Ilomba	Pycnanthus angolensis	60
1325	Kondroti	Rodognaphalon brevicuspe	50
1326	Koto	Pterygota macrocarpa	60
1327	Kumbi	Lannea welwitschii	50
1328	Landa	Erythroxylum mannii	50
1329	Lati	Amphimas ferrugineus	50
1330	Lati Parallèle	Amphimas pterocarpoides	50
1331	Limbali	Gilbertiodendron dewevrei	60
1332	Mambodé	Detarium marocarpum	50
1333	Mukulungu	Autranella congolensis	60
1334	Mutondo	Funtumia elastica	50
1335	Naga	Brachystega cynometrioides	60
1336	Naga parallèle	Brachystegia mildbraedli	60
1337	Nganga	Cynometra hankei	60
1338	Niové	Staudtia kamerunensis	50
1339	Oboto	Mammea africana	50
1340	Oduma	Gossweilerodendron joveri	80
1341	Okan	Cylicodiscus gabonesis	60
1342	Onzabili "K"	Antrocaryon klaineanum	50
1343	Osanga	Pteleopsis hylodendron	50
1344	Padouk blanc	Pterocarpus mildbraedii	60
1345	Padouk rouge	Pterocarpus soyauxii	60
1346	Tali	Erythropleum ivorense	50
1347	Tchitola dibamba	Oxystigma mannii	60
1348	Tola	Gossweilerodendron balsamiferum	100
1349	Zingana	Microberlinia bisulcata	80

SPECIES OF GROUP 4

CODE	PILOTE NAME	SCIENTIFIC NAME	DME (cm)
1401	Abalé	Petersianthus macrocarpus	50
1402	Abam à poils rouges	Gambeya beguei	50
1419	Abam vrai	Gambeya lacourtiana	50
1424	Abena	Homalium letestul	50
1432	Abip élé	Keayodendron bridelioides	50
1437	Abura	Mitragyna stipulosa	60
1439	Adjap londjap	Manilkara pelligriniana	50
1440	Adjap mang	Manilkara obovata	50
1442	Adjap osoé	Manilkara argentea	50
1444	Afane	Panda oleosa	50
1446	Afoe bilobi	Erismadelphus exul	50
1458	Akodiakédé	Pterygota beguaertii	60
1461	Akurna/Ossoko	Scyphocephalium mannii	50
1474	Alumbi	Julbernardia seretii	50
1480	Andok	Irvingia gabonensis	50
1482	Andongwe	Irvingia grandifolia	50
1485	Angelin	Andira anermis	50
1493	Anzem	Coparifera religiosa	60
1527	Awoura	Paraberlinia bifoliolata	60
1548	Cordia d'Afrique	Cordia platythyrsa	60
1549	Coula	Coula edulis	50
1550	Crabwood d'afrique	Carapa procera	50
1551	Crabwood de montagne	Carapa grandiflora	50
1554	Diana	Celtis tessmannii	50
1556	Divida	Scorodophloeus zenken	50
1561	Ebap	Santiria trimera	50
1562	Ebébeng	Phyllanthus discoideus	50
1564	Ebiara Yaoundé	Berlinia grandiflora	50
1584	Ekobem Edéa	Gilbertiodendron klaenei	50
1590	Ekop ewolet	Plagiosiphon emarginatus	50
1593	Ekop GH	Talbotiella batesii	50
1596	Ekop léké	Brachystegia zenkeri	60
1604	Ekop tani	Cryptosepalum staudtii	50
1635	Essesang	Ricinodendron heudelotii	50
1639	Esson	Stemonocoleus micranthus	50

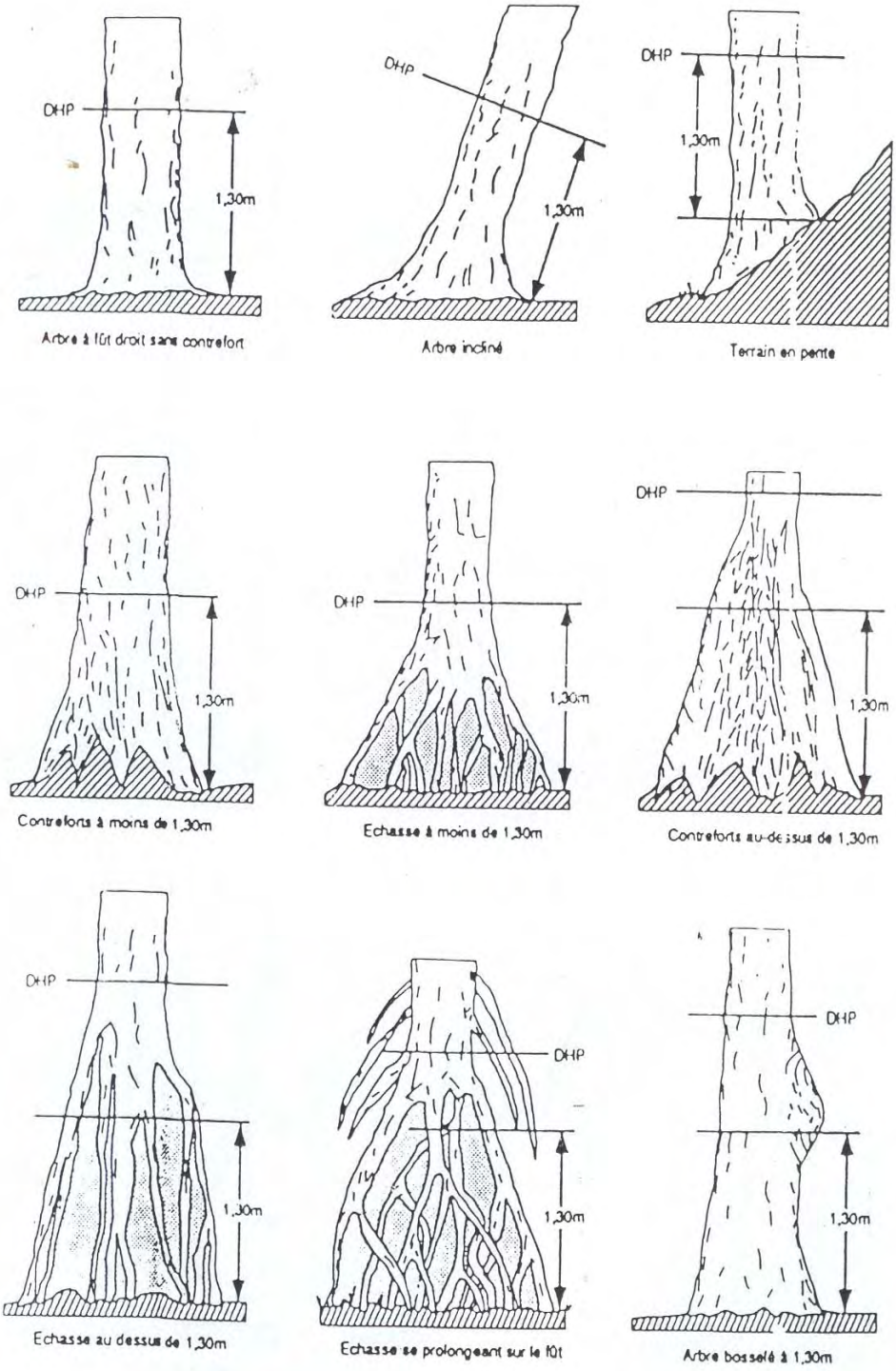
SPECIES OF GROUP 4 (FOLLOW)

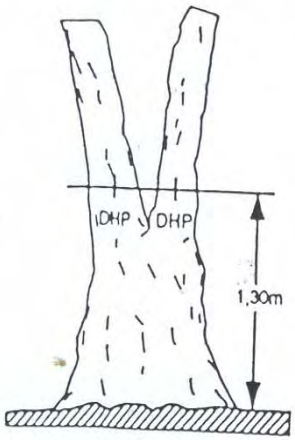
CODE	PILOTE NAME	SCIENTIFIC NAME	DME (cm)
1646	Eveuss	Klainedoxa gabonensis	50
1647	Eveuss à petites feuilles	Klainedoxa microphylla	50
1660	Eyoum	Dialum pachyphyllum	60
1661	Eyoum à petites feuilles	Dialum dinklagei	60
1662	Eyoum blanc	Dialum zenkeri	60
1663	Eyoum foncé	Dialum guineensis	60
1664	Eyoum rouge	Dialum bipendense	60
1665	Faro mezilli	Daniella klainei	60
1669	Gombé zing	Toubaoute brevipaniculata	60
1670	Izombé	Testulea gabonensis	80
1671	Johimbé	Pausinystalia johimbe	50
1680	Kanda grandes feuilles	Beilschmiedia anarcadioides	50
1683	Kapokier	Bombax buonopozense	60
1687	Kekelé	Holoptelea grandis	60
1688	Kiasosé	Pentadesma butyracea	60
1689	Kibakoko à feuilles argentées	Anthonotha fragrans	50
1690	Kibakoko à feuilles roussâtres	Anthonotha ferruginea	60
1698	Lo	Parkia bicolor	50
1724	Miama	Calpocalyx dinklagei	50
1733	Mubala	Pentaclethra macrophylla	50
1737	Mvanda	Hylodendron gabonense	50
1825	Nom Ozek	Hannoa klaineana	50
1826	Nom Sodong	Mildbreadiodendron excelsum	60
1859	Ohia	Celtis mildbreadii	60
1869	Onié	Garcinia kola	50
1883	Ouochi	Albizia zigia	50
1885	Ovoga	Poga oleosa	50
1894	Ozek	Odyendyea gabonensis	60
1895	Ozouga	Saccoglottis gabonensis	50
1896	Padouk de rivière	Pterocarpus osun	50
1899	Rikio	Uapaca guineensis	50
1904	Sougué à grandes feuilles	Parinari excelsa	50
1905	Tali Yaoundé	Erythropleum suaveolens	60
1918	Vessambata	Oldfieldia africana	50
1919	Wamba	Tessmannia anomala	50
1920	Wamba à grandes feuilles	Tessmannia africana	50
1922	Zoa élé	Monopetalanthus hedinii	50

SPECIES OF GROUP 5

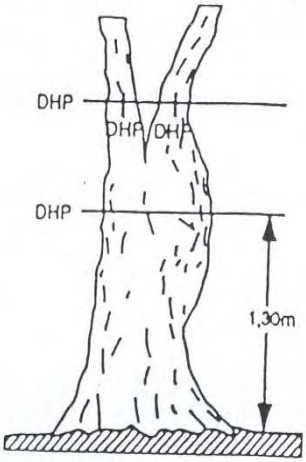
CODE	PILOTE NAME	SCIENTIFIC NAME	DME (cm)
1911	Eucalyptus	Eucalyptus camaldulensis	30
1916	Gmelina	Gmelina arborea	30
1923	Pin	Pinus Khesya	50
1926	Podo/Manio	Podocarpus milanjianus	60
1929	Teak	Tectona grandis	60

ANNEX 7: PARTICULAR CASES OF DIAMETER MEASUREMENT

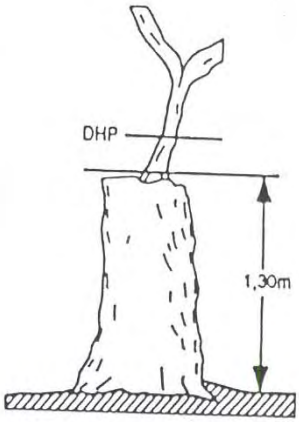




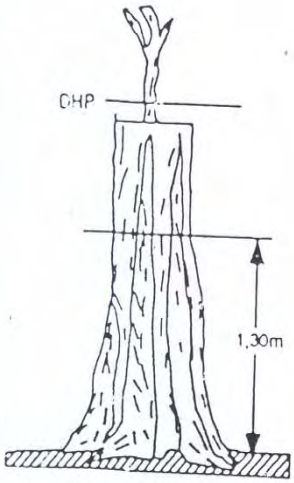
Arbre fourchu à moins de 1,30m



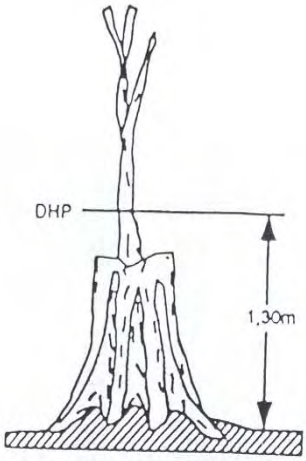
Arbre fourchu et bosselé à 1,30m



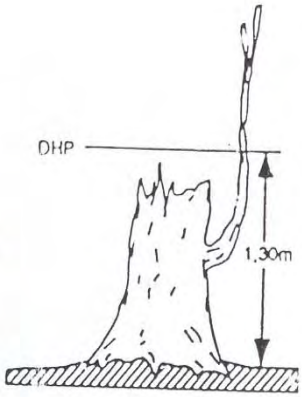
Abattage à 1,30m



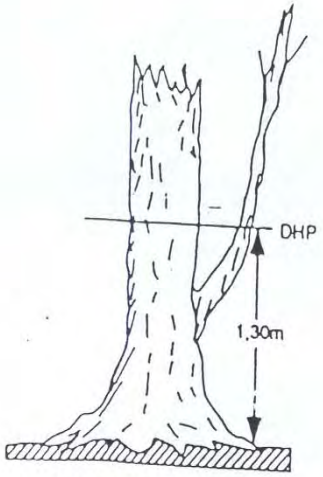
Abattage au-delà de 1,30m



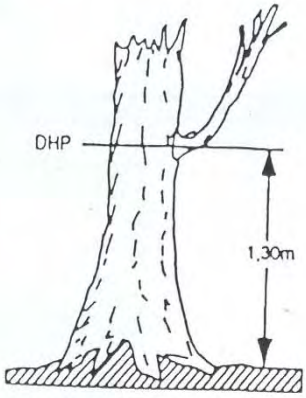
Abattage au dessous de 1,30m



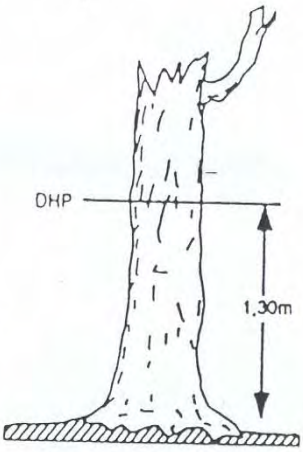
Cassé inférieure à 1,30m



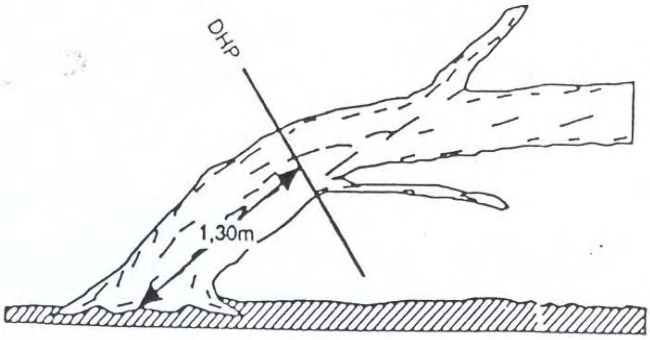
Cassé au-delà de 1,30m
dont rejet plus bas que 1,30m



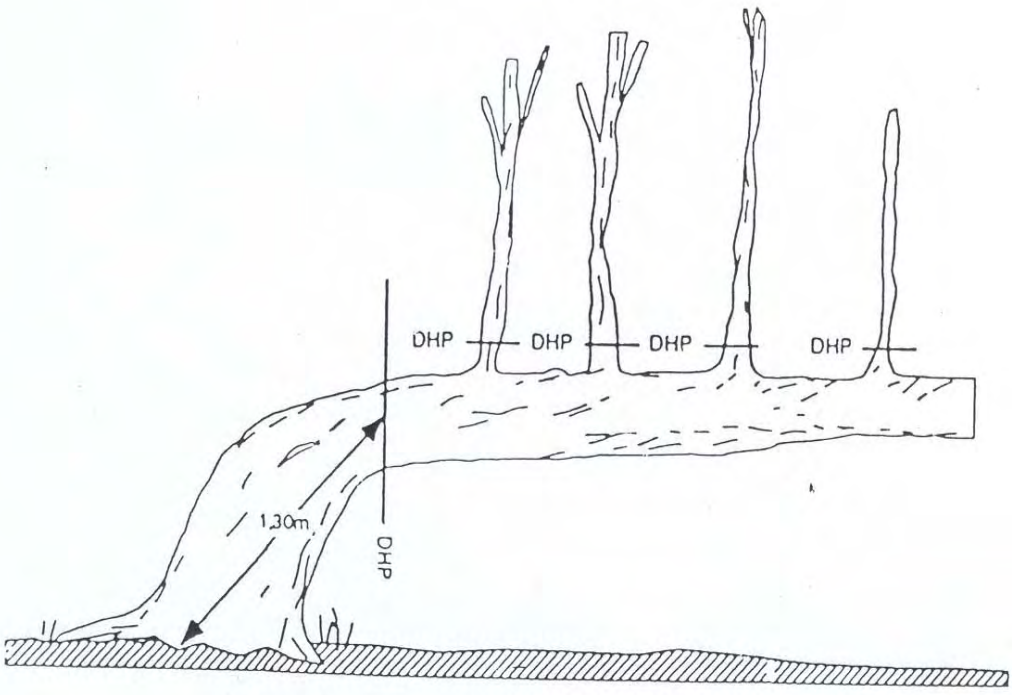
Cassé au-delà de 1,30m
dont rejet à 1,30m



Cassé au-delà de 1,30m
dont rejet au delà de 1,30m



Arbre couché sans rejet important



Arbre couché avec rejets importants

ANNEX 8: Manufacture and use of the graduated board to measure trees with high buttresses

The graduated board is used to read the diameter class of trees with high buttresses.

It is fixed on a long pole. With this the graduated pole is leaned against the trunk of the tree at the required height (above buttresses). The diameter is read by an observer with 10 m distance to the centre of the tree (cf. figure)

To correct the error of the parallaxe the diameter class limits to mark on the board are as follows:

Diameter Class	LOWER DIAMETER LIMIT OF THE CLASS	
	EXACT LIMIT	LIMIT ON TO MARK ON THE BOARD
	cm	cm
	10	10,0
1	20	19,8
2	30	29,6
3	40	39,2
4	50	48,8
5	60	58,3
6	70	67,7
7	80	77,1
8	90	86,3
9	100	95,5
10	110	104,6
11	120	113,6
12	130	122,5
13	140	131,4
14	150	140,1

The graduated board shall be of a dimension of 150 cm x 10 cm x 1 cm, made out of a stable and resistant timber e.g. Padouk, and painted in white.The diameter class limits and the number of the diameter class are painted red.

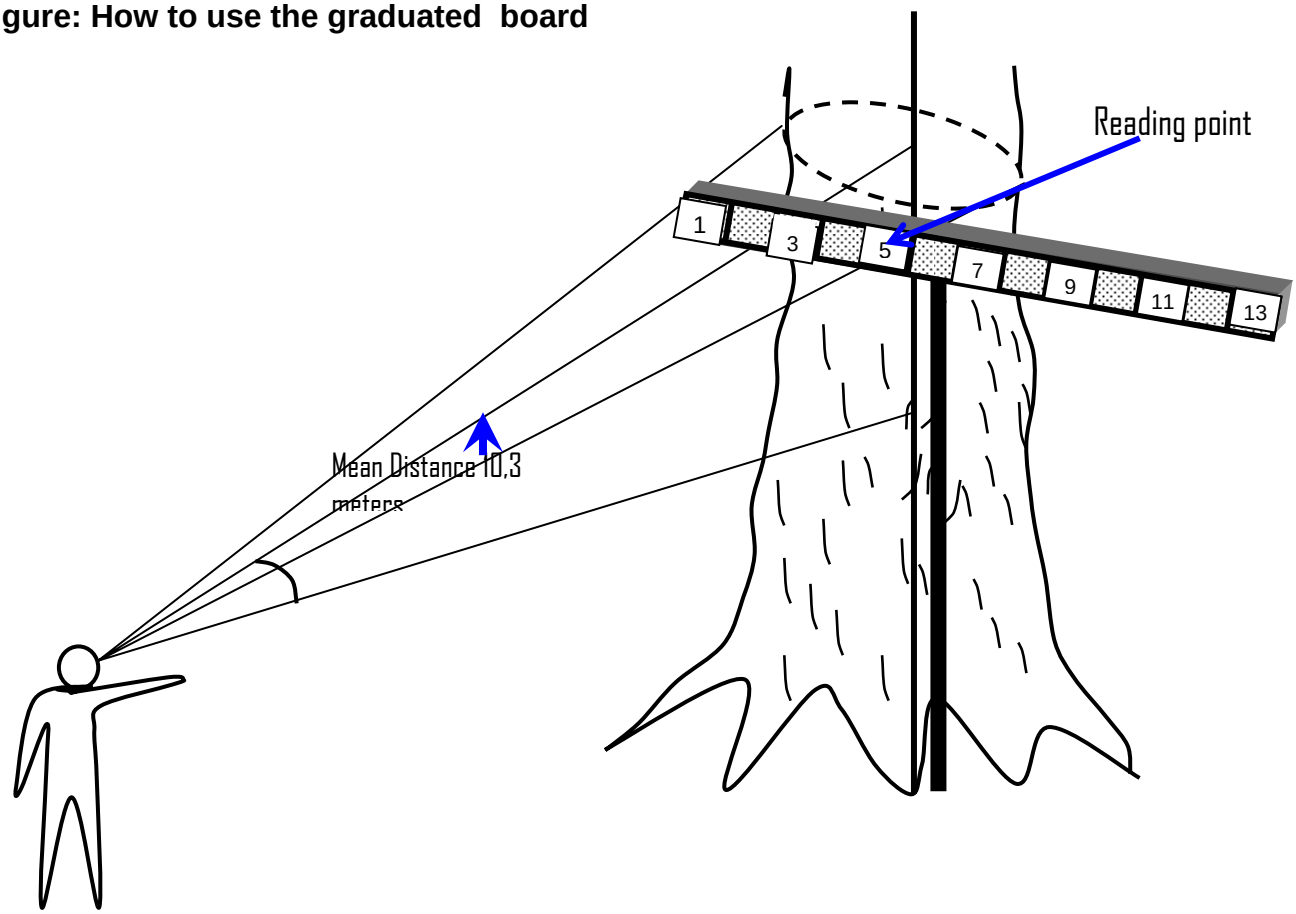
The observer places himself at a horizontal distance of 10 from the centre of the tree. The table with the limits to mark on the board is based on a mean distance of 10.3m between the eye of the observer and the board being leaned against the tree at a height between 1.5 m to 5 m (cf. Memento du Forestier).

The board holder leans the board against the tree at the required height. The board has to be perpendicular to the sighting direction of the observer. The extreme left border of the board has to be aligned to the left border of the trunk. The observer is then reading the diameter class which is marked by the right border of the trunk.

If the trunk is oval two measurements have to be taken from a perpendicular direction to determine a mean value for the diameter class.

If there is a slope between the observer and the tree, some distance has to be add according to the slope correction table of 10 m in annex 5.

Figure: How to use the graduated board



ANNEX 9: DEFINITION OF DBH CLASSES

CLASS LIMITS				CLASSES
20 cm	≤	DBH	≤	29 cm ……1
30 cm	≤	DBH	≤	39 cm ……...2
40 cm	≤	DBH	≤	49 cm ……..…3
50 cm	≤	DBH	≤	59 cm ……4
60 cm	≤	DBH	≤	69 cm ……5
70 cm	≤	DBH	≤	79 cm …… 6
80 cm	≤	DBH	≤	89 cm …… 7
90 cm	≤	DBH	≤	99 cm …… 8
100 cm	≤	DBH	≤	1 09 cm …….. 9
110 cm	≤	DBH	≤	119 cm …….. 10
120 cm	≤	DBH	≤	129 cm …….. 11
130 cm	≤	DBH	≤	139 cm …….. 12
140 cm	≤	DBH	≤	149 cm …….. 13
150 cm and more ……;;;…….. 14				

ANNEX 10: Quality quotation for the bole of a tree

The quality quotation has to be effected for all trees of species group 1, 2 and 3 which have a DBH >= 40 cm (DBH Class 3 and above).

QUALITY 1 : which gives at least on log of very good quality (« EXPORT ») with a minimum length of 8 m

QUALITY 2 : which gives at least a log of good quality 6 m long with slight defects

QUALITY 3 : which gives at least a log 6 m long with more pronounced defects

QUALITY 4 : tree not usable for the timber industry

QUALITY CLASSES		**1**	**2**	**3**
Min. Length of logs		**> 8 m**	**> 6 m**	**> 6 m**
CRITERIA	**DEFECTS**			
section	**fluted** ribbed	no	slightly	slightly
	gutter (« pirogue »)	no	1 not very pronounced	1
	flattened	no	slighly	strongly
bole	curved	Very slight	slightly	More pronounced
	bump	no	1	yes
	twisted grain	no	Slighly < 15%	Slightly <15%
	living branch	no	1	3
	sound knot sound scar	no	yes	yes
health	strangled by a ficus	no	no	no
	open wound	no	no	1
	broken branch large sucker	no	1	2
	rotten at the base rotten hole rotten knot hollow trunk fungi	no	no	One of these defects
	wormholes	no	On a small surface	Yes