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Large Mammal Survey of the Nguti Council Forest, South West Province - Cameroon.

Realized for PSMNR-SWP

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The PSMNR-SWP requested WWF – Coastal Forests Programme to undertake large mammal surveys in this Forest in order to compliment its requirements for the Management Plan Procedures. More specifically, the expected main outputs are:

1. The densities or relative densities of large mammal species as well as their spatial distributions
2. The spatial distribution of poaching/hunting activities.

The Nguti Council Forest covers about 12,083 ha. It is situated in Nguti sub-division, Kupe-manenguba Division, South West Province of Cameroon. It has a common boundary on its western part with the Korup National Park along the Bake River and on its northern part with the Nkwende Hills Protection Forest. It is located within latitude UTM 575000 to 588000 and longitude UTM 521000 to 539000

The PSMNR-SWP geo-referenced 4x4 km grid was used. A total 10 random transects of 2 km each (located in each of the 4x4 km quadrate) were planned to be cut. The field teams faced a problem that is recurrent to random transects; certain transects were not completed due to deep valleys. The starting point of each transect was randomly generated using a random number table. Their exact positions in the field were determined by the use of a GPS GARMIN 12XL. The survey of 10 transects generated a sampling effort of 19 km. Transects were oriented to cross major drainage features in order to sample a representative proportion of all vegetation types.

Eight (8) species of large mammals were recorded within the Nguti Council Forest. They belong to two cohorts, three orders and four families. The family Bovidae is well represented by 4 species that are the forest buffalo (*Syncerus caffer*), the blue duiker (*Cephalophus monticola*), the bay duiker (*Cephalophus dorsalis*) and ogilbyi duikers (*Cephalophus ogilbyi*). The Cercopithecinae family follows with two species; Mona monkey (*Cercopithecus mona*), and greater white-nosed monkey (*Cercopithecus nictitans*). The Elephantidae and Suidae families are represented each by one species; the forest elephant (*Loxodonta africana cylotis*) and the red river hog (*Potamochoerus porcus*) respectively.

The overall Relative Density of large mammals in the Nguti Council Forest was estimated to be 0.34 signs per km. In other words, one would identify less than one large mammal signs for every kilometre walked in the study area. The proposed Nguti Council forest appears therefore to be poor in large mammals' biodiversity.

The spatial distribution of large mammals' biodiversity "hot spots" reveals concentrations in the northern and central parts of the study area.

All human activities were lumped to determine the human activities hot spots. Analysis suggests a mean encounter rate of 1.46 signs km^{-1} (more than one sign per km). The spatial distribution shows a high concentration area in the eastern and western borders of the Nguti Council Forest.

The highest mean encounter rates for human activities in the study area were recorded for hunting (snare lines, gun shells, gun shots, bush huts, hunters trails and cutlass cuts) with 1.9 signs km^{-1} (about two signs recorded per km). The spatial distribution shows a high concentration in most of the Nguti Council Forest.

Market hunting, the main threat to the region's wildlife (Wilkie et al. 2001) has being enhanced by the infrastructure and transportation networks in place. Manyemen and Nguti markets are used by inhabitants neighbouring the Nguti Council Forest to sell their products, especially bushmeat. Hunting activities mainly carried out by hunters from Osirayib, Ayong, Manyemen, increases the pressure on wildlife in the region.

1. INTRODUCTION

The Nguti Council Forest is relatively unknown, with little or no previous biological surveys carried out. The PSMNR-SWP requested WWF – Coastal Forests Programme to undertake large mammal surveys in this Forest in order to compliment its requirements for the Management Plan Procedures. More specifically, the expected main outputs are:

1. The densities or relative densities of large mammal species as well as their spatial distributions
2. The spatial distribution of poaching/hunting activities.

2. STUDY AREA

2.1 Location

The Nguti Council Forest covers about 12,083 ha. It is situated in Nguti sub-division, Kupe-manenguba Division, South West Province of Cameroon. It has a common boundary on its western part with the Korup National Park along the Bake River and on its northern part with the Nkwende Hills Protection Forest. It is located within latitude UTM 575000 to 588000 and longitude UTM 521000 to 539000 (Figure 1).
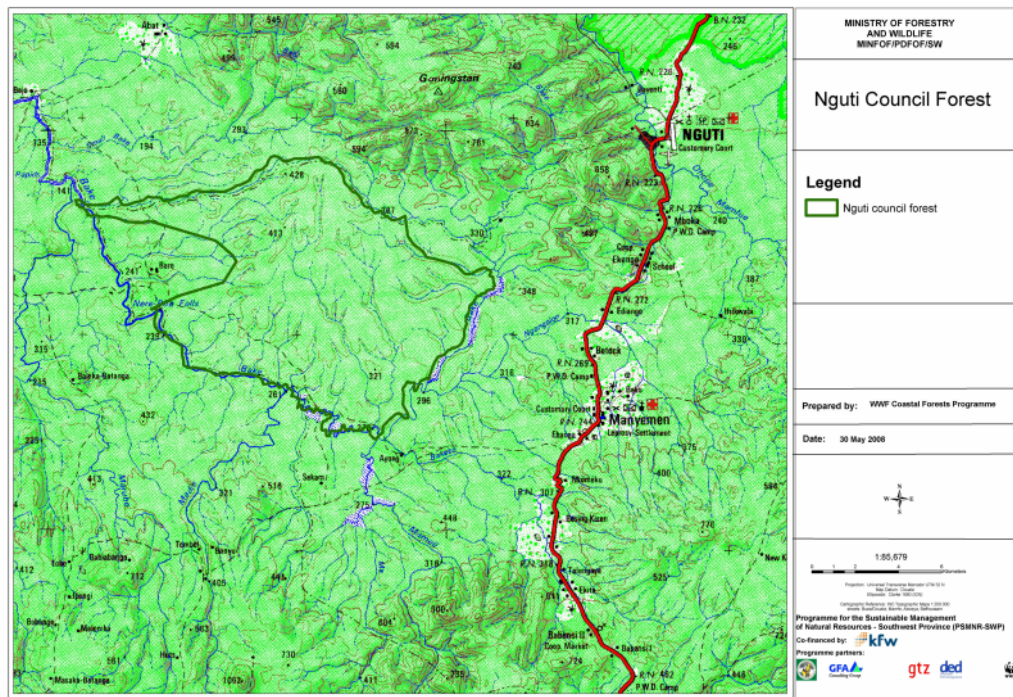

Figure 1: Study site

2.2 Climate

The climate is characterised by two seasons: one dry season from November to mid-March and one wet season from mid-March to October with the wettest months being July and September. The total rainfall is estimated at 5,000 mm per annum (Zimmermann, 2000). The mean annual relative humidity is 83%, the mean daily maximum is 98% and the minimum is 66%. The mean annual temperature is about 25 °C with August and February being the coldest and hottest months respectively. The radiation is greatest during the early wet season (March-May), decreasing during the peak rains in July and August and rising again in the late wet season (October to December), (Gartlan, 1989).

2.3 Geology

Four main geological types of rock have been identified from the area (Gartlan, 1989):

1. **Basalt and Andesite**;
2. **Cretaceous Sedimentary Sandstone**;
3. **Precambrian Basement Rock** consisting mainly of closely related types: ectinites, quartzites, gneisses, embrechites and syntectonic granite;
4. **Tertiary Basalts** (at higher elevations) overlaying the much older basement rocks.

2.4 Hydrology

The Nguti Council Forest is mainly drained by rivers Bake and Bakebe. River Bake takes its rise from the Nkwende Hills and flows southerly as the boundary of the Nguti Council Forest to the south of Osirayib. River Bakebe meets River Bake near Ayong village at the southern borders and River Bake continues to flow north-westerly.

2.5 Biodiversity

2.5.1 Vegetation

The Nguti Council forest contains three different forests associations described by Letouzey (1985):

-**Atlantic Biafran Forest**: A lowland evergreen association that occurs in wet coastal areas with very protracted wet seasons characterised by the dominance of large, gregarious Caesalpiniaceae species. This forest type covers the majority of the Nguti Council Forest. It is very important for conservation since it is species-rich and contains many poorly known, rare and endemic plant species. It is also important for timber production and non-timber forest products (NTFPs).

-**Swamp Forest**: This forest type occurs on sandy soils with ground water at or near to the surface on areas of the banks of River Bake. Canopy height is 25-30m. Species diversity is poor. Herbs and shrubs are very sparse. Species characteristic of this vegetation type include *Crateranthus talbotti, Mitragyna stipulosa, Protomegabaria stapfiana, Diospyros preussi, Spondianthus preussi, Symphonia globulifera, Amanoa strobilacea, Raphia sp., Liparis sp., Affrofittonia silvestris* and *Renealmia sp*.

-**Piedmont Forest**: Semi-deciduous forest at altitudes between 500m and 800m, not dominated by Caesalpiniaceae species, was mapped by Letouzey as Piedmont Forest.

Piedmont forest occurs as a transition vegetation type between lowland evergreen forest type and submontane forest. The "semi-deciduous" elements refer to areas of secondary forest, probably resulting from past agricultural practices. This forest type is very important for conservation since it is species-rich and contains many poorly known, rare and endemic plant species (Thomas, 1995).

Frequently occurring species in the forest include; Azobe (*Lophira alata*), Ekop naga (*Brachystegia spp.*), Tali (*Erythrophleum ivorensis*), Okan (*Cyclodiscus gabonensis*), Framire (*Terminalia ivorensis*), Dabema (*Pipadeniastrum africanum*). Other occurring species are Bilinga (*Nauclea diderrichii*), Ilomba (*Pycnanthus angolensis*), Niove (*Staudtia stipitata*), Padouk (*Pterocarpus soyauxii*), Moabi (*Baillonella toxisperma*), Movingui (*Distemonanthus benthamianus*), Doussie (*Afzelia spp.*), Aiele (*Canarium schweinfurthii*) (PSMNR-SWP, 2007).

2.5.2. Fauna

The area is relatively rich in large mammalian fauna, most especially the ungulates. There is also the presence of Buffalo, and Elephant.

3. METHODOLOGY

3.1 Overall Approach

The PSMNR-SWP geo-referenced 4x4 km grid was used. A total 10 random transects of 2 km each (located in each of the 4x4 km quadrate) were planned to be cut. The field teams faced a problem that is recurrent to random transects; certain transects were not completed due to deep valleys. The starting point of each transect was randomly generated using a random number table. Their exact positions in the field were determined by the use of a GPS GARMIN 12XL. The survey of 10 transects generated a sampling effort of 19 km. Transects were oriented to cross major drainage features in order to sample a representative proportion of all vegetation types.
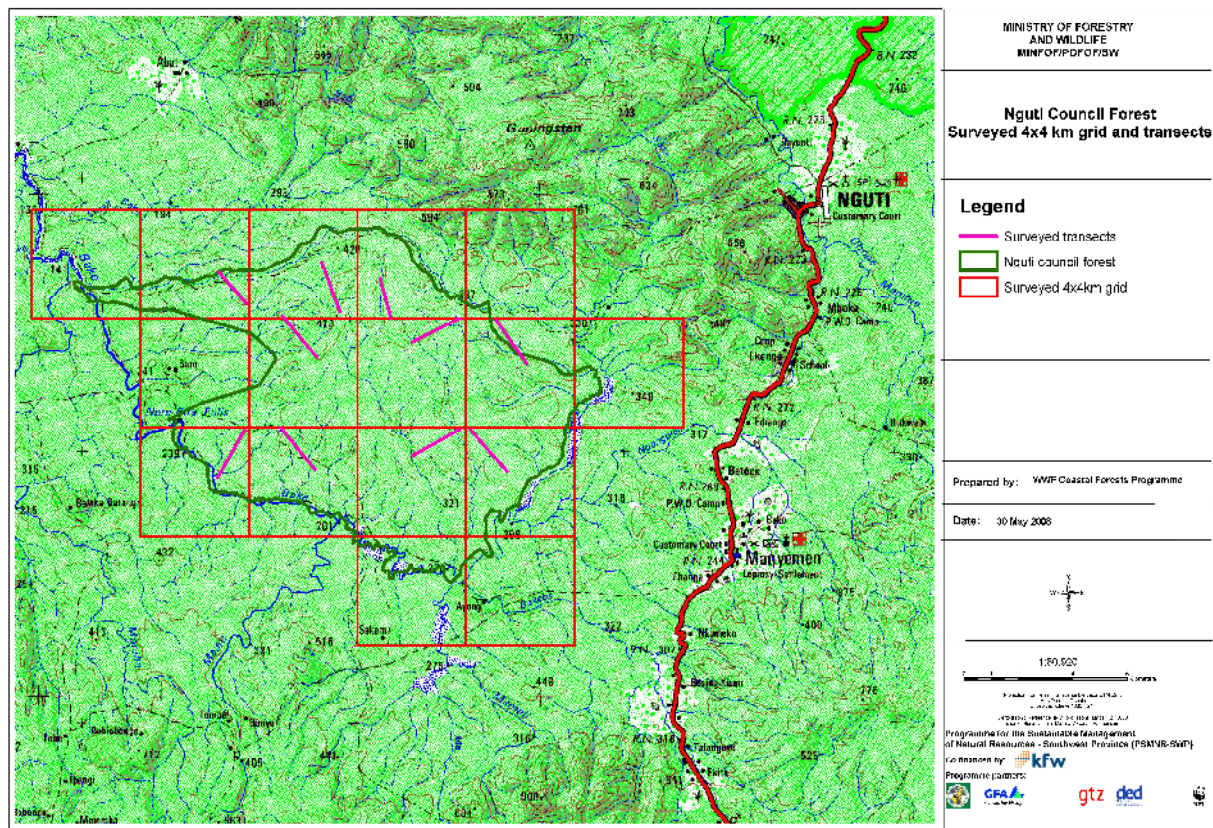

Figure 2: Schematic representation of transects in the study site

Transects were cut by two teams of five, consisting of a leader, two assistants and two labourers. The leader was responsible for reading the bearing, searching for animal signs and recording data. The two assistants were measuring distances to the nearest centimetre, searching for animal signs and ensuring that the measuring tape lay straight on the ground. The two labourers were cutting transects ahead along the compass bearing. Care was taken during the data collection that animal signs on or near transect lines were never missed and that all the measurements of distances were accurately recorded with fibre tapes to the nearest centimetre. The line was determined by a 50 m fibre tape that was also helping in measuring the length of transects. Cutting was restricted to the minimum necessary to facilitate passage and identify the location of transect starting points.

3.2 Key species

The study was focused principally on large mammals (from Blue duiker to Elephant) for the following reasons:

1. Large mammals are sensitive to hunting pressure and constitute global integrity indicators for the conservation status of a particular area;

2. Majority of large mammal species are of national and international importance for conservation;

3. Large mammals and their signs are very visible.

3.3 Data Collection

Data on all large mammal sightings, vocalisations and signs (dung, nest, tracks etc.) were recorded and perpendicular distances measured (Buckland, S.T. *et al* 1993; Ekobo, A. 1995). Although tracks cannot be used to estimate absolute animal density, as one cannot estimate the times per day an animal would cross the transect, they can be used to calculate encounter rates and therefore relative abundance.

3.3.1 Dung piles

Dung counts were used to survey elephants. For each dung-pile (set of boli) the distance along the transect, perpendicular distance from the transect line to the middle of the dung-pile and the stage of dung were recorded. The following stages were used for the classification of dung:

A: Fresh – boli intact, still warm, strong smell, shiny fatty acid sheen glistering on exterior;

B: Recent – boli intact, odour when boli is break, flies, fatty acid sheen disappear;

C: Old – no odour, dung form still intact although boli may be partly or completely broken down into an amorphous mass;

D: Very old – dispersed, flattened, tending to disappear;

E: Fossilised – dung matrix become soil, presence of few resistant fibres or seeds indicates a very old dung pile.

3.3.2 Ape nests

All ape nest sites observed were recorded and perpendicular distances from the centre of transects measured. Additional information was recorded including nest type and tree height. The age of the nest was estimated and construction of nest documented as follows:

A: Fresh – vegetation green or not wilted

B: Recent – vegetation dry and changing colour

C: Old – vegetation dead but nest still intact

D: Rotting – nest beginning to disintegrate

3.3.3 Type of Nest

Zero = No nest structure exists and the gorilla has slept on the ground. The sleeping side appears as a flattened patch usually with scattered leaves or small flattened plants. The presence of faeces or hair and, sometimes the smell of gorilla aids in identification of the site.

Minimum = Nest consists of between 3 or more stems of herbaceous plants that have been bent (sometimes several times) to form a rudimentary pad where the gorilla has slept.

Herbaceous = A nest that consists of between 3 or more stems of herbaceous plants that have been bent, and sometimes interwoven, to form a substantial platform with a roughly circular depression where the gorilla has slept.

Mixed = Similar to herbaceous nests but woody vegetation (lianas, shrubs, saplings or small-detached branches) has been incorporated into the nest.

Tree = Nests built in trees constructed by bending/breaking branches to form a platform.

Woody = Nests built on the ground entirely of woody vegetation from bent lianas, shrubs or saplings.

Detached Woody = These are similar to woody nests but built entirely from detached leafy branches that have been carried to the site and assembled into a nest.

If additional nest groups were located after leaving the transect (either to examine nests seen from the transect or during random searches) identical information was still recorded but it was noted that they had not been seen from transects.

3.3.4 Human activities

All human sign or direct encounters were recorded including:

- Roads (used or disused)

- Village sites (used or disused)

- Cutlass cut

- Regularly used human trails

- Honey extraction

11

- Snare line (active or abandoned; number of snares)

- Shut gun shells

- Gun shots

- Camp sites (active or abandoned)

- Fire places

- Current or past agricultural activity

- Bark striping for construction, medicine etc.

- Sites where nuts such as *Panda oleosa* have been cracked open

- Hunting

- Fishing

- Tree cutting (logging)

- Tree cutting (indigenous people)

- Yam digging

- Fruits gathering.

3.4 Data Analysis

3.4.1 Relative density

The relative density (RD) also known as encounter rate (ER) that represents the number of direct sightings or signs per kilometre of transect was estimated for mammal signs and human activities. Absolute densities could not be estimated using the DISTANCE programme due to the low number of observations (N < 40).

3.4.2 Large mammals' hot spots

All data on large mammals were lumped together and encounter rates for each transect estimated for the determination of biodiversity hot spots.

3.4.3 Spatial distribution maps

Spatial distribution maps were produced using geo-referenced relative densities that were imported into Arcview 3.2 for shape files production and finally into ArcGIS 9.2.

4. RESULTS

4.1 Species presence

Eight (8) species of large mammals were recorded within the Nguti Council Forest. They belong to two cohorts, three orders and four families. The family Bovidae is well represented by 4 species that are the forest buffalo (*Syncerus caffer*), the blue duiker (*Cephalophus monticola*), the bay duiker (*Cephalophus dorsalis*) and ogilbyi duikers (*Cephalophus ogilbyi*). The Cercopithecinae family follows with two species; Mona monkey (*Cercopithecus mona*), and greater white-nosed monkey (*Cercopithecus nictitans*). The Elephantidae and Suidae families are represented each by one species; the forest elephant (*Loxodonta africana cylotis*) and the red river hog (*Potamochoerus porcus*) respectively (Table 1).

Table 1: Large mammals recorded during the surveys

Cohort	Order	Family	Scientific name	English Name
FERUNGULATA	Proboscidae	Elephantidae	*Loxodonta africana*	Forest elephant
	Artiodactyla	Bovidae	*Syncerus caffer*	Forest buffalo
			Cephalophus ogilbyi	Ogilbyi duiker
			Cephalophus dorsalis	Bay duiker
			Cephalophus monticola	Blue duiker
		Suidae	*Potamochoerus porcus*	Red river hog
UNGUICULATA	Primates	Cercopithecinae	*Cercopithecus Mona*	Mona monkey
			Cercopithecus nictitans	Greater white-nosed monkey

4.2 Relative densities

4.2.1 Large mammals' biodiversity Hotspots

The overall Relative Density of large mammals in the Nguti Council Forest was estimated to be 0.34 signs per km (Table 2). In other words, one would identify less than one large mammal signs for every kilometre walked in the study area. The proposed Nguti Council forest appears therefore to be poor in large mammals' biodiversity.

The spatial distribution of large mammals' biodiversity "hot spots" as shown in Figure 1, reveals concentrations in the northern and central parts of the study area.

13

Table 2: Relative densities (RD) of large mammal species identified in Nguti Council Forest

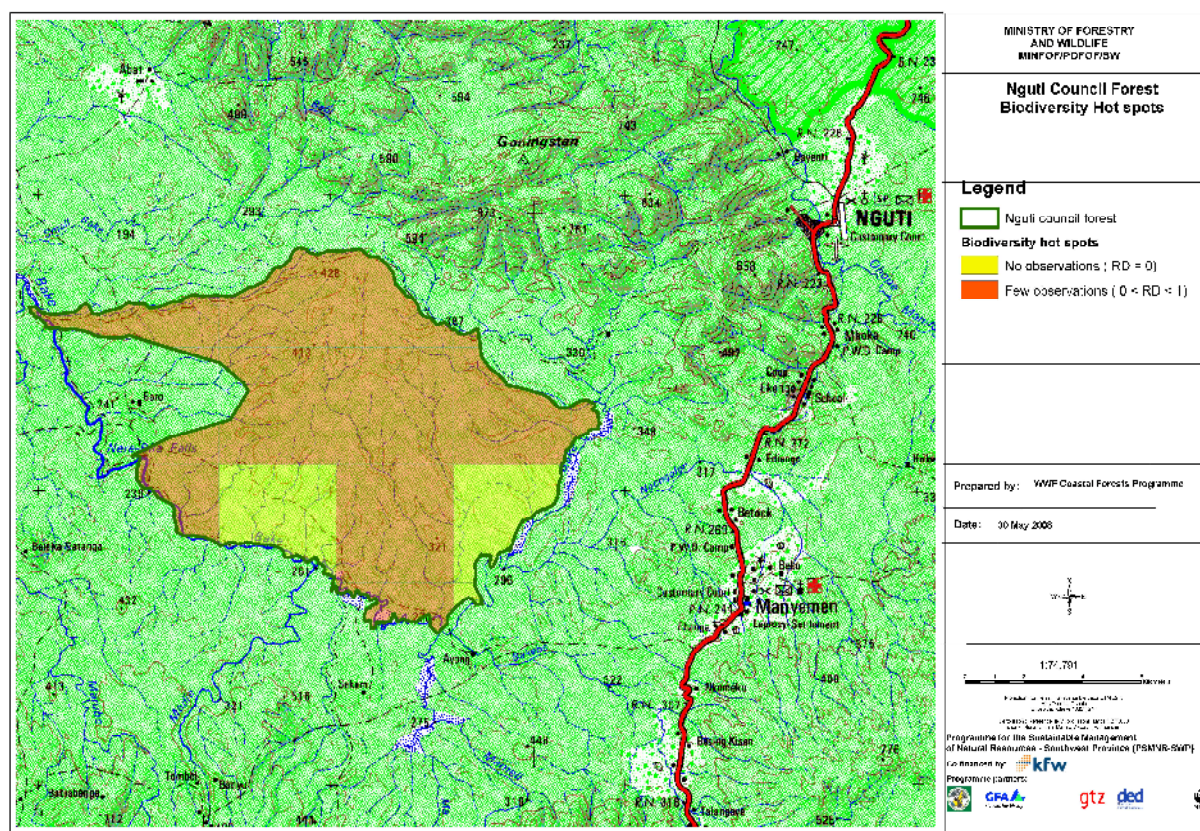| Species	Relative densities (RD)
Elephant	0.62
Buffalo	0.05
Red river hog	0.4
Bay duiker	0.48
Blue duiker	0.38
Ogilbyi duiker	0.23
Greater white-nosed monkey	0.12
Mona monkey	0.05
Min	**0.05**
Max	**0.62**
Mean	**0.34**

Figure 3: **Spatial distribution of large mammals' biodiversity hotspots in the Nguti Council Forest**

4.3 Proboscidae

4.3.1 Elephantidae

This family is represented by the African forest elephant (*Loxodonta africana cyclotis*). The results suggest from data collected that this is the most abundant species present in the study area recording a mean RD of 0.62 signs km^{-1} (less than 1 elephant sign per kilometre). The spatial distribution map of this species is shown in Figure 4.
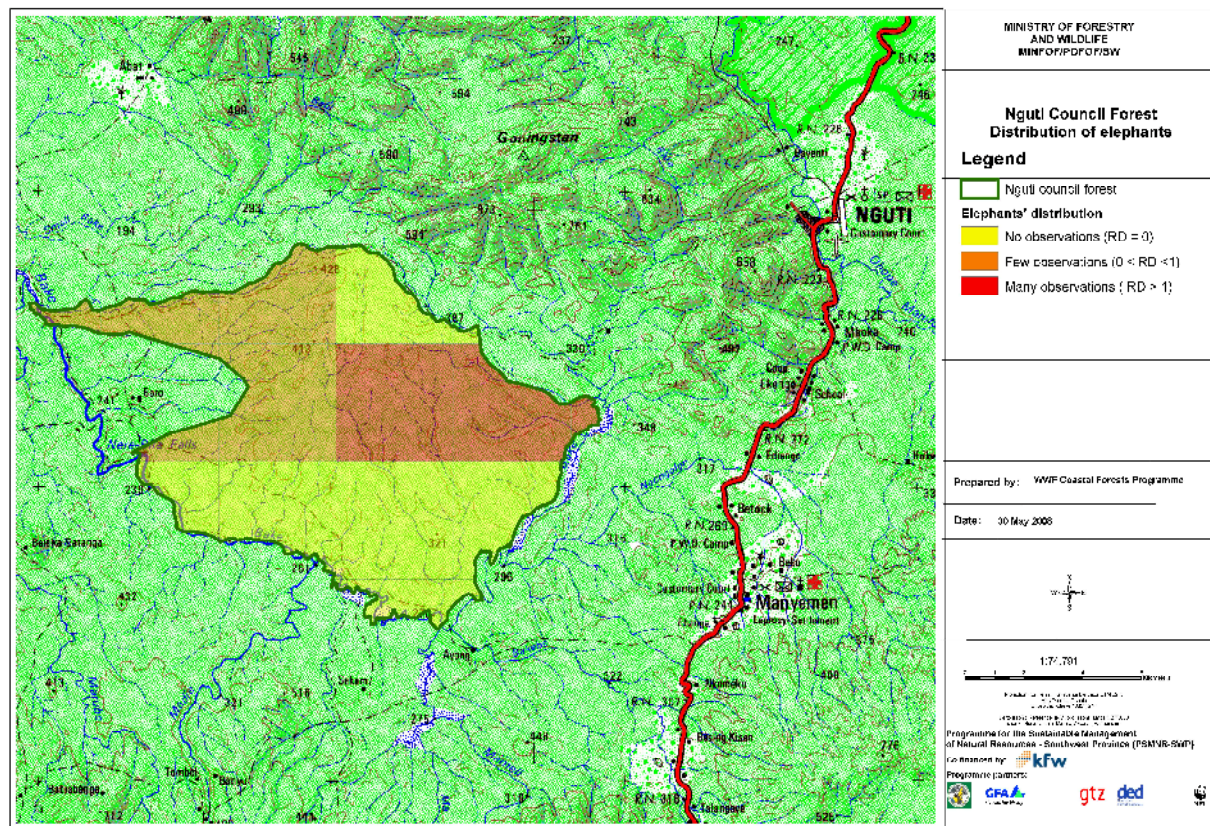

Figure 4: **Spatial distribution of forest elephants in the Nguti Council Forest**

4.4 Artiodactyla

4.4.1 Bovidea

This family is the most important as far as species richness is concerned with four (4) species.

The data suggest the Bay duiker (*Cephalophus dorsalis*) is the most abundant species with a mean encounter rate of 0.48 signs km^{-1}. This species showed one area of concentration in the south-western corner of the study site (Figure 5).
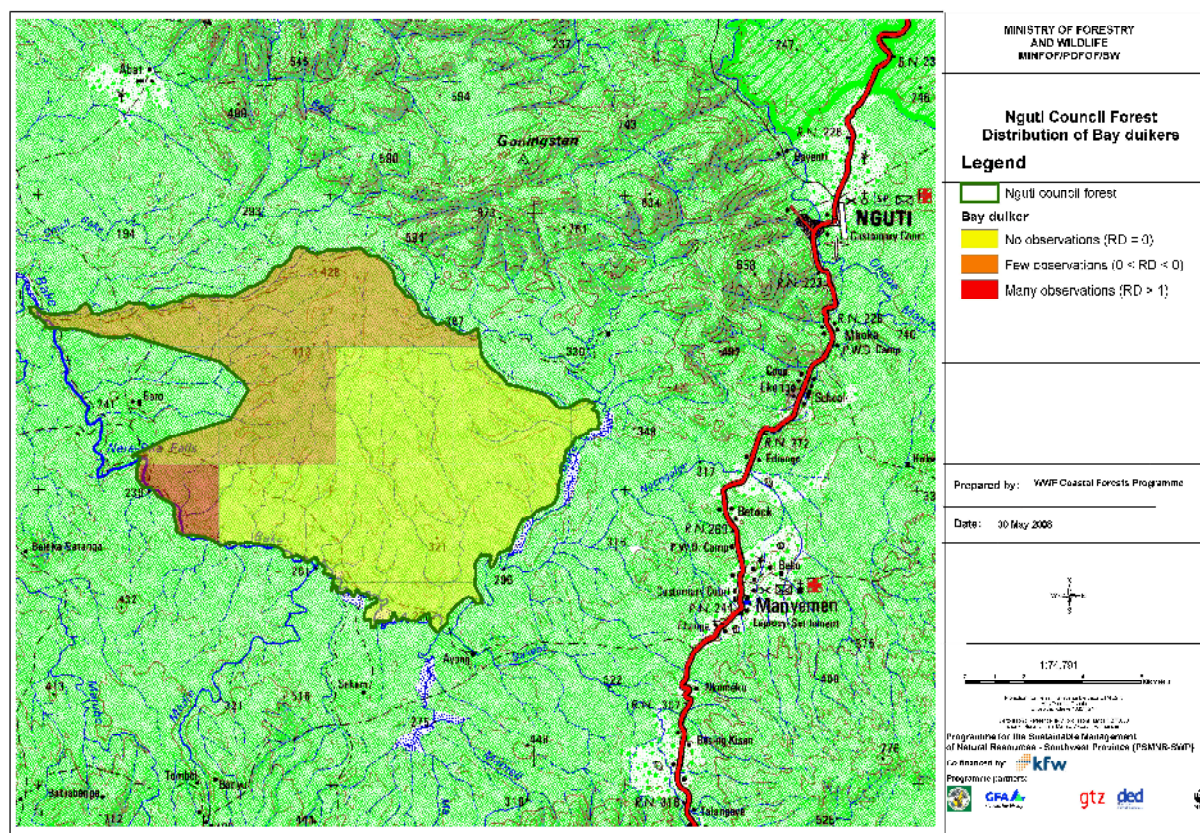
Figure 5: Spatial distribution of bay duiker in the Nguti Council Forest

The Blue duiker (*Cephalophus monticola*), Ogilbyi duiker (*Cephalophus ogilbyi*) and Forest buffalo (*Syncerus caffer*) had a mean encounter rates of 0.38, 0.23 & 0.05 signs km^{-1} respectively. Their spatial distributions (Figure 6, Figure 7 and Figure 8) depict the central-southern region of Nguti Council Forest as areas of concentration.
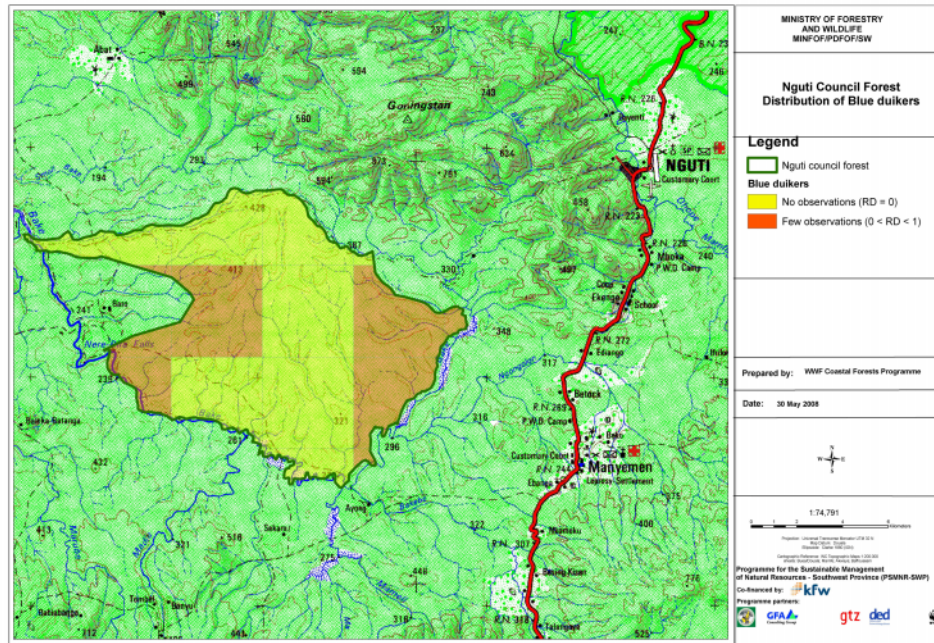
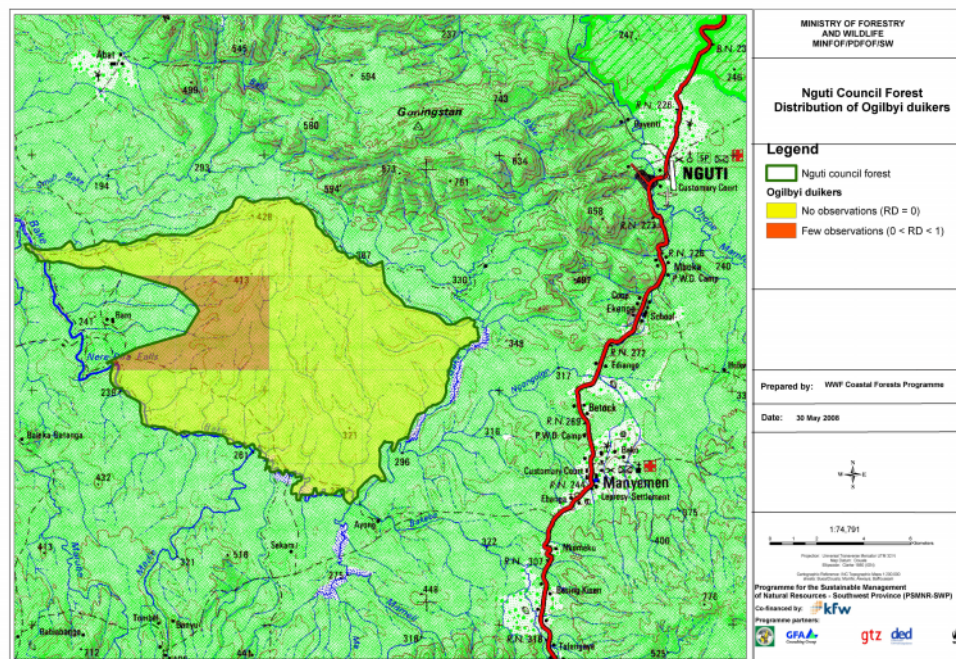**Figure 6: Spatial distribution of blue duiker in the Nguti Council Forest**

Figure 7: Spatial distribution of ogilbyi duiker in the Nguti Council Forest
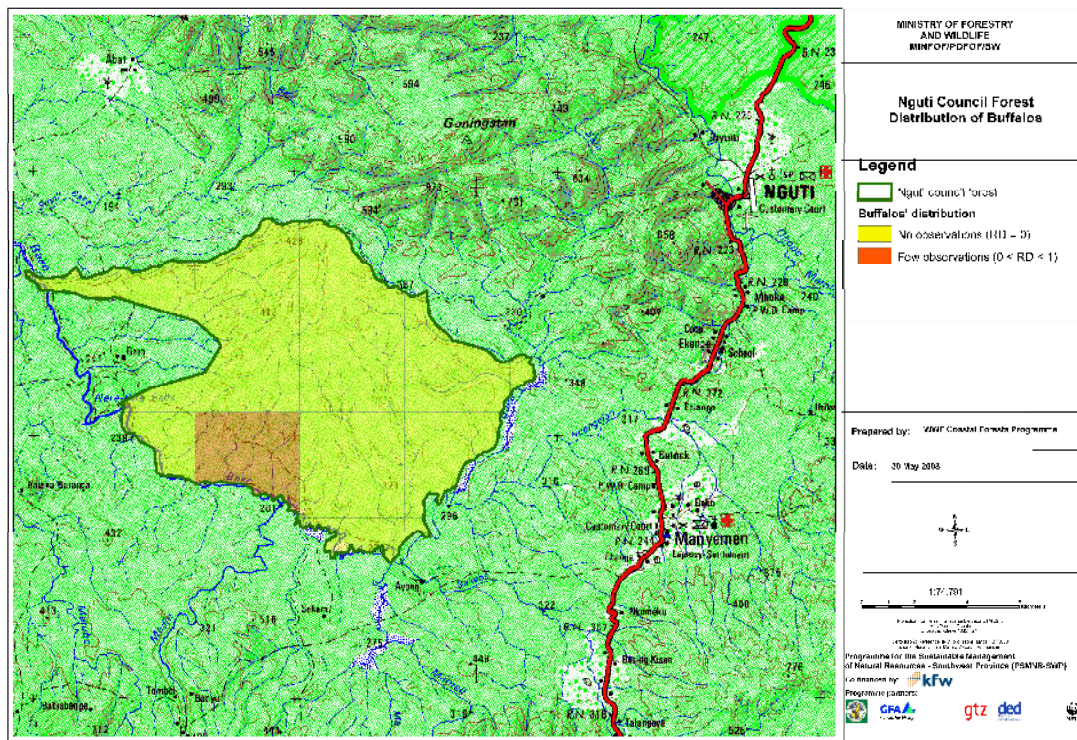
Figure 8: Spatial distribution of forest buffalo in the Nguti Council Forest

4.4.2 Suidea

The family Suidea is represented by the Red river hog (*Potamochoerus porcus*). The data reveals that species is not abundant with a mean encounter rate of 0.4 signs km^{-1} . The spatial distribution map (Figure 9) shows a high concentration area in the western and southern parts of the Nguti Council Forest.

4.5 Primates

4.5.1 Cercopithecidea

This family is represented by two species; the most abundant is the Greater white-nosed monkey (*Cercopithecus nictitans*) 0.12 signs km^{-1}, followed by the Mona monkey (*Cercopithecus mona*) 0.05 signs km^{-1}. The spatial distribution maps are presented in Figure 10 and Figure 11.
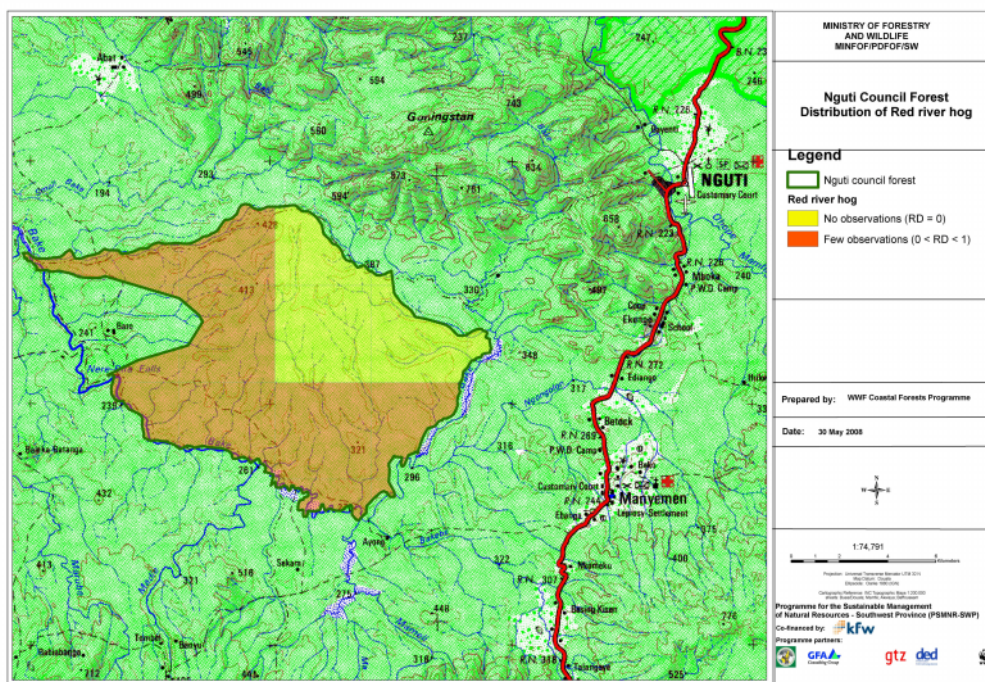
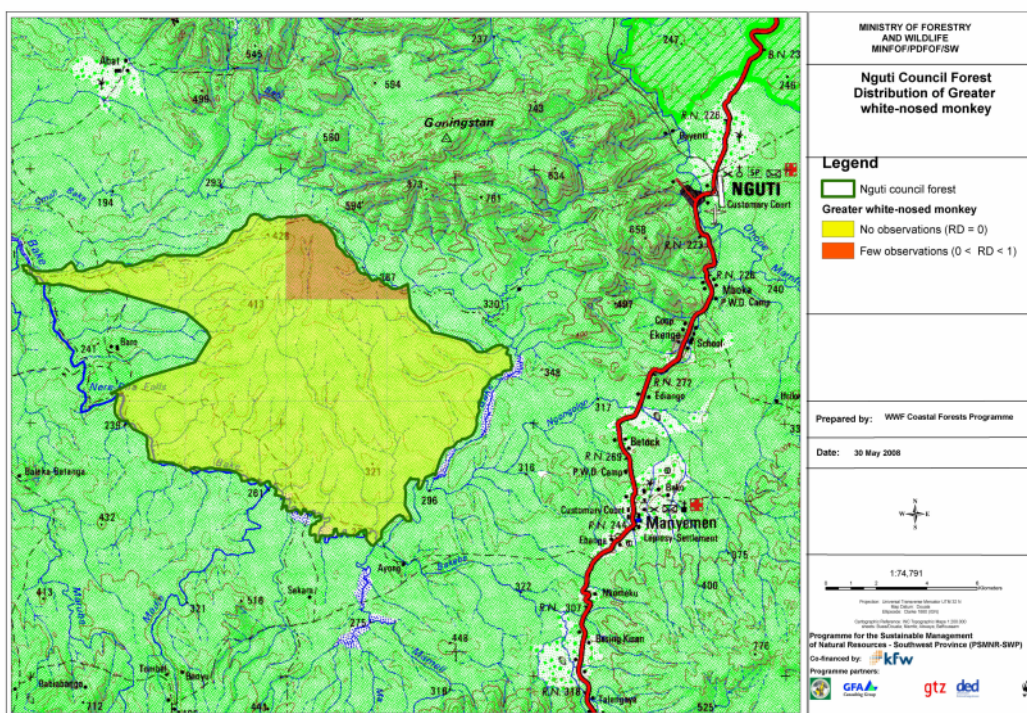**Figure 9: Spatial distribution of red river hog in the Nguti Council Forest**

Figure 10: Spatial distribution of greater white-nosed monkey in the Nguti Council Forest
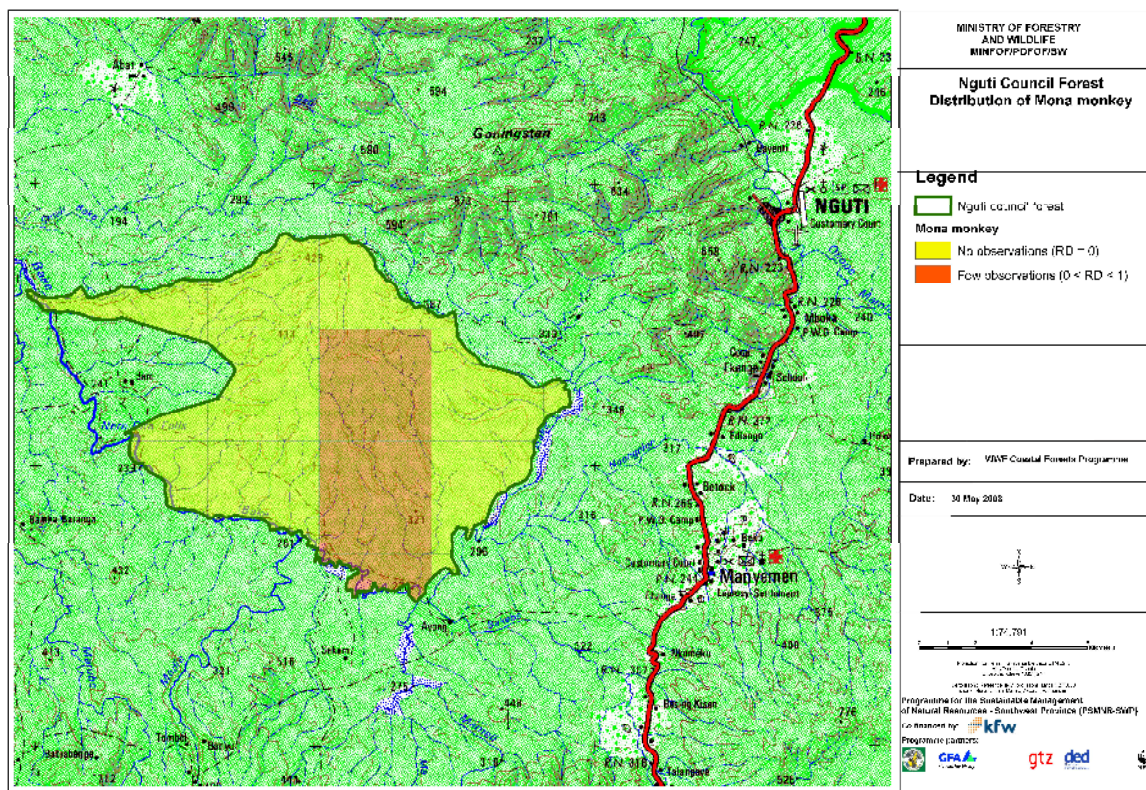
Figure 11: Spatial distribution of mona monkey in the Nguti Council Forest

4.6 Human activities

All human activities were lumped to determine the human activities hot spots. Analysis (Table 3) suggests a mean encounter rate of 1.46 signs km^{-1} (more than one sign per km). The spatial distribution map (Figure 12) shows a high concentration area in the eastern and western borders of the Nguti Council Forest.

Table 3: Relative densities of human pressure

Human Activities	Relative density (RD)
Hunting	1.9
Logging	1.01
Min	**1.01**
Max	**1.9**
Mean	**1.46**

The highest mean encounter rates for human activities in the study area were recorded for hunting (snare lines, gun shells, gun shots, bush huts, hunters trails and cutlass cuts) with 1.9 signs km^{-1} (about two signs recorded per km). The spatial distribution map (Figure 13) shows a high concentration in most of the Nguti Council Forest. Logging activities' data suggest a mean encounter rate of 1.01 signs km^{-1} (about one signs per km). The spatial distribution map (Figure 14) shows a high concentration area in the western parts of the study area. It was observed that logging activities took place about 2 decades ago in most of the Nguti Council Forest.
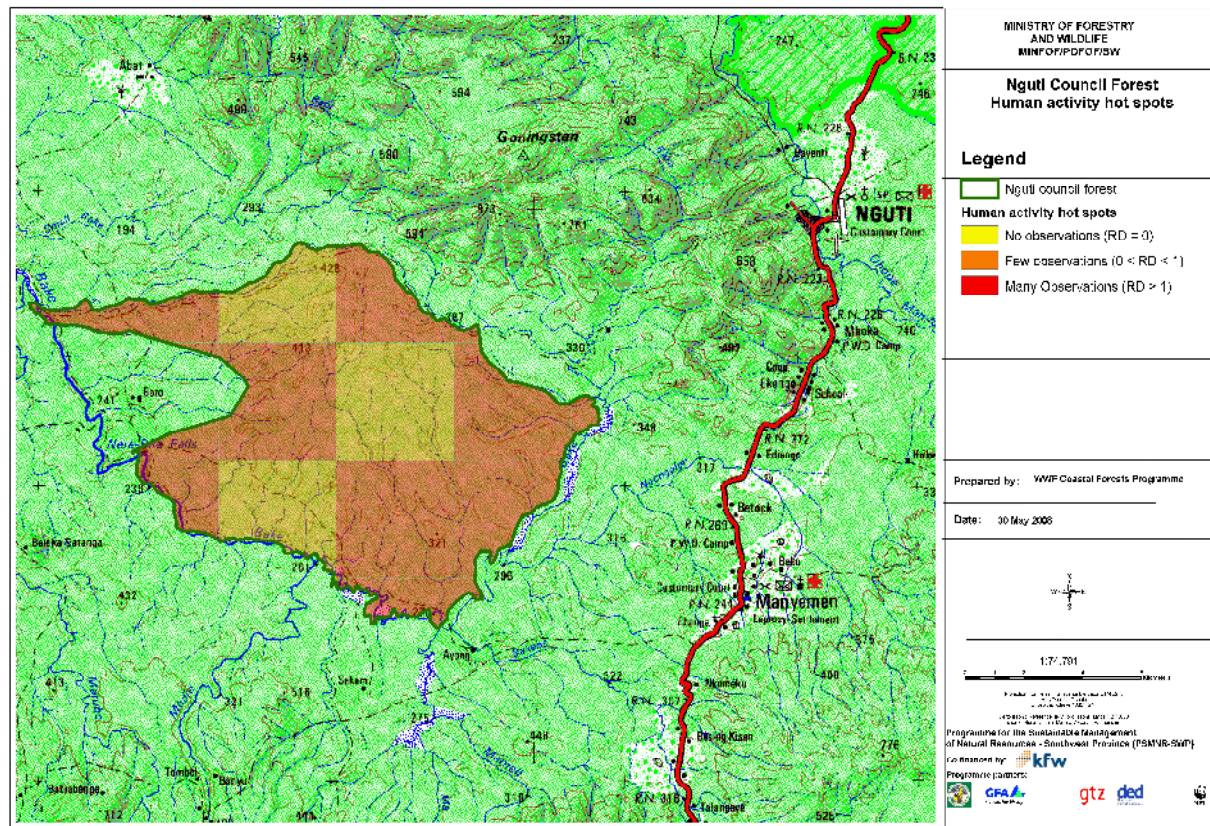

Figure 12: Spatial distribution of human activities hot spots in the Nguti Council Forest
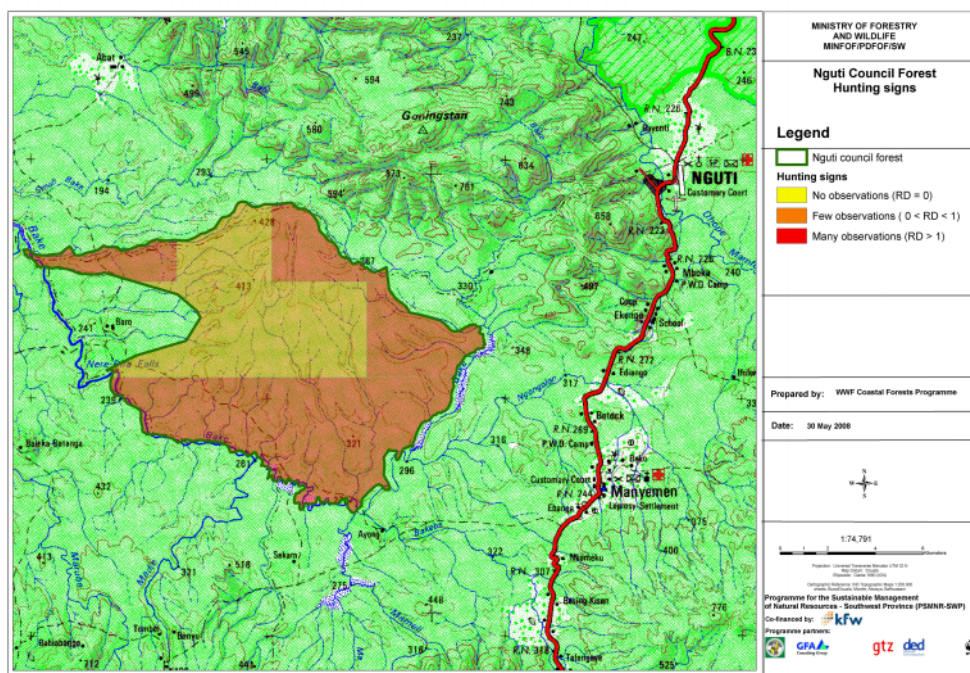
Figure 13: Spatial distribution of hunting pressure in the Nguti Council Forest
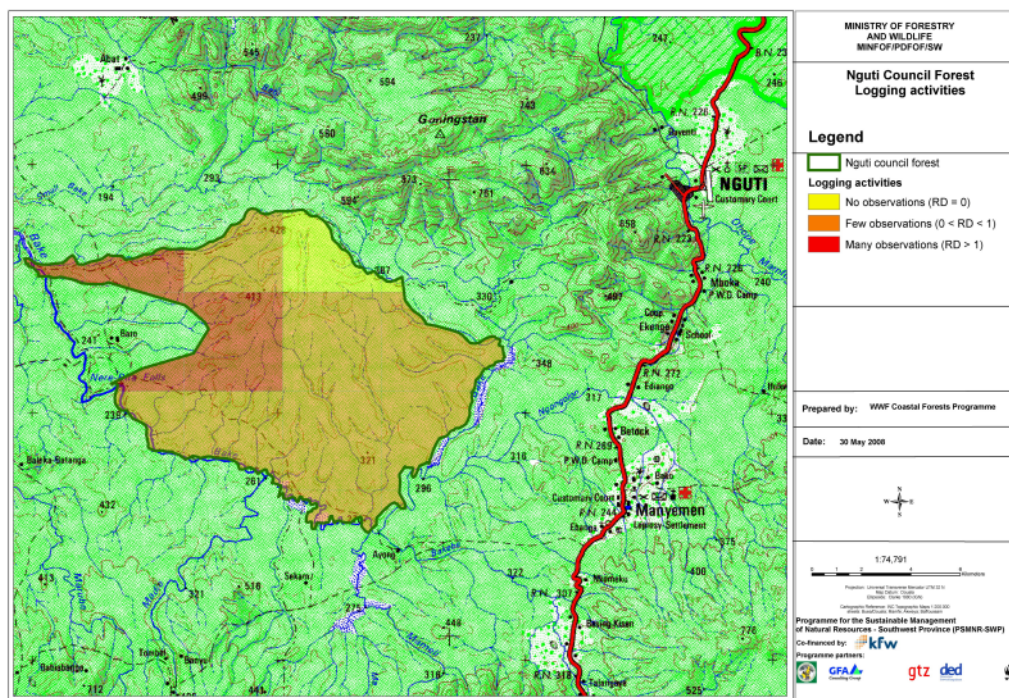

Figure 14: Spatial distribution of logging activities in the Nguti Council Forest

5. DISCUSSIONS AND CONCLUSION

Eight species of large mammals were recorded in the Nguti Council Forest, including one proboscides, two diurnal primate species and five ungulates.

The spatial distribution of large mammals' biodiversity "hot spots" reveals concentrations in the northern and central parts of the study area

Primate species encountered in the study area were relatively rare. This might be due to a less suitable habitat, but might also be the result of intense hunting activities. Hunters from Osirayib were encountered on two occasions with mammal species in their hunting camps and on the way to the village.

Market hunting, the main threat to the region's wildlife (Wilkie et al. 2001) has being enhanced by the infrastructure and transportation networks in place. Manyemen and Nguti markets are used by inhabitants neighbouring the Nguti Council Forest to sell their products, especially bushmeat. Hunting activities mainly carried out by hunters from Osirayib, Ayong, Manyemen, increases the pressure on wildlife in the region.

6. MANAGEMENT RECOMMENDATION

- Control of village hunting:
  - Regulation and control of bushmeat trade by organising the registration of transactions of bushmeat at the guard posts controlled by MINFOF personnel;
  - Registration of hunters, shotguns and snare lines;
  - Control of hunting and trade of Class A and B species;
  - Conducting surveys of market hunting within logging concessions throughout the region;
  - Development of a management plan for sustainable harvest of bushmeat by local inhabitants.
- A reduced 'logging damage' concept leading to the negative impact of logging on mammals can be addressed by:
  - Leaving patches of unlogged forest inside the Nguti Council Forest;
  - Giving abandoned timber logs both in the forest and roadsides to nearby villages as fuel wood for villagers;
  - Sparing important food sources of frugivores;
  - Avoiding the felling of trees adjacent to the timber trees, to reduce gap size to below 300 m^2;
  - Barring logging roads with metal poles and locks to avoid use by (motorised) poachers and the keys kept by MINFOF authorities in cases of patrols.
- The development of alternatives to hunting is urgently recommended in order to reduce pressure on wildlife; people need to be encouraged, advised and supported to find new ways to earn their living;

exploitation of non timber forest products (NTFPs), breeding of domesticated wild animals, beekeeping and honey production, fisheries and agricultural productivity is recommended; farmers cultivating cocoa have to be supported and encouraged with farm to market roads considering the recent rise in cocoa prices.

- Education and an effective widespread public awareness programmes is needed; people need to get involved and interested in conservation matters; people need to be informed on the law, on endangered species, sustainable hunting and alternatives to hunting.

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ANNEX 1: Large mammal Relative Density comparison within the Nguti Council Forset region

Species	Scientific name	This study (2008)	UFA 11-001 (2008)	KORUP (2007)
Forest elephant	*Loxodonta africana cyclotis*	0.62	0.03	2.39
Forest buffalo	*Syncerus caffer*	0.05	-	-
Red river hog	*Potamochoerus porcus*	0.4	0.56	1.36
Red duiker	*Cephalophus spp*	-	0.38	1.15
Ogilbyi duiker	*Cephalophus ogilbyi*	0.23	-	-
Drill	*Mandrillus leucophaeus*	-	0.04	0.09
Blue duiker	*Cephalophus monticola*	0.38	0.79	2.61
Greater white-nosed monkey	*Cercopithecus nictitans*	0.12	0.08	0.20
Mona monkey	*Cercopithecus mona*	0.05	0.12	0.11
Bay duiker	*Cephalophus dorsalis*	0.48	0.74	0.36
Water chevrotain	*Hymoschus aquaticus*	-	0.03	0.06