The Cross River gorilla and large mammals species diversity in the in the Lebialem-Mone Forest Landscape, Cameroon

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Abstract

Lebialem-Mone Forests Landscape is located in Western Cameroon and constitutes a transitional zone of rainforest and forest savannah. This study assessed large mammals’ diversity with focus on the Cross river gorilla and anthropogenic activities in the Lebialem-Mone Forest Landscape, Cameroon. A total of 36 transects of 4x4 km grid were surveyed. Relative density was estimated for mammal signs and human activities using DISTANCE. All data on large mammals were lumped together and encounter rates for each transect estimated for the determination of biodiversity hot spots. 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. This study documents the abundance and distribution of 7 species of large mammals including 2 great apes; Pan troglodytes elliotti and Gorilla gorilla diehli. The overall Relative Density of large mammals in the forest landscape was estimated to be 0.64 signs per km with high potential for great apes. The highest mean encounter rates for human activities in the study were recorded for hunting. The findings of this survey indicate that the forest landscape lodges a fragile and important population of great apes and large mammals. The levels of hunting and agricultural activities eventually increase the pressure on the wildlife populations and the landscape.

Keywords: Cross River gorilla, Species diversity, Species density, anthropogenic activities

INTRODUCTION

Lebialem-Mone Forests Landscape (LMFL) is located in Western Cameroon and constitutes a transitional zone of rainforest and forest savannah. This eco-regional feature makes it to be extremely rich in wild life species amongst which some of them are endemic (Bethan et al. 2010, MINFOF 2011). As compared to Korup and Mount Cameroon National Parks, this forest area is rather sparsely populated and, in general terms, less developed (Ajabji et al. 2008). Since population pressure and encroachment activities are less pronounced, there is still a rather important potential of forest products that has so far been hardly developed, for example with respect to high-value timber products. On the other hand, encroachment activities of the surrounding communities are progressively threatening this forest area (Nkembi et al. 2008, Wright and Priston 2010, Etiendem et al. 2011, Nkemnyi et al. 2011)

The Cross River gorilla (GRG) is a subspecies of the western gorilla (Gorilla gorilla). The western gorillas include the GRG - Gorilla gorilla diehli and the western lowland gorilla - Gorilla gorilla gorilla (Taah et al. 2005). The CRGs are found on the border highland between Cameroon and Nigeria (Oates et al. 2003). The CRG has fewer than 300 individuals estimated to exist in the wild, and just a single identified member in captivity (Bergl 2006, Bergl and Vigilant 2007, Oates et al. 2007, Bergl et al. 2008). The Cross River gorilla is the most endangered of the African apes, and is
one of the world's 25 most endangered primates according to the IUCN Primate Specialist Group (Mittermeier et al. 2009). It is classified as critically endangered which is the highest ranking for species that remain in the wild, and this means that the population has decreased, or will decrease, by 80% within three generations. The continued fragmentation of CRG habitat across a large, complex area, together with the threat from hunting and the small number of gorillas remaining, has led to its critically endangered status (Bergl 2006, Singer 2008). The CRG is a unique subspecies, which only lives in a relatively small area of 11 fragmented habitats (Etienne et al. 2011). The Cross River region has been named as a “biodiversity hotspot”, that is a region with a high level of species richness and endemism across a range of taxa (Oates et al. 2007, Bethan et al. 2010). This particular hotspot is home to many primates, and a number of endemic species and subspecies other than the Cross River Gorilla (this includes, the Gulf of Guinea chimpanzee, Preuss's gibbon, forest elephants, forest buffalo, many species of duiker, 26 endemic birds). Several parts of the Cross River region have been designated by Birdlife International as important bird areas, and USAID's Central African Regional Program for the Environment has named it a landscape of High Conservation Priority (ERuDeF 2009). Decisions that have been made in wildlife management revolve around large mammals in general and the great apes in particular in the Lebialem-Mone Landscape Forest (Nkembi et al. 2008). These decisions can have far-reaching consequences, and they need to be based on watertight information. Therefore, there is need to have as much accurate and up-to-date data as possible. The main objective of this study was to collect data on the status, threats and spatial distribution of large mammals, with particular focus on the Cross River gorilla.

MATERIAL & METHODS

The Study Location

The study was conducted in the Lebialem-Mone Forest Landscape, South West Region of Cameroon. It is located between 50 37’ - 50 42’ latitude and 90 53’ - 90 58’ longitude. The area is characterised by an undulated landscape from 260m in the lower altitudes to 2400m in the higher altitudes, with a chain of peaks notably the Tofala Hill (866m). This area is situated western region of Cameroon and adjacent to the Forest Management Unit 11-002 and the Mone Forest Reserve. The forest area covers a total surface area of about 800 km2 (ERuDeF and ACF 2011). The area is found along the Cameroon mountain chain, hence highly vulnerable to stochastic events such as landslides, soil erosion and floods caused by seismic activity. The population of the area is estimated at over 35,000 inhabitants (Ajabji et al. 2008). The area is an important watershed with many fast flowing forest streams that jointly form the Manyu River. The forest landscape is within the equatorial rainforest zone characterized by two major seasons: the dry season (November-February) and the wet season (March-October). The annual rainfall recorded in the area is as high as 3500mm (Gartlan 1989 ) (Gartlan 1989 ). The climate is characterised at high altitudes by low temperatures, low rainfalls, high relative humidity and mountains often covered in clouds. Daily temperatures vary between 20°C and 35°C, with the peak in March. The area falls within the Guino-Congollian tropical lowland rainforests and form part of the forest chain of the Gulf of Guinea. It varies from the lowland rainforest, through submontane to montane forest with the lowland and submontane forests dominating. The variation in altitude (360 to 2400m above sea level) accounts for the variation in forest type, which in turn accounts for the huge floristic variety of the area (Etienne et al. 2011, Nkemnyi et al. 2011).

Data collection

The stratification approach was employed where the total sampling area was stratified into grids of 4x4 km and random transects of 2 km each were cut. 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 36 transects generated a sampling effort of 49.0 km. Transects were oriented to cross major drainage features in order to sample a representative proportion of all vegetation types. Transects were cut by a team of six, consisting of a leader, two assistants and three 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 three 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. The study was focused principally on large mammals (from Blue duiker to Buffalo) 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.

Data on all large mammal sightings, vocalisations and signs (dung, nest, tracks etc.) were recorded and perpendicular distances measured. 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.

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:

- 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 nests 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.

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, snare line (active or abandoned; number of snares), gun shells, gun shots, camp sites (active or abandoned), fire places, current or past agricultural activity, bark striping for construction and medicine, sites where nuts such as Panda oleosa have been cracked open, hunting, fishing, logging, yam digging and fruits gathering.

Data Analysis
Relative density
The relative density (RD) also known as encounter rate (ER) that represents the number of direct sightings or signs per kilometer 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).

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.

Spatial distribution maps
Spatial distribution maps (Annex 1) were produced using geo-referenced relative densities that were imported into Arc view 3.2 for shape files production and finally into ArcGIS 9.2.

RESULTS & DISCUSSION
A census effort of 49.0 km of line transects were established and walked in the Lebialem-Mone Forest Landscape. The results present encounter rates of mammals and human activities in the study area. Seven (7) species of large mammals were documented within the surveyed area.
including two (2) great apes; chimpanzee (Pan troglodytes ellioti) and cross river gorilla (Gorilla gorilla diehli). They belong to two cohorts, two orders and four families. The family Bovidae is well represented by 3 species that are the forest buffalo (Syncerus caffer), the bay duiker (Cephalophus dorsalis) and Peter’s duikers (Cephalophus callipygus). The Pongidae family follows with two species; Chimpanzee (Pan troglodytes vellerosus) and Cross River gorilla (Gorilla gorilla diehli). The Cercopithecidea family is represented by the white-nosed monkey (Cercopithecus nictitans). The Cercopithecinae and Suidae families are represented each by one species; Mona monkey (Cercopithecus mona) and the red river hog (Potamochoerus porcus) respectively (Table 1).

Relative densities
3.2.1 Large mammals’ biodiversity Hotspots
The overall Relative Density of large mammals in the Lebialem-Mone Forest was estimated to be 0.64 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 Lebialem-Mone forest appears therefore to be poor in large mammals’ biodiversity but has a high potential for great ape conservation.

The spatial distribution of large mammals’ biodiversity “hot spots” as shown in (annex 1), reveals concentrations in the western and south eastern parts of the study area

Primate
Pongidae
The family Pongidea was represented by the Chimpanzee and Cross River gorilla with a mean encounter rate of 1.26 signs km-1 (more than 1 sign recorded every kilometre of transect walked) and 0.31 signs km-1 (about one sign recorded every two (2) km of transect walked) respectively. The results suggest from data collected that chimpanzee is the most abundant species present in the study area recording a mean RD of 1.26 signs km-1 (more than 1 chimp sign per kilometre).

Cercopithecidea
This family is represented by one species; the Mona monkey (Cercopithecus mona) 0.05 signs km-1.

Artiodactyla
Bovidae
This family is the most important as far as species richness is concerned with 3 species. The data suggest the Bay duiker (Cephalophus dorsalis) is the most abundant species with a mean encounter rate of 0.04 signs km-1. This species showed one area of concentration in the south-western corner of the study site. The Peter’s duiker (Cephalophus callipygus) and Forest buffalo (Syncerus caffer) had a mean encounter rates of 0.02 & 0.01 signs km-1 respectively. Their spatial distributions depict the central-southern region of Lebialem-Mone Forest as areas of concentration.

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 0.03 signs km-1. The spatial distribution shows a high concentration area in the central and southern parts of the Lebialem-Mone Forest.

Human activities
All human activities were lumped to determine the human activities hot spots. Analysis (Table 3) suggests a mean encounter rate of 1.05 signs km-1 (more than one sign per km). The spatial distribution map (Annex 2) shows a high concentration area in the eastern and western borders of the Lebialem-Mone 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 study area.

Agricultural activities’ data suggest a mean encounter rate of 1.0 signs km-1 (about one signs per km). Agricultural activities includes; farming and plantations. The spatial distribution shows a high concentration area in the western parts of the study area.

CONCLUSION
There was a very high encounter rate of chimpanzee (Pan troglodytes ellioti) nest sites in the area surveyed. Ground nest sites and feeding signs were recorded indicating the presence of the cross river gorilla (Gorilla gorilla diehli) in the area during the survey period. The presence of nest sites was mostly confirmed in remote/hilly areas with a relatively low intensity of human use/activity. Human activity was relatively high in lowland area compared to high land area were most gorillas and chimpanzee nest were located. The high encounter rate of human activities in
lowland area can be attributed to its easy accessibility by hunters and farmers alike.

The findings of this survey indicate that the Lebialem-Mone Landscape forest lodges a fragile and important population of gorilla and chimpanzee. The levels of hunting and agricultural activities eventually increase the pressure on the wildlife populations and home range.

ACKNOWLEDGMENT

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REFERENCE


MININFO. 2011. Technical note for the creation of the proposed Tofala Hill Wildlife Sanctuary (THWS)
Table 1. List of large mammals identified in the study area

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Order</th>
<th>Family</th>
<th>Scientific name</th>
<th>English Name</th>
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<tbody>
<tr>
<td>FERUNGULATA</td>
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<td>Bovidae</td>
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<td></td>
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<td>Cephalophus dorsalis</td>
<td>Bay duiker</td>
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<td></td>
<td></td>
<td>Cephalophus callipygus</td>
<td>Peter’s duiker</td>
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<td></td>
<td>Suidae</td>
<td>Potamochoerus porcus</td>
<td>Red river hog</td>
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<td></td>
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<td>Gorilla gorilla diehli</td>
<td>Cross river gorilla</td>
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<td></td>
<td></td>
<td>Cercopithecinae</td>
<td>Cercopithecus mona</td>
<td>Mona monkey</td>
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</table>

Table 1. Relative densities (RD) of large mammal species identified in Lebialem-Mone Forest

<table>
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<th>Species</th>
<th>Relative densities (RD)</th>
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<tr>
<td>Cross river gorilla</td>
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</tr>
<tr>
<td>Red river hog</td>
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</tr>
<tr>
<td>Bay duiker</td>
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</tr>
<tr>
<td>Peter’s duiker</td>
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<tr>
<td>Min</td>
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<td>Max</td>
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<tr>
<td>Mean</td>
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Table 2. Relative densities of human pressure

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<th>Human Activities</th>
<th>Relative density (RD)</th>
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<tr>
<td>Agriculture</td>
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<td>Min</td>
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<tr>
<td>Max</td>
<td>1.1</td>
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<tr>
<td>Mean</td>
<td>1.05</td>
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Fig 1. The spatial distribution of large mammals’ biodiversity
Spatial distribution of the number of large mammal species in the Lebialem-Mone Forest

Fig 2. The spatial distribution of Human activity in the study area
Spatial distribution of human activities hot spots in the Lebialem-Mone Forest