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Impact of Hunting and Bushmeat Trade on Biodiversity Loss in Cameroon: A
Case Study of the Banyang-Mbo Wildlife Sanctuary

Auswirkung von Jagd und Buschfleisch mit Handel auf den Verlust von Biodiversität in
Kamerun: Eine Fallstudie aus dem Banyang-Mbo Wild Schongebiet

A Dissertation Approved by the Faculty of Environmental Sciences and Process Engineering
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Environmental and Resource Management.

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CERTIFICATION

This dissertation entitled ``Impact of hunting and bushmeat trade on biodiversity loss in Cameroon: A case study of the Banyang-Mbo Wildlife Sanctuary`` by Samuel Ajonina Abugiche (B.Sc ABU, M.Sc Ibadan, Nigeria) meets the regulations governing the award of a Doctor of Philosophy Degree (Ph.D) in Environmental and Resource Management of the Brandenburg University of Technology Cottbus, Germany and was approved for its contribution to scientific knowledge and literary presentation.

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DECLARATION

I hereby do solemnly declare that this dissertation was written independently without the help of a second party. I have used and cited only referenced material and sources and have quoted all words, phrases or passages taken from these sources. This piece of work is wholly the author's efforts and has not been part of any presentation for any other academic qualification in its present form or similar version.

Cottbus,

.....
Samuel Ajonina Abugiche
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DEDICATION

This piece of work is dedicated to my loving wife Mrs. Abugiche Winifred Bobmia, my sons, Presley Iku and Blakely Benyella Abugiche who missed the love of a husband and father during my studies abroad. This dissertation is also dedicated to my sister Mrs. Mbong Miriam Ajiakwa for the encouragement and spirit of ``don't surrender`` she instilled in me throughout this level of my educational career.

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ABSTRACT

The Banyang-Mbo Wildlife Sanctuary is a multiple-use lowland tropical rainforest in South West of Cameroon. This area was designated by the government of Cameroon with a focus of protecting 11 species including the most endangered primates in Central and West Africa, the Drill (*Mandrillus leucophaeus*) and Chimpanzees (*Pan troglodytes*). Local communities maintain user-rights of the forest and its natural resources as long as the conservation goals of the protected areas are not compromised. With many villages in and around the sanctuary and an ever-increasing population, most villagers rely on bushmeat to meet both dietary requirements and as a source of income. The purpose of the six-month study was to assess the current impact of hunting pressure on wildlife biodiversity loss with hope to recommend managed sustainable hunting system to the Ministry of Forestry and Wildlife. Carcasses of animals brought in daily by the eighty-four hunters who participated in the study were weighed, sexed and aged and socio-economic data collected by recording weapon type, use, price of each animal killed and its destination by 14 research assistants in 14 study villages. Hunters were interviewed in an attempt to understand hunters' perception of hunted game and their capacity to implement a managed hunting system.

Study results indicated that 44 animal species were harvested with a total of 3,176 individual animals killed, giving an estimated total biomass of 22,397 kg in both the Banyang and Mbo areas. The Banyang ethnic group registered more harvest in terms of both off-take 1,888 animals and biomass 13,476 kg (13.5 tons) while the Mbo ethnic group extracted 1,288 animals with a biomass of 8,921.02 kg (9.00 tons) over the six-month study period. When placed into taxonomic groups, duikers constituting (34%), rodents (22%), other protected species (15%) and monkeys (11%) of the total animals extracted were most affected by hunting within the whole of BMWS. Larger-bodied animals like primates and duikers were most vulnerable to gun hunting while smaller carnivores and rodents were more vulnerable to wire snaring and trapping. Poisoned baits were used in some villages to trap Cane rats and Monkeys. Hunting peaks were attained during the raining season especially during the months of July and August.

However, some small peaks occurred during the dry season especially in the months of November and January. More males (47%) were killed than females (43%) for all species over the six-month study period. Unknown sex constituted (10%) of the total extracted animals registered. Adults comprised (69%) of the total catch for all species registered, juveniles and infants constituted (23%) and (8%) respectively.

Generally the Banyang ethnic group either consumed or sold locally (83%) of their total harvested bushmeat and sold only (11%) to outside traders. The Mbo ethnic group consumed or sold locally (47%) of the total bushmeat killed and sold (39%) to outside bushmeat dealers. Economic gains in terms of financial income from sale of bushmeat at the Banyang-Mbo Wildlife Sanctuary do not seem to be profitable as one hunter earned on average 22.629F CFA (US \$47) per month over the study period compared to 125.000F CFA (US \$258) earned by an average civil servant in Cameroon.

One kilogramme of the most expensive bushmeat such as Pangolin (*Manis gigantea*) and Brush-tailed porcupine (*Atherurus africanus*) was on the average about 4.7 times less expensive than the price of one kg of domesticated animals such as fresh cow beef or goat meat. The Drill (*Mandrillus leucophaeus*) and the Chimpanzee (*Pan troglodytes*) are at high risk of local extinction in this area. Meanwhile species like the Leopard (*Panthera pardus*), Buffalo (*Syncerus nanus*), the African Elephant (*Loxodonta africana*) and the Giant pangolin (*Manis gigantea*) were not recorded killed in any of the 14 study villages and are feared to be locally extinct. There was a steady decline in off-take and biomass of large-bodied species like duikers and primates in the total harvest of both ethnic groups over time during the study period. This suggests that hunting of larger-bodied animals may not be sustainable within the Banyang-Mbo Wildlife Sanctuary. The future of Blue duikers seems bleak if hunting continues unchecked. Poverty, population increase, unemployment and the weak enforcement of existing wildlife laws are the driving forces behind the unsustainable harvest of wildlife resources at the Banyang-Mbo wildlife Sanctuary.

Key words: Impact, Hunting, Bushmeat trade, Biodiversity loss, Banyang-Mbo Wildlife Sanctuary

Zusammenfassung:

Das Banyang-Mbo Wildlife Schutzgebiet ist ein unter vielfältigen Nutzungen stehender tropischer Regenwald im südwestlichen Flachlandbereich des westafrikanischen Landes Kamerun. Dieser Bereich wurde durch die Regierung Kameruns unter Schutz gestellt, um insgesamt 11 Arten zu schützen, u.a. die in Zentral-und Westafrika gefährdeten Primatennarten (*Mandrillus leucophaeus*) und (*Pan troglodytes*). Der lokalen Bevölkerung wurden gewisse Nutzungsrechte eingeräumt, soweit die ausdrücklich formulierten Schutzziele des Schutzgebietes nicht berührt sind. Um das Schutzgebiet herum liegen viele Dörfer mit einer stetig steigenden Bevölkerungszahl, und die meisten Dorfbewohner nutzen das Wild einerseits für ihre eigene Ernährung und andererseits als Einkommensquelle. Ziel der sechsmonatigen Untersuchungen war es, den gegenwärtigen Einfluß der Jagd auf den Rückgang der Biodiversität zu analysieren und Vorschläge für ein nachhaltiges Wildmanagement zu entwickeln. Die täglich von den 84 an der Studie teilnehmenden Jägern getöteten Tiere wurden gewogen, Geschlecht und Alter bestimmt; weitere sozio-ökonomische Daten wie Waffentyp, Anwendung, Preise für die getöteten Tiere und deren Verwendung wurden von 14 Mitarbeitern in den 14 in die Untersuchungen einbezogenen Dörfern erhoben. Die Jäger wurden bezüglich ihrer Meinung zur Jagd, zu den gejagten Tieren und zu den Möglichkeiten der Implementation eines geordneten Jagdsystems befragt.

Die Untersuchungsergebnisse zeigen, dass 44 Tierarten gejagt wurden, wobei insgesamt 3.176 Individuen getötet wurden. Dies entspricht einer Biomasse von 22.400 kg in den Gebieten von Banyang und Mbo. Im Untersuchungszeitraum von sechs Monaten entnahmen die Banyang insgesamt 1.888 Tiere mit einer Biomasse von 13.479 kg, während die Mbo 1.288 Tiere mit einer Biomasse von 8.921 kg erlegten. Dabei entfällt ein Anteil von (34%) auf Ducker, auf Nager (22%), auf andere geschützte Arten (15%) und auf Primaten (11%) aller gejagten Tiere innerhalb des gesamten Schutzgebietes. Großtiere wie Primaten und größere Antilopen sind gefährdeter durch die Jagd mit Gewehren, während kleinere, räuberisch lebende Tiere öfter durch Schlingfallen gefangen werden. Köderfallen wurden gelegentlich zum Fang von Rohrratten und Affen eingesetzt. Die meisten Tiere wurden während der Regenzeit, besonders im Juli und August erlegt, allerdings wurden auch viele Tiere in der Trockenzeit, besonders im November und im Januar erlegt. Männchen wurden öfter getötet als Weibchen (47% zu 43% für alle Arten in sechs

Monaten, (10%) konnten nicht zugeordnet werden). Erwachsene Tiere machten einen Anteil von (69%) aus.

Im Allgemeinen verzehrten die Banyang (83%) des erjagten Buschfleisches und verkauften nur (11%), die Mbo verzehrten (47%) und verkauften (39%) an Händler. Ökonomischer Gewinn in Form von Einkommen aus dem Handel mit Buschfleisch im Bereich des Banyang-Mbo Wildlife Schutzgebietes ist offenbar nicht hoch, ein Jäger verdient im Mittel 22.629F CFA (47 US \$) pro Monat über den Untersuchungszeitraum, während ein öffentlich Bediensteter in Kamerun pro Monat 125.000F CFA (258 US \$) verdient.

Ein Kilogramm des teuersten Buschfleisches wie das des Pangolin (*Manis gigantea*) und das des Stachelschweines *Atherurus africana* war etwa 2,7 mal teurer als das Fleisch domestizierter Tiere wie etwa Rinder oder Ziegen. Der Drill (*Mandrillus leucophaeus*) und der Schimpanse (*Pan troglodytes*) sind in den untersuchten Bereichen stark vom Aussterben bedroht. Andererseits wurden Arten wie der Leopard (*Panthera pardus*), Büffel (*Sycerus nanus*), Elefant (*Loxodonta africana*) und Riesenschuppentier (*Manis gigantea*) im Bereich der 14 untersuchten Dörfer nicht gejagt und getötet, eventuell sind diese Arten bereits lokal ausgestorben. Es wurde eine stetige Abnahme der Entnahme von Biomasse größerer Tiere durch Jagd durch beide ethnischen Gruppen während des Untersuchungszeitraumes festgestellt. Dies legt die Vermutung nahe, daß die Jagd auf Großtiere keine nachhaltige Bewirtschaftung des Banyang-Mbo Wildlife Schutzgebietes darstellt. Armut, hohes Bevölkerungswachstum, Arbeitslosigkeit und die unzureichende Umsetzung der gesetzlichen Regelungen bilden die wichtigsten Gründe für die nichtnachhaltige Bewirtschaftung der Ressourcen im "Banyang-Mbo Wildlife Sanctuary".

Schlagworte:

Jagd, Buschfleisch (Wild), Rückgang der Biodiversität, Kamerun

Key words: Einfluß, Jagd, Buschfleischhandel, Biodiversitätsrückgang, Banyang-Mbo Wild Schongebiet

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LIST OF ABBREVIATIONS

ATO	African Timber Organisation
BMWS	Banyang-Mbo Wildlife Sanctuary
BSI	Bio synergy Institute, UK
C.A.R	Central African Republic
CBD	Convention on Biological Diversity
CFA	African franc zone
CFCs	Chlorofluorocarbon
CITES	International Convention on Trade in Endangered Species
CNU	Cameroon National Union
CPDM	Cameroon People's Democratic Movement
CoP	Conference of the Parties
CUC	Cameroon United Congress
GDP	Gross Domestic Product
Gov` t	Government
GPS	Global Positioning System
ITTO	International Tropical Timber Organisation
IUCN	International Union for Conservation of Nature
Kg	Kilogram
LBZG	Limbe Botanic and Zoological Garden, Cameroon
MINEF	Ministry of Environment and Forestry, Cameroon
MYS	Maximum Sustainable Yield
NBSAP	National Biodiversity Strategy and Action Plan
NTFPs	Non timber forest products
NW	North West
ONADAEF	Office Nationale de Development de Foret
SDF	Social Democratic Front
SODECAO	Société de development du cacao

SONARA	Société Nationale de Refineries
Sp	Species
SPSS	Statistical Package for Social Sciences (Software)
TRAFFIC	Wildlife Trade Monitoring Network
UNCED	United Nations Conference on Environment and Development
UNFPA	United Nations Population Fund
UPC	Union de people Camerounaise
WCMC	World Conservation Monitoring Centre
WCS	Wildlife Conservation Society, New York, USA
WRI	World Resource Institute
WWF	World Wild Fund for Nature

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CHAPTER 1

1. INTRODUCTION

In Africa the forest and woodland is often referred to as the “bush” and therefore, wild animal products derived from the bush are known as “bushmeat”. Bushmeat is made up of a vast range of animal species ranging from duikers (*Cephalophus* spp.) to rodents such as Cane rats (*Thryonomis swinderianus*), Panthers (*Panthera pardus*), Chimpanzees (*Pan troglodytes*), Hornbill (*Ceratogymna atrata*), Gorillas (*Gorilla gorilla gorilla*) to the African Elephants (*Loxodonta africana cyclotis*). Wild game “bushmeat” has been variously defined to refer to any species of animal or bird that is shot, speared, or trapped and sold for public consumption either fresh or preserved.

Cameroon’s forests are rich in flora and fauna biodiversity however; recently the bushmeat and wildlife trade has been a growing threat to forest biodiversity in Cameroon. Several field surveys conducted by different researchers have variously shown that local communities in the rural areas of Cameroon like else where in the Central and West African tropical forests, mostly rely on hunted game “bushmeat” to both meet their essential protein requirements and as primary and secondary sources of income (Asibey 1991; Martin 1983; Anadu et al. 1988; Geist 1983; Juste et al. 1995; Noss 1998; Wilkie and Carpenter 1999; Eves and Ruggiero 2000 cited in Willcox 2002). Field studies conducted by Robinson and Bennett (2000) on hunter-gatherer societies’ levels on removal of renewable natural resources through hunting, fishing and gathering of NTFPs from the forest have revealed that these extractions have been very sustainable. Although according to Lee and De Vore (1968), the hunter-gatherer way of life has been the most successful and persistent adaptation man has ever achieved. It is doubtful that such sustainable life style could have persisted over prolonged eras of human population expansion and attendant livestock development (Robinson and Bennett 2000). Nevertheless, it is on this romantic view of man’s living in balance with his environment that today’s community-based conservation approach is emerging (Wright 1994). According to an investigation by Fa et al. (2002) communities have elaborate rituals and practices that limit off-take levels, restrict access to critical resources and distribute harvests evenly.

The Banyang-Mbo Wildlife Sanctuary a biodiversity hotspot in the South West Province is one of the reserves in Cameroon currently considered for long-term management for the protection of eleven animal species and other endangered species after a long period of neglect by the government of Cameroon. The necessity for skilful forest exploitation has for over successive generations evolved a strong tradition of hunting expertise. This naturally results in the accumulation of detailed ethno biological knowledge that is of great significance to conservationists and ecologists alike in their search for understanding of tropical biodiversity and human impact on it.

Most rural Cameroonians use wildlife resources for food and income, but also for social, cultural and religious functions. In a survey conducted in upper Banyang area by Tataw et al. (2001) it was revealed that certain animal species may play important roles in spiritual ceremonies, or have taboos associated with them that forbid certain harvests. In the Banyang-Mbo area, bushmeat consumption and sale has been going on for years back and as long as it was practiced for subsistence, there was no danger of species disappearance (Nambu 2000; Nchanji and Plumptre 2001; Inyang 2002). However, with the advent of industrial revolution brought to Africa during the colonial period, poaching emerged (Wilkie and Carpenter 1999; Wilkie 2001; Ngwayi 2003). Elephants were mostly targeted for ivory. According to Wilkie et al. (2005) and Willcox and Nzouango (2000) increase in forest exploitation through the establishment of forest sites, opening of forest trails, transport and hunting by workers of logging companies and their families, commercial hunting witnessed a boom. With all this pressure on forest wildlife, the first signs of threat on certain species started to be noticed (Koulangna 2001). In the Banyang-Mbo region, a combination of factors such as increase in population growth, the economic crisis that affected Cameroon in the late 1980s, devaluation of the CFA francs in 1994 and poverty resulting from the above factors has resulted in a high increase in demand for bushmeat (Oslisly et al. 2000). Kellert (1984) found out that to be successful in forest management, projects have to build on the traditional activities which are already practiced in that area. It was further established that many attempts to switch suddenly to year-round capital-intensive activities, which differ drastically from the local traditions practiced in such area have failed.

In addition, he found out that if the projects do not understand the local community's practices to know which groups rely on which specific natural resource products, they may introduce innovations that are technically feasible but bring about negative socio-economic effects. Too often, the actual value that communities place on their wildlife resources is not fully understood until after the resource is gone (Pomerantz 1986).

According to a recent survey by Fa (2000), bushmeat hunting is the single most geographically widespread form of wildlife extraction in tropical forests today. Several other ecological surveys have pointed to the fact that apart from climate change, bushmeat hunting for commercial purposes is the only other activity that is leading to massive fauna biodiversity loss in the tropics today. The Banyang-Mbo Wildlife Sanctuary is a multiple use biodiversity hotspot in Cameroon that is facing a high decline in animal species due to such unsustainable hunting for bushmeat. Hunting and consumption of forest fauna has been a long traditional subsistence activity by communities in and around the Banyang-Mbo Wildlife Sanctuary, with hunted game contributing up to (98%) of animal protein consumed by local households (Koppet et al.1993). Recent field studies have shown that within the past two decades bushmeat hunting at the Banyang-Mbo Wildlife Sanctuary has been transformed very rapidly into a commercial trade. A report by Ellis (2000) indicates that products of bushmeat are sold directly in the open markets in big cities of Cameroon.

1.1 STATEMENT OF PROBLEM

Wildlife populations and the livelihoods of people in Cameroon are threatened by escalating unsustainable use of wild meat, driven by increasing demand due to human population growth, poverty and consumer preferences, and aggravated by problems of governance, use of increasingly efficient technology, and provision of hunting access in remote areas by logging roads. Wildlife species are harvested for meat by both subsistence and commercial hunters. The subsistence harvest, undertaken by poor, rural inhabitants, is an important source of protein and often is an important part of local culture. In some regions of Cameroon like the Banyang-Mbo area, rural inhabitants also earn income through low revenue trade.

Due to the ever growing population in Cameroon today with a high demand for animal protein, research studies have suggested that due to lack of modern technological knowledge and capital to cater for domestic animal production, the latter may be insufficient. Given the relatively low prices of wild meat products combined with the relatively little investment input into the business the slaughter and consumption of bushmeat has led to a more environmentally destructive commercial trade.

Rural inhabitants generally do not benefit from the increasing trend in consumers' willingness to pay. They also face a resulting decline in availability as the resource is removed for ends that are more profitable. Agriculture is not always a viable option or complement to the use of wild game meat, as it generally requires more resources (money and labour) although it does provide a more secured income source.

1.1.1 Impact of wild meat harvest and trade on food security and livelihoods

In Cameroon rural populations are continuing to expand and are already placing unsustainable demands on local resources. Improved hunting techniques, materials and equipment as well as access to remote areas have improved the efficiency of harvests. In addition, as a result of large-scale commercial wild game meat harvest, marginalized rural people have a declining resource on which to base any improvement in their situation and are becoming poorer and increasingly undernourished.

1.1.2 Bushmeat harvests, sustainability and impacts on biodiversity taxonomy

Achieving ecological sustainability is crucial if the long-term goal of conserving tropical forest systems and biodiversity is to be attained. One of the main contributing factors to the population decline in a number of species in Cameroon is its use for food. This evidence points to severe declines in some primate populations as a result of this trade. Information from pheasant conservationists indicates that this is also a serious problem for these taxa.

In contrast, the data regarding use of many species of rodents and duikers suggest that, although some of the species are being heavily exploited, there are other species in these taxa that can sustain a significant level of hunting. However, these species require management actions to ensure that this harvest is sustainable to support future generations.

1.1.3 Habitat destruction

It has been observed that individual animal species are affected by slight natural changes occurring at a gradual pace. However, when changes occur at a fast pace, there is little or no time for individual species to react and adjust to new circumstances. Human activities have been well documented to be one principle source of endangerment to most animal species loss through habitat loss. Their activities such as hunting (poaching), slash and burn agriculture, road development and felling down of forest for building materials have often than not caused rapid habitat fragmentation resulting in species endangerment. Ecologists through research surveys have proven that nearly every region of the earth has been affected by human activity, particularly during this past century. Through uncontrolled harvesting of bushmeat and NTFPs by the local communities and other outside interest, the Banyang-Mbo Wildlife Sanctuary due to lack of proper management, has gone through a process of gradual degradation and habitat alteration and some endangered species like the Leopard, the African forest Elephant, Chimpanzee and the Giant pangolin are being threatened to local extinction at the Banyang-Mbo area. It can be difficult for an individual to recognize the effects that humans have had on specific species.

1.1.4 Over-exploitation

The rate at which a species is being extracted from the forest for bushmeat determines its chance of becoming extinct. It is documented that unrestricted whaling during the 20th century is an example of over-exploitation and the whaling industry brought many species of whales to extremely low population sizes. This led to many whale species being faced with extinction and concerned nations had to agree to abide by an international moratorium on whaling.

This agreement saw some whale species such as the grey whale made a remarkable comeback while others are still threatened or endangered. In the same light, Robinson and Bennett (2000) have observed that commercial bushmeat trade is currently not sustainable and may result in rapid local extinction of large mammals from the African tropical rain forest. Due to this trade in animal parts, many species continue to suffer high rates of exploitation in Cameroon's forests today. Estimates now considered by some conservationists place annual bushmeat off-take at one million metric tons in the Congo basin (Wilkie and Carpenter 1999). Several conservation biologists have suggested a bleak future for apes and other wildlife species like the Leopard and African forest Elephants in Cameroon due to the high pressure exerted on them by hunters for the bushmeat trade. Pollution has seriously affected multiple terrestrial and aquatic species, and limited distributions as a result of habitat loss due to agricultural expansion and human settlement which are frequently a consequence of other threats populations confined to few small areas due to habitat loss for example, may be disastrously affected by random factors. At the Banyang-Mbo region there is no authority regulating hunting hence (99.8%) of the hunting is carried out without seeking for or obtaining prior permission (Willcox 2002). Several villages share hunting areas however, if strangers want to hunt in a village's hunting area, they have to register with the traditional council and pay a fee. Despite this high consumptive and extractive rate of wildlife resources, there is lack of quantitative data on the utilization of forest animals by the local populations and even more on the impact of this (Mittermeir 1987). The partial or total degradation of the forest ecosystem in terms of wildlife reduction is posing a serious threat to both wildlife and human survival.

According to Eves and Ruggiero (2000), wildlife conservation in Cameroon is faced with unprecedented challenges. This is resulting from the loss of biodiversity through local extinction of species and rapid decline in wildlife numbers. Hunting of forest mammals for human consumption is widespread over much of Guineo-Congolian rainforest of Africa (Juste et al. 1995). This continuous threat to Cameroon's rich biological heritage requires a wide range of interventions from the public sector, bilateral cooperation agencies, NGOs and the local communities.

1.2 AIMS AND OBJECTIVES OF STUDY

The primary aim of this study is to assess the level of mega-fauna biodiversity loss through hunting, by quantifying animal species off-take at the Banyang-Mbo Wildlife Sanctuary. This is with a view to assist Cameroon's Ministry of Forestry and Wildlife to set up a managed hunting system based on one or more of the following:

- species,
- age,
- sex,
- season,
- weapon type,
- location of kills.

This research intends to achieve the following objectives:

- To assess the current level of hunting and its impact on mega-fauna biodiversity loss within the Banyang-Mbo Wildlife Sanctuary
- To investigate the time and season dedicated to hunting
- To investigate consumption patterns of bushmeat in BMWS
- To investigate commercialization of bushmeat in BMWS
- To identify incidental uses of wildlife in BMWS
- To identify different hunting tools/methods used in BMWS
- To understand the root causes of the crisis and then build capacity to address them both in immediate emergencies and over a long term.
- To carry out a socio-economic data collection to assess the revenue generated by hunting bushmeat

The following questions were addressed:

- 1 What is the current status of wildlife biodiversity loss at the BMWS?
- 2 What is the current level of hunting in this area?

- 3 Which species of animals are most affected by illegal hunting?
- 4 Which species of animals are already threatened or locally extinct due to over-exploitation in this area?
- 5 Which species are most preferred by hunters and why?
- 6 What strategies can be employed to reduce the current level of illegal hunting for bushmeat trade at Banyang-Mbo Wildlife Sanctuary?
- 7 Are there socio-cultural or religious taboos and / or sentiments attached to the killing and eating of certain wildlife species by tribes within the Banyang-Mbo Wildlife Sanctuary?
If yes, how can they be made useful?

Answering these questions is ever more relevant as the Cameroonian Ministry of Wildlife and Forestry and some international conservation agencies seek strategies and solutions to integrate short-term economic needs with long-term development needs, through the conservation of forest ecosystems and species.

1.3 JUSTIFICATION OF STUDY

Since bushmeat resources are integral to the livelihoods of the inhabitants of the Banyang-Mbo Wildlife Sanctuary, the bushmeat off-take needs to be quantified to know the impact that the current hunting level has on the fauna of the area (Wilkie et al. 1998). Hunting pressure on the Banyang-Mbo Wildlife Sanctuary is relatively high as can be seen from the fact that this forest that covers an area of 89000 hectares (Nambu 2000) has a high population of resident hunters. The sanctuary has an estimated total of 429 resident hunters (Willcox and Nzouango 2000), over and above outside hunters who have frequently been reported by communities of the Sanctuary. The loss of wildlife as a resource will have drastic repercussion on both the lifestyles and diets of the local population as well as the general ecology of the Banyang-Mbo Wildlife Sanctuary. It is hoped that information on frame conditions and baseline socio-economic data collected during the study will be used by the Ministry of Wildlife and Forestry to draft a sustainable management plan for the forest and threatened wildlife species in and around the sanctuary.

A key conservation issue at the Banyang-Mbo Wildlife Sanctuary is the effect of hunting on wildlife populations. Currently sustainable wildlife off-take level that is within productive capacity of the ecosystem is not well established. Despite the fact that Cameroon's law gives full protection to endangered species, large-scale illegal trade in bushmeat and life captured wildlife including threatened and endangered species may be driving wildlife species towards local extinction at the Banyang-Mbo Wildlife Sanctuary. Therefore quantification would enable an appraisal of the impact of bushmeat hunting and sale on fauna biodiversity loss in the area.

The present study also has as its goal to promote awareness among the local communities as well as the government of Cameroon and the international community on the current status of fauna biodiversity loss and the need to protect wildlife especially the critically endangered species within the Banyang-Mbo Wildlife Sanctuary.

It is also aimed to secure local community support for future conservation efforts since the five year community-base conservation initiative introduced by Wildlife Conservation Society was to a larger extent not very successful within this area.

1.4 RESEARCH HYPOTHESES

The following research hypotheses were the basis of this study:

1. The current hunting level of wildlife for bushmeat trade and family consumption at the Banyang-Mbo Wildlife Sanctuary is unsustainable.
2. The economic environment in and around the BMWS contributes to an increase in wildlife harvesting.
3. Poverty is a root cause of over harvesting of wildlife at the Banyang-Mbo Wildlife Sanctuary.
4. The institutional setup of Cameroon facilitates wildlife harvesting, thereby contributing to biodiversity loss.

The following predictions were derived from the above hypotheses:

Hypothesis (1) predicted that:

- Hunting is leading to a rapid decline in particular species in the Banyang-Mbo Wildlife Sanctuary
- There is currently an increase in the loss of wildlife species at the Banyang-Mbo Wildlife Sanctuary
- There is a total decline in wildlife populations at the Banyang-Mbo Wildlife Sanctuary

Hypothesis (2) predicts that:

- There is high demand for bushmeat in and around the Banyang-Mbo Wildlife Sanctuary
- The people in and around the sanctuary are poor and cannot afford alternative sources of animal protein
- There are no alternative sources of income in and around the Banyang-Mbo hence the people depend on wildlife resources for a livelihood

Hypothesis (3) predicts that:

- The people in and around the Banyang-Mbo area cannot afford basic needs due to lack of employment
- The people in and around the sanctuary need to sell bushmeat in order to meet up with their day to day livelihood needs

Hypothesis (4) predicts that:

- The forestry and wildlife laws protecting this reserve are weakly enforced
- There are no logistics put in place for implementation and enforcement of laws against poaching in this reserve
- Bribery and corruption is rampant between officials and hunters, thereby leading to weak enforcement of wildlife and forestry laws
- Lack of secondary industries in this area has diverted all attention to natural resource exploitation

- The general unemployment situation and economic crisis in Cameroon has resulted in many people from urban areas entering to rural areas to hunt wildlife
- There is little or no collaboration between various ministries who jointly administer the natural resources of Cameroon.

1.5 DELIMITATION OF STUDY

1.5.1 Wildlife

Generally the term “wildlife” has no universal definition. The term wildlife in the context of this study refers to all animals that live outside the direct control of man in a natural undomesticated state. The term is used here in the traditional sense to refer to large mammals above 1kg assumed to be beneficial to man in terms of their meat, e.g. squirrels, grass cutter, bush pig, antelopes and duikers, elephants and primates. However, this study will focus itself on large and medium size wildlife existing at the BMWS.

1.5.2 Utilisation

Wildlife utilization in this context refers to the hunting of wild game for consumption, commercialization or decoration. It is generally hoped that these practices should be conducted in a sustainable manner in order to save guard and ensure availability of wildlife for generations to come. The utilization of wildlife has a long history. Among these uses are edible products (food and medicine), non-edible products (trophies) and as sport hunting (tourism).

CHAPTER 2

GENERAL BACKGROUND TO STUDY

2.1 IMPORTANCE OF WILDLIFE AS A NATURAL RESOURCE FOR CENTRAL AND WEST AFRICAN COMMUNITIES

Reports from several authors indicate that most local communities in Central and West African tropical forest depend on hunted game “bushmeat” to both meet their essential dietary protein needs and as primary and secondary sources of income (Asibey 1991; Martin 1983; Anadu et al. 1998; Geist 1983; Juste et al. 1995; Noss 1998; Wilkie and Carpenter 1999; Eves and Ruggiero 2000). According to Bennett and Robinson (2000), wildlife species are hunted for food, sale, social and cultural reasons and because they are agricultural pest. According to Martin (1985) about 95% of the total population of Southern Nigeria consume bushmeat. Annual bushmeat consumption in the Congo basin is estimated variously to exceed one million tons per year (Wilkie and Carpenter 1999) or less conservatively to be nearly 5 million tons per year (Fa et al. 2002). Currently West and Central Africa are in a “bushmeat boom” which will soon be followed by a “bushmeat burst” (Barnes 2002).

Previous research findings have revealed that the inhabitants of West and Central African tropical forests have hunted wild game for centuries without gravely influencing wildlife populations (Ngwayi 2003). However, several factors and social changes have now contributed to the current bushmeat crisis in Central and West Africa. With advances in modern medicines, people are living longer and infant mortality rate have drastically reduced. Family planning more specifically, birth control is non-existent in most societies. Advances in agricultural technology have made more food available and the sedentary lifestyle in tropical forest (Wilkie and Curran 1993; Stearman 2000). All these factors have caused recent exponential population growth in Central and West Africa. If the human populations in this region rely only on bushmeat as a source of protein and income, then the tropical forest might only support a very low population density.

Robinson and Bennett (2000) estimated the carrying capacity of around one person per km² for humans who utilize bushmeat in tropical forests. Another factor that has increased off-take is the adoption of new hunting technologies. Short guns and wire snares have replaced many of the traditional hunting practices of hunters. The shift by traditional hunters who once used cross bows, nets and snares made of forest materials to modern technologies, has made hunting a less skilled and more productive activity thus increasing overall yield (Lahm 1993; Noss 1998; Bennett et al. 1997). Furthermore, the colonial era of Central and West Africa sparked the entrance of traditional cultures into the modern market economy. The implication of this on hunting is seen at several levels. Tropical people gained an interest for manufactured goods and they accrued new costs as they now pay for school fees, public transportation, healthcare etc. In many instances, the only source of income to pay for these new goods and services is through the sale of bushmeat. The modern market economy has also brought extractive industries such as timber into previously unexploited areas. As the timber company extracts materials, bushmeat markets are created to feed the employees and hunters gain increased access to the forest through the newly created roads (Wilkie et al.1992; Robinson et al. 1999; Auzel and Wilkie 2000).

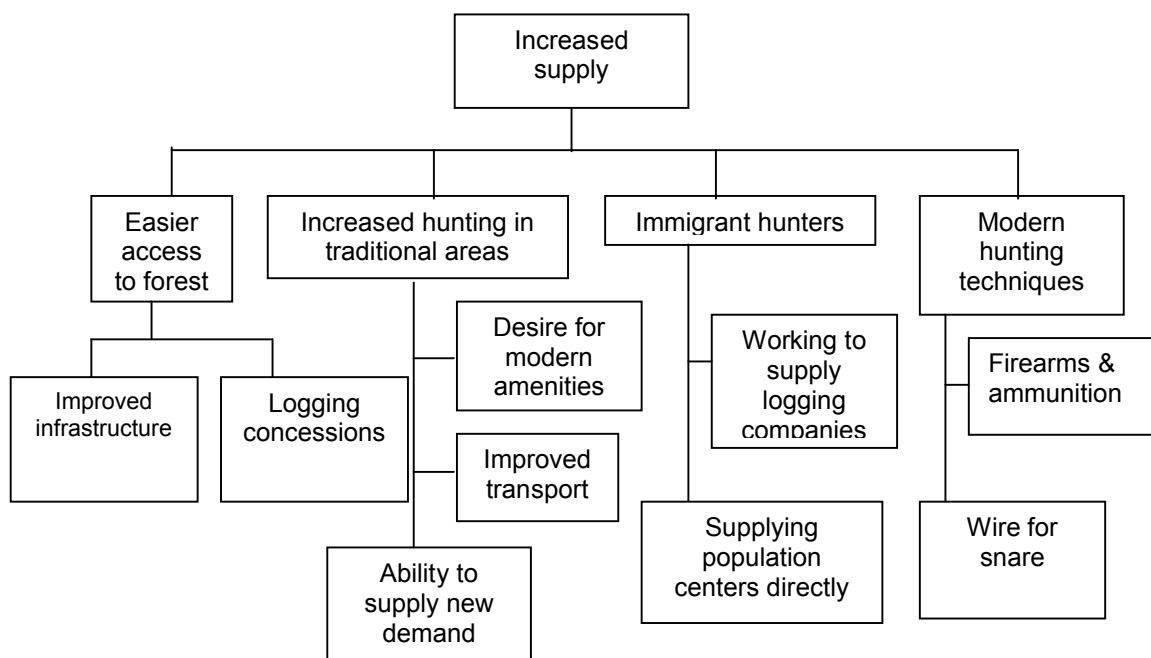


Figure 2.1 Causes of the increasing supply of bushmeat

Hunting is now recognized as a dire threat to large mammal populations in the Congo Basin. The implication of this practice will not only be felt by conservationists concern with local extinction and biodiversity loss, but they will directly affect the local populations of the Central and West African states as a major source of dietary protein and income is eradicated.

2.2 BUSHMEAT HARVESTING IN THE CENTRAL AFRICAN SUB REGION

It was predicted in a survey aimed at comparing apes' density and gun hunting pressure in 29 Aka and Bantu villages along the Motoba river area of north eastern Congo Republic by Kano and Asato (1994) that the apes in this region have a bleak future. In their survey, they found out that over (80%) of their 173 Aka informants were willing to eat gorilla or chimpanzee meat. Among 120 Bantu informants, (70%) were willing to eat gorilla and (57%) would eat chimpanzee meat. From a conservation view point although this hunting was carried out to serve the villagers and not for commercial export it is traditionally not subsistence hunting.

According to BSI (1996), Ape Alliance (1998), BCTF (2000) as the taste for bushmeat continue to spread across equatorial Africa at an accelerated pace, hunting and meat export capacity improves. A study carried out by Ammann and Peace (1995) showed that African primates especially the great apes and other edible wildlife is faced with severe threats of local extinction from hunting. These researchers revealed that hunters in the Kika, Moloundou and Mabale triangle in Cameroon estimated that around 25 guns are active on any given day and that successful gorilla hunts take place on about (10%) of outings. This analysis shows that up to 800 gorillas could be estimated killed in a year. The hunters indicated that they bring out up to 400 chimpanzees a year putting the total number of great apes killed at 1200, in a year in one district of Cameroon. Following a WCS report, hunting in the Banyang-Mbo Wildlife Sanctuary has become highly commercialized.

The principle reason given was lack of jobs in the urban centres, forcing people to come back to the villages to hunt. Moreover, people here see hunting and sales of bushmeat as a quick way to earn money whereas farming is a long process before the financial gains are realized. Reports by Willcox

and Nzouango (2000), Nambu (2000), Tataw et al. (2001) and Inyang (2002) estimated that hunting of wildlife at the Banyang-Mbo region is becoming unsustainable and could lead to fauna biodiversity loss if not checked immediately. These reports revealed that protected animals at the Banyang-Mbo sanctuary included all IUCN red-list animals and several others added to the decree of the BMWS when gazetted by the government of Cameroon. It was revealed that the BMWS project started a sensitization campaign in all project villages since 1997, stressing the rules and regulations of the BMWS. This included the listing of the species that receive total protection under law. However, regardless of this, within their studies, there were steady records of these animals in data sheets. However, the number they registered was low but they strongly believed that most hunters must have hidden protected animals. Nevertheless, while examining the total kill records, they found that the rate at which protected animals are killed is alarming and demands an urgent solution.

To stop this slaughter will require understanding the root causes of the crisis and then build capacity to address them both in immediate emergencies and over a long term. For example Fa et al. (2002a) estimated that five million tons of bushmeat are extracted from the tropical Congo forests each year. An inventory of the four main bushmeat markets in Yaoundé, Cameroon's capital city by Baillon 1995 (cited in Fondo et al. 2005) revealed a monthly arrival of 70 to 90 tons of bushmeat, with an average of 2.3 tons per day. The meat arrives in Yaoundé either by road (20%) or by train (80%).

This survey indicated that hunters do not discriminate among species of animals they hunt since the price of bushmeat is determined by the overall weight of bushmeat. Wilkie (2001) discovered that “a highly endangered sun-tailed guenon (*Cercopithecus solatus*) on sale in Libreville market in Gabon was priced the same as the much more abundant white-nosed guenon (*Cercopithecus cephus*).” This therefore makes hunters indiscriminate killers. Bowen-Jones et al. (2003) also observed that the most prevalent species sold in markets were duikers and that they made up (42-84%) of the total bushmeat sold.

Table 2.1 Hunting methods used by native hunters to kill animals from a number of taxonomic groups in Central-Western Tanzania

Taxonomic Group	Guns	Traps	Spears	Dogs	Total	Percentage
Insectivor	-	9	-	1	10	4.23
Nocturnal primates	-	2	-	-	2	0.84
Diurnal primates	6	1	4	3	12	5.93
Carnivora	22	8	4	20	54	22.88
Hyracoidea	1	-	-	1	2	0.84
Suidae	7	-	5	-	12	5.08
Hippopotamidae	1	-	-	-	1	0.42
Bovidae	82	9	10	3	104	44.06
Pholidota	-	-	1	-	1	0.42
Rodentia	6	6	2	3	17	7.20
Lagomorpha	2	10	-	7	19	8.05
Total	127	45	26	38	236	100
Percentage	53.81	19.06	11.01	16.10	100	100

Source: Carpento and Fusari 2000

Various surveys by different authors have documented different methods by which hunters extract bushmeat from the forest, these include the use of hunting dogs, netting, shooting, trapping and snaring (De Merode et al. 2004; Fa et al. 2002a; Blom et al. 2005 and Bowen-Jones et al. 2003; Hofer et al. 1996; Campbell and Hofer 1995). In another survey, Wilkie et al. (1992) established that hunters in the Congo-Basin carry out net hunting instead of snare hunting because up to (25%) of species caught in snares are lost to scavengers or rot. However, Noss (1995) reported that snaring is a preferred method of hunting because it is a cheaper technique. Milner-Gulland et al. (2002), in a separate study also confirmed that nylon snares are used to trap bush pigs.

Most of the bushmeat harvested via one of the hunting methods mentioned above are often smoked in specialized smoking camps by commercial hunters. By so doing the meat gets toughens and helps prevent infestation with maggots.

The smoked bushmeat is then carried to the village where bushmeat traders come and buy or it can be sold at the local markets. Fa et al. (2002a) estimated that (60%) of mammals in the Congo basin are hunted unsustainably for bushmeat trade. Field studies have also recorded over-harvesting of bushmeat in some protected areas in the Southwest of Cameroon (Nambu 2000; Ayeni et al. 2003; Willcox and Nzouango 2000; Inyang 2002).

2.3 COMPLEXITIES OF HUNTING IN CENTRAL AFRICAN RAIN FORESTS

According to Blom et al. (2004) and King (1994) the extinction of certain large animal species in the Congo basin are correlated with the presence of humans and were certainly due to hunting. Studies elsewhere have also reported the expansion of humans resulting to local extinction of large animals e.g. when humans expanded into Latin America, this led to the extinction of giant sloths (Leeuwenberg and Robinson 2000). Human migration into Madagascar and New Zealand also led to the extinction of many island birds and giant lemurs (Lee 2000). There is good evidence that communities in the Congo basin tropical forest have depended on bushmeat and fish to meet their animal protein requirements for many thousands of years. Within the last decade hunting was often carried out to meet the immediate economic requirements of tropical forest communities in a rapidly changing world situation.

2.4 BUSHMEAT AS AN ESSENTIAL SOURCE OF PROTEIN

Wildlife and fish contributes a minimum of about (20%) of the animal protein in rural diets of the populations in about 162 countries of the world (Bennett and Robinson 2000). According to Anstey (1991), Bennett et al. (2000) and Townsend (2000), wildlife provides significant calorie to rural communities as well as essential proteins and fats. In West Africa about (25%) of protein requirements are met by wild animal meat. A research survey conducted by Bennett and Robinson (2000) in Liberia showed that (75%) of the country's meat is got from wild game.

Studies throughout the tropics have shown that individual hunters take significant numbers of animals to provide this amount of protein (Table 2.2).

Table 2.2 Number of animals killed per hunter per year (hunters are from indigenous forest communities, hunting entirely or predominantly for subsistence).

Ethnic group	Country	Number of all mammals > 1 kg
Xavante	Brazil	119.7
Huaorani	Ecuador	20.9
Siriono	Bolivia	36.3
Ache	Paraguay	33.0
Wana Sulawesi	Malaysia	1.82
Murut Sabah	Malaysia	17.1
Lun Dayah	Malaysia	13.4
Iban Sarawak	Malaysia	16.6
Kelabit	Malaysia	51.1

Source: Bennett et al. 2000

Previous researches across the world have shown that more than 13,600 animal species are harvested from the Arabuko-Sokoke forest in Kenya each year and in Malaysia, subsistence hunters take a minimum of 23,513 tons of wild meat per year. Following Hofer et al. (1996) about 159,811 species of animals were harvested each year in the Serengeti national park in Tanzania to provide either for protein requirement of the hunters' families or as a source of income. With such off-take rates, the effect of hunting on wildlife populations can be considerable. In most Cameroonian villages like elsewhere in sub-Saharan Africa bushmeat is seen as an important source of protein, constituting about (98%) of animal protein. In 2002 a conference held in Yaoundé and attended by the World Conservation Union, the United Nations, the Food and Agricultural Organization and TRAFFIC, defined extreme poverty as someone who earns a personal income of < US\$1 a day (Davies 2002). People from third-world countries are the group that is most likely to fit into this bracket.

Davies (2002) stated that (50%) of people in the Congo basin are food-insecure and therefore cannot afford to buy meat. Carpento and Fusari (2000) and Fa et al. (2005) observed that there were a number of agricultural problems that pressurized local indigenous people into hunting for bushmeat. Bowen-Jones et al. (2003) found out in a field survey that since freshwater fishing has a low yield, people usually increase the chance of obtaining more animal protein from hunting and consumption of bushmeat. In another study Carpento and Fusari (2000) discovered that the presence of the tse-tse fly would mean that rearing of cattle in tropical forest zones could have a detrimental effect as the tse-tse fly carries trypanosomiasis a filarial parasite that causes African sleeping sickness which could infect the farmer.

Wilkie et al. (1998) and Wilkie (2001) in a study to find out how bushmeat hunting was affecting local communities in the Congo basin found out that the majority of peoples' diets consisted of carbohydrate sources such as cassava, plantain, cocoyam and yams and that some amino acids were provided through the consumption of Gnetum leaves. They further reported that because of the above reasons, local indigenous people hunt for bushmeat to either supplement their intake of protein or to fulfil it completely (Fa et al. 2002a; Wilkie et al.1998; Wilkie et al. 2001; Carpento and Fusari 2000; Newing 2001 and De Merode et al. 2004). In a study conducted in the Dja reserve in Cameroon, Bowen-Jones et al. (2003) noted that (98%) of protein intake came from bushmeat.

2.5 BUSHMEAT A READILY AVAILABLE SOURCE OF PROTEIN WITH COMMERCIAL VALUE

For many rural communities as well as meeting the subsistence needs, hunting can also be a major source of income for the rural people from sale of meat and pelts or sale of animals as pets and trophies (Bodmer 1994; FitzGibbon et al. 2000 and Noss 2000). Research reports indicate that in Tahuayo low land in Peru, 1.278 animals are extracted annually from a 500 km² area, (14%) is consumed locally and the remaining (86%) is sold for more than US\$17.000 per year. It has also been reported that each gun owner in Congo sells meat worth US\$395 annually.

In the Arabuko sokoke forest in Kenya, local hunters have been reported to earn US\$275 per year by selling meat in an area where the average annual per capita income is US\$38 (Bennett and Robinson 2000). In another survey carried out in Central African Republic, hunters were reported to earn US\$ 9.30 per week from snaring wildlife where average local wages are US\$2 to 13 per week (Bennett and Robinson 2000). Many tropical forest people do not seem to see the line drawn between subsistence and commercial use of wildlife. Meat from the forest supplements both diets and income. The combined subsistence and commercial values of wild meat produced by a tropical forest can be very significant (Table 2.2). According to Wilkie and Carpenter (1999), the total volume and value of wild game production at regional levels are staggering. For the Amazon basin the value of wild meat harvested exceeds US\$175 million tons per year and the total wild meat extracted from the Congo basin is estimated to exceed one million tons per year. With an increase in the population of Cameroon, the migration of people and resettlement policies come an increase in demand for protein and therefore bushmeat. Bowen-Jones et al. (2003) observed that there are two types of bushmeat consumer; subsistence hunters who see bushmeat as an essential dietary requirement and rural populations that are not in the extreme poverty bracket and therefore see bushmeat as a luxury item or as a preference to domestic beef.

Bushmeat hunting and trade has widely been reported by many authors to generate huge sums of money which is used by many subsistence farmers, loggers and others on low wages to supplement their income. According to Wilkie et al. (1998), some farmers have also been pushed into subsidizing their income via bushmeat sales as a result of a decrease in world prices for cocoa and coffee. In another study by De Merode et al. (2004), it was found out that normal household diets in the Congo consisted of (3.1%) of bushmeat, (6.2%) fish and wild plant consisted of (9.6%) of the diet. They further revealed that during low crop yield both sales and consumption of bushmeat, fish and other wild plants increased.

In their study they found out that the sales of fish, wild plants and bushmeat increased (365%, 233% and 155%) respectively. According to De Merode household incomes were observed to be highest during the lean season. With such statistics many families and individuals would obviously be plugged into extreme poverty.

Table 2.3 Estimated value of the bushmeat trade in a number of African countries.

Country	Value of bushmeat trade (Annual, millions of US\$)	Year
Gabon	26 urban; 22 rural	1993
Central African Republic	22 (production)	1994/5
Cote d'Ivoire	105	1996
Ghana	205	1996/7
Liberia	42	1989

Source: Davies 2002

Hunters are said to generate a high income from sales of bushmeat than farmers. According to findings by Wilkie et al. (1998), snare trappers in south western Central African Republic earned US \$400-700 whereas local guards in the park reserve only earned US \$450-650 annually. They commented that hunting could be more of a lucrative industry to the millions in extreme poverty and that global harvesting of bushmeat is worth hundreds of millions of dollars.

In a similar study carried out in Ivory Coast, the market value of bushmeat was found to be significantly high; it was estimated to yield US \$117 million annually. The Bushmeat market value was also reported to yield about US \$42 million annually in Liberia (Robinson et al.1999). Based on a study by World Society for Protection of Animals, estimated 800 western lowland Gorillas and 400 Chimpanzees are reported killed annually for bushmeat trade in one district in Cameroon. Another study by Fa (2000) concluded that, of the Congo basin mammal taxa, (60%) are harvested unsustainably for bushmeat trade.

A previous research by Robinson and Bodmer (1999) showed that primates in particular are heavily over harvested throughout their range in West and Central Africa. According to a market survey in Equatorial Guinea, 4.222 primate carcasses were recorded on sale over 424 days (Chapman and Peres 2001).

Primate studies have shown that populations of long-lived species such as Gorillas (*Gorilla gorilla gorilla*) and Chimpanzees (*Pan troglodytes*) with low reproductive rates and high parental investment are said to be particularly vulnerable to the negative effects of over harvesting. According to MINEF (1998a), a law enacted in 1994 in Cameroon to prohibit the hunting of endangered species for bushmeat is now being enforced. However, many Cameroonians are dissatisfied to see or hear of people being jailed for hunting a source of food like Chimpanzee, Leopard or Elephant. The endangered species are seen to be a source of livelihood to many rural families and a delicacy for the rich city dwellers just like any other wildlife species. For decades, indiscriminate hunting has provided jobs not only to villagers in Cameroon's vast rainforests but also to thousands of traders who bring some three tons of every species of bushmeat to the big cities of Cameroon daily (Ayeni 2001). Their catch usually includes smoked and fresh meat of protected species such as Gorilla (*Gorilla gorilla gorilla*) Chimpanzees (*Pan troglodytes*), Elephants (*Loxodonta africana*), Leopards (*Panthera pardus*) and monkey species.

While the bushmeat trade is a complex multifaceted problem, it is a crisis rooted in perception of wildlife and its value by the Cameroonian public. In a comparative study between urban and rural areas in the consumption of bushmeat, Bowen-Jones (2003) discovered that although there is a considerable regional variation, bushmeat is often considered a delicacy in urban centres. In addition, there are cultural values and perceptions held in rural areas about bushmeat. According to Rose (1996f), some village chiefs and provincial governors in Cameroon enhance their status by serving ceremonial meals with expensive wild game such as Gorilla or Monkey meat. Infact affluent urban citizens may actualize their personal power and potential with traditional foods and game imported from the rain forest. All these underlying needs drive behaviour, which becomes habit.

Human populations are rapidly rising in urban areas of Cameroon and preference for wild game ensures continued demand (Robinson and Bodmer 1999). According to this author's report, consumers are even willing to pay a premium price for this cultural delicacy. Some other research studies indicated that in Libreville Gabon, the price of bushmeat was over 1.6 times the price of the most popular cut of beef (Steel 1994).

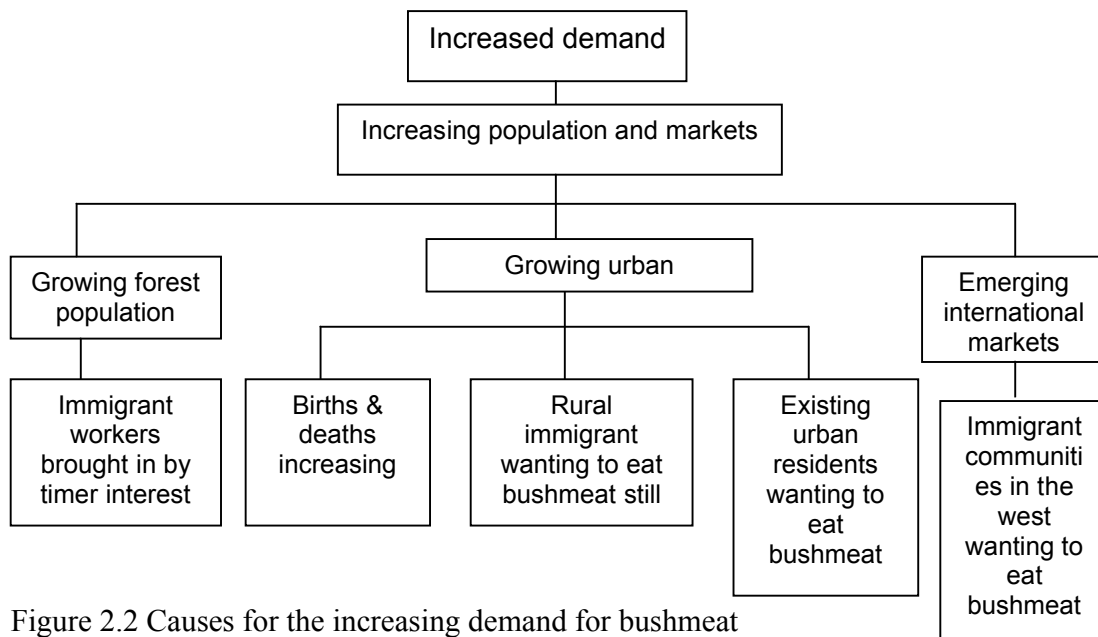


Figure 2.2 Causes for the increasing demand for bushmeat

Even though wild meat is usually considered a “minor forest product” and not included in most estimates of Gross Domestic Products (GDP), its value within local and nutritional economics is considerable.

2.6 INFLUX OF LARGE WORKFORCES WITH CAPITAL

According to Koulangna (2001), logging companies do not supply their workers with protein as a result the workers have resorted to poaching of wild game. Today the bushmeat crisis has several aspects ranging from ecological, social, economic and cultural implications in Cameroon (Koulangna 2001; Williamson and Usongo 1996). Hunting for bushmeat has seriously affected parks and protected areas in Cameroon within the last decades (Fondo et al. 2005; BCTF 2000; Eves and Ruggiero 2000; Njiforti 1996). In separate studies conducted by Fimbel et al. (2000) and Koulangna (2001), wildlife species in protected areas of Cameroon like the Dja Wildlife Reserve, Boubandjida National Park, Lobeke National Park, Korup National Park, Faro National Park, and the Banyang-

Mbo Wildlife Sanctuary are on a serious decline due to poaching for commercial bushmeat trade (Table 2.4).

Table 2.4 Wildlife species off-take in two protected areas in Cameroon.

Species	Banyang-Mbo Wildlife Sanctuary (%)	Dja Wildlife Reserve (%)
Duikers	36	80
Rodents	13	5
Gorillas	0	44 (yearly)
Elephants	84 (3 years)	150 (yearly)
Other primates	10	4
Chimpanzees	10 (2002)	26 (2001)

Source: Koulanga 2001

It has been reported that the influence of man's direct activities on the environment such as logging and oil companies, mining, clearance of forest for agriculture and hydroelectric dams has led to the disappearance of vast amount of forests. According to Peres (2000), this has led to an increase in forest frontiers, therefore bringing a vast number of people into closer contact with wild animals. Large-scale agricultural practices in such areas are going on leading to a high demand for food. Bushmeat which is the nearest available food source is harvested for consumption by the local people. Bowen-Jones and Pendry (1999) reported that logging companies pay local hunters to supply bushmeat to their workforce. It has also been noted variously by different authors that roads also provide an easy means for the transportation of bushmeat to market places (Dupain et al. 2000; Bowen-Jones and Pendry 1999; Thibault and Blaney 2003 and Walsh et al. 2003).

Logging roads are said to provide access to the jungles for hunters. Wilkie et al. (1998) found out that loggers could earn 2 to 3 times the national wage and could therefore afford to buy bushmeat. This was confirmed in a study conducted by Bowen-Jones et al. (2003) whereby they discovered that there were many "chop bars" in logging areas in the forest within the Congo basin.

These chop bars are roadside cafeterias where bushmeat is being sold in stew and the presence of such indicates that bushmeat is readily supplied to loggers who can afford to consume it.

It has been observed recently that not only the local farmers try to supplement their income by hunting. Many employees of oil companies and loggers also hunt bushmeat to supplement their income. Though employees of logging and oil companies are prohibited to hunt for bushmeat within their forest concessions, Thibault and Blaney (2003) however, noticed in their study that hunters were seen driving oil company vehicles and buying bushmeat at Gamba markets in Gabon. In a 67 day survey carried out by Thibault and Blaney (2003) during which Shell private flights to Gabon were searched, large quantities of bushmeat was discovered which included 49 kg of unidentified primate and other species including gorilla, python and blue duiker, the attractive, lucrative aspect of the bushmeat trade was revealed. Within recent time, bushmeat trade has become so commercialized that in some West African countries such as Liberia bushmeat trade is now thought to be more lucrative than the timber trade (Bowen-Jones et al. 2003).

2.7 BUSHMEAT IS A CHEAP PROTEIN SOURCE

It has generally been revealed that rural communities in the forest and savannah zones of Cameroon consume bushmeat because of its lower price relative to other alternative sources of protein. According to Walsh et al. (2003) it was found out that bushmeat cost about 1/3 the price of any of the other alternative sources of animal protein such as beef, fish or chicken in remote villages in the Congo basin.

In another survey conducted by Wilkie et al. (1998 cited in Noss 1998), in Bayanga an area in Central African Republic, beef prices were estimated at 2 to 3 times higher than the prices of bushmeat. Similarly, it was established that a kilogram of bushmeat in various towns near the Ngotto forest in CAR ranged from US \$0.32-0.75 whereas one kg of goat meat was US \$1.75 / kg chickens were US \$3.52 / kg and caterpillars were relatively expensive US \$3.65 / kg (Delving 1997).

2.8 CULTURAL AND SOCIAL BENEFITS OF BUSHMEAT

In addition to providing meat important social and cultural tradition for many tropical forest people of Cameroon. Acquisition of animal trophies as cultural artefacts or for personal adornment (e.g. skin, feathers and teeth) is a widespread practice throughout tropical forest regions (plate 2.1).



Plate 2.1 Tooth of an elephant shown to researcher in one of the Mbo villages

In many African cultures, animals and hunting are inextricably woven. Hunters gain lots of respect within their local communities and it has further been revealed that hunting is used to test a man's attainment of manhood or winning a bride. It has also been shown that hunting can also be essential for other cultural events such as the naming of children. This has caused people in the tropical forest to hunt for bushmeat even when alternative sources of protein or income do exist (Table 2.5) (Eves and Ruggiero 2000; Hill and Padwe 2000; Jorgenson 2000; Lee 2000).

Table 2.5 Combined subsistence and commercial value of bushmeat produced per km² of tropical forest per year.

Area	Value of bushmeat/km ² /yr (US \$)	Sustainability of hunting
Korup Nat. Park Cameroon	106	NO
Arabuko-Sokoke Kenya	94	NO
Ituri forest (Democratic Rep. Congo)	318	NO
Tahuayo Peru	42	NO
Tahuayo Peru	31	YES

Source: Adapted from Bennett and Robinson 2000

In a survey by Peres (2000) it was observed that forest aborigines have a phrase for “craving meat” and they feel that a meal is not a meal in the absence of bushmeat or fish. According to Newing (2001), hunters have a “have to eat today principle”. In a study conducted by Carpento and Fusari (2000) on the Banyamurezi hunters in central-western Tanzania it was revealed that 27.54% of all bushmeat came from the hunting of carnivores and primates. These groups of animals were mostly targeted because they were preying on domestic animals and also destroying crops. They further speculated that the meat of these animals was not consumed because of the presence of taboos or a dislike for the taste of the meat. Another hunting ecological study in the DRC by Wilkie et al. (1998) reported consumption of bushmeat as a source of protein even though local people may own domestic animals. They found out that domestic animals were not killed because they are used as savings or to pay for health care, births, marriages and deaths.

According to a report by Wilkie (2001), many people in the Congo basin have a strong cultural preference for bushmeat and people in Gabon buy bushmeat that is 1.6 times the price of normal domestic animal meat. Their report revealed that bushmeat is seen in some social arenas as a luxury item for the elite. In yet another study conducted in Nigeria, Bowen-Jones (2003) concluded in his findings from the survey that bushmeat is considered as a delicacy for the rich people in some areas of that country.

He proposed that purchasing and consuming bushmeat is a way of getting back to the roots “village food” and to “show-off” wealth. He also found out that although people have preferences over the type of bushmeat they consume, they will only switch their preference depending on prices and availability.

2.9 RELATIONSHIP BETWEEN HUMANS AND WILDLIFE

There are many traditional legends and folk tales in cultures which point to an intricate relationship between humans and wildlife. A common belief is that some wildlife exists as the totems of some ethnic groups, clans or individuals (Inyang 2002). Embola (1999) noted how as a result of their feeding habits, some species notably the chimpanzees and gorillas are regarded by the local people as the closest human ancestors and are therefore commonly forbidden to be eaten (Inyang 2002; Willcox and Nzouango 2000).

There exist a complex relationship between humans and Elephants in Banyang-Mbo and Korup forest areas. Although Elephants raid farms and are feared and treated as pests, they play a very important role in the local folklore. Some traditional societies are dedicated to Elephants Powell (1997) and there is a universal and strong belief among the local populations that humans are capable of transforming and do transform, themselves into Elephants (Powell 1997; Inyang 2002). It is believed that natives can transform into Elephants and take revenge against their enemies Embola (1999) or exact retribution for some unpaid debt of crop raiding by cult members of the neighbouring villages (Inyang 2002).

2.10 CAUSES OF WILDLIFE HUMAN CONFLICTS

The significance of wildlife has turned it into such a highly priced political commodity that politicians use it to discriminate between allies and enemies.

In the same vein, because wildlife is an important economic and political resource, individuals and groups have sought to structure policies to secure its benefits for themselves. The frequent outcome of this effort is the formulation and application of wildlife policies that do not necessarily protect animals, as evident by the attendant generation of poor conservation results in some countries but rather protect the interests of certain groups. Despite the meat and income derived from hunting, villagers consider the costs imposed by wild animals to be extremely burdensome and would rather prefer to have the marauding species eliminated in their area (Gibson 1999; Inyang 2003; Nchanji 2001). A number of factors have been identified that contribute to the conflict between humans and wildlife. Some of these can be found in a definition of environmental conflict as a conflict that is caused by a real or perceived resource scarcity, which in turn, stems from environmental degradation or negative environmental change (Lewis 1996). Human-wildlife conflict has become widespread due to rapid human population growth in Africa, which leads to the encroachment of agricultural activities into wildlife habitats (Hoare 1999). This results in fragmentation of the rangelands, with a significant impact on wildlife biodiversity loss especially the larger animals due to inadequate living space within the smaller forest patches.

2.11 TRENDS OF HUNTING IN CAMEROON'S TARGET SPECIES

Recent research activities in the field clearly shows that the most targeted species of wildlife are found among duikers, primates and the forest Elephants (Koulangna 2001). Following studies in and around the Dja biosphere, Seme and Amougou cited in Koulangna (2001), eighty percent of hunters' catch were made up of Artiodactyla, belonging to the order making up the family of duikers. In another study carried out in the same area, primates represented 4% of animals killed in the area.

Independent studies carried out by Wal and Nku, (1999) and Williamson and Usongo (1996) indicated that the Dja reserve has the largest quantity of great apes in the whole of Central Africa (1.9 head /km² and 1.6 heads/ km² respectively).

In another study by WCS in the Banyang-Mbo Wildlife Sanctuary, duiker species represented (36%) of all the animals found in hunters' possession, rodents (13%) and primates (10%). Ayeni et al. (2001) also indicated that duikers constituted most of the animals (44%) found in the harvest of hunters in a field survey conducted at the Takamanda Forest Reserve. Rodents represented (35%) and primates (18%). It is quite evident that in terms of numbers of wildlife killed all over Cameroon, duikers in general and blue duikers in particular are the most threatened species (Koulangna 2001). His study showed that in terms of biomass off-take and the effect on the ecosystem, Elephants and primates are on a steady increase. This has become a major worry to wildlife managers in Cameroon. Van der Wall and Nku (1999) after surveying the Dja reserve to take inventory of wildlife harvested yearly came out with finding which showed that 44 Gorillas and 150 Elephants are killed each year in the Dja reserve, whereas Fotso (2000) in an Elephant survey at the Banyang-Mbo area found out that 84 Elephants were killed every 3 years within the sanctuary area. In another study in the South East of Cameroon, Usongo and Ngeungeu (2000) reported 350 Elephants killed each year.

2.12 IMPACTS OF HUNTING ON WILDLIFE

In Cameroon like elsewhere in the tropics, even when hunting is meant for subsistence alone, large numbers of animals are harvested from the forest every year (Table 2.6), the total catch does not only constitute "bushmeat" generally considered to be important for human nutrition, but includes a wide range of other species. Such hunting has a significant effect on wildlife populations. Following a field study in Cameroon conducted by Bennett and Robinson (2000) it was concluded that like elsewhere in the Congo basin, hunting in Cameroon was largely additive to natural mortality and to a large extent contributes most to population decline of hunted species.

Table 2.6 Percentage of hunted species for which hunting rates are unsustainable

Ethnic group	Country	Hunting reason	% Unsustainable Hunting of species
Huaorani	Ecuador	Subsistence	30 (10)
Ache	Paraguay	Subsistence	0 (7)
Siriono	Bolivia	Subsistence	50 (10)
Sanya	Kenya	Subsistence	42.9 (7)
Bubis Fang	Bioko Equatorial Guinea	Subsistence & trade	30.7 (16)
Various	Central African Rep.	Subsistence & trade	100 (4)
Bangando, Baka	Cameroon	Subsistence & trade	100 (2)

Figures in parentheses = number of species analyzed.

All hunters comprised members of local communities

Source: Robison and Bennett 2000

Forest hunters often take a wide range of species e.g. the Maraca Indians of Colombia kill at least 51 species of birds, the Huaorani of Ecuador take about 25 species of mammals, 11 birds and 5 reptiles Mena et al. (2000), whereas in another study carried out in Bolivia, Townsend reported that the Siriono Indians hunted 23 species of mammals, 33 birds and 9 reptiles. In similar studies across Africa, Noss (2000) documented the capture of 33 species of mammals, 7 reptiles and 3 birds using wire snares in southwest Central African Republic while Fimbel et al. (2000) reported that hunters in the Lobeke region of Cameroon take at least 36 animal species. World wide hunting studies show that while a few species provides most of the diet, they are not the only ones significantly affected by hunting. Recent studies indicate that to most tropical forest hunters, “game” is any animal encountered ranging from small rodents or birds to large ungulates and almost anything else in between (Bennett and Robinson 2000; Hofer et al.1996).

Table 2.7 Number of mammals (> 1 kg) hunted/ km²/ year. All hunters comprise members of local communities in areas free from logging.

Ethnic group	Country	No. of animals hunted/km ² /year
Maya	Mexico	0.49
Ache	Paraguay	14.9
Huaorani	Ecuador	10.1
Siriono	Bolivia	14.3
Sanya, Mijikenda	Kenya	8.0
Xavante	Brazil	0.77
Various	Central African Republic	26.9
Various	Indonesia	7.39
Various at Ambang	Indonesia	4.52

Source: Bennett and Robinson 2000

2.13 FACTORS AFFECTING THE SUSTAINABILITY OF HUNTING IN THE CONGO BASIN

Many factors affect the sustainability of hunting in the tropics. These factors can act both independently and together. Based on results from recent studies in tropical forests, the main factors affecting the sustainability of hunting in Cameroon like elsewhere in the tropics can be attributed to biological, social (including patterns of human settlement and immigration), cultural and religious, physical and geographical and economic (Robinson and Bennett 2000a).

2.13.1 Biological factors

The biological characteristics of harvested populations limit the supply of wildlife products and thus determine the extent to which wildlife species can be harvested sustainably. Production is the addition to the wildlife population, whether or not those additional animals survive.

It has been established by many ecological field surveys that production varies greatly between habitats. According to Bennett and Robinson (2000), hunting areas with low production are less likely to be sustainable since few animals are produced and the number of animals harvested can quickly exceed the number produced. Field report also indicates that in comparison with grassland and savannah ecosystems, tropical forests have a very low production / km² (Robinson and Bennett 2000b). The standing biomass / km² of harvestable animals in tropical forests are relatively very low and many species in tropical forests habitats have low intrinsic rates of population increase.

2.13.2 Vulnerability to harvest

Some species are more vulnerable to hunting pressure than others. Species with intrinsic rates of population increase are less resilient to hunting example primates and carnivores tend to have lower rates, while ungulates and rodents tend to have high rates. Hunting impact field surveys across the tropics have established that species whose mating, nesting, predator avoidance or social behaviour allow easy harvest are especially vulnerable to hunting example are group-living species like most primates since hunters encounter and can hunt more than one animal at one time (Wilkie and Carpenter 1999; Robinson and Bennett 2000b). Studies have also revealed that animals with spectacular displays or loud calls (e.g. birds of paradise and Hornbills (*Ceratogymna atrata*) or those that breed communally in accessible areas (e.g. maleo birds, turtles) are likely to be more at risk of being hunted. Slow-moving species, once detected are easily caught by hand (e.g. Tortoise, Bear cuscus, Pangolins).

Also species with a regular pathway are easy to trap (e.g. Porcupines); whereas species which are easy to bait, are also very vulnerable to hunting. Many species however, change their behaviour in response to hunting which lowers their risk of being hunted by e.g. changing their calling behaviour, avoiding vulnerable areas or becoming more nocturnal.

2.13.3 Social Factors

Human social patterns strongly influence the sustainability of hunting, primarily through demand for wildlife products and the effects of such demand on the rates of harvest of wild species. Human population densities influence hunting sustainability through their impact on demand and harvest levels; the more people using the resource, the less likelihood of sustainable harvest. A report from a field survey conducted by Robinson and Bennett (2000a) showed that when the biological carrying capacity of humans in tropical forests is exceeded, no amount of political empowerment or institutional strengthening will allow communities to manage or conserve their natural resources well. As forests areas decrease due to logging or agricultural conversion, the density of hunters using the remaining forests will increase. Effective population density also increases if peoples' access to forest is curtailed through the loss of land tenure, usufruct rights or other social dislocations. The problem is further compounded when new immigrants move into the area or outsiders start hunting along new access roads.

2.13.4 Cultural and religious factors

Religious and cultural traditions affect sustainability of hunting by controlling which species are hunted. Islam and Christianity have religious laws restricting the killing and eating of some species of wildlife. Where societies do hunt, religious and other cultural factors act on the sustainability of hunting primarily by influencing the diversity of species harvested and within a species, the numbers of animals and range of age-sex classes harvested as well as the hunting technology used.

2.13.5 Hunting practices

Traditional hunting practices are more likely to be sustainable than those employing new technologies, especially when the former are part of the repertoire of human groups who have lived for millennia in the same tropical forests. As hunting practices change, the probability that hunting will be sustainable decreases. Social taboos have also been shown to traditionally provide another safeguard against over-harvesting of certain species as reported by (Bennett et al. 2000; Hill and Padwe 2000; Leeuwenberg and Robinson 2000).

These taboos can be wide spread across a region or limited to certain ethnic groups, clans or families. Taboos can be formal, as in the case of many indigenous societies or informal as found in many other forest-dwelling people. As social taboos against hunting certain species break down, over hunting ensues.

2.13.6 Hunting technology

In separate studies conducted by some authors, it was revealed that improvement in hunting technology generally increases overall harvest as well as the diversity of species harvested (Mena et al. 2000; Hill and Padwe 2000; Bennett et al. 2000). It has been observed that even minor changes in technology can allow increased efficiency of harvesting wildlife. The novel use of dogs in conjunction with traditional spears by the Huaorani in Ecuador resulted in their starting to hunt tapir, brocket deer and collared peccary. The introduction of batteries and flashlights allowed hunting of nocturnal animals by the Kelabits in Sarawak. Access to bikes, motor bikes, and gasoline has all increased efficiency of hunting, the size of areas that can be hunted and ability to transport products. This leads to a decrease to sustainability of hunting. More over, the need for cash to purchase new hunting technology can increase harvesting of forest wildlife.

2.13.7 Economic factors

Increasingly the harvest of wildlife in tropical forests areas is becoming commercialized. As more areas of forest become accessible to local communities and forest people become increasingly involve in a cash economy, a major commodity to be traded will be wild game meat. Other wildlife products such as skin, skulls, feathers and fur might also be sold. Indigenous people increasingly trade wildlife for other goods including school fees, modern machines, books, salt, and televisions.

Whatever the reasons for its occurrence, commercialization of the wildlife trade from tropical forests invariably leads to greatly reduced sustainability of hunting. Commercialization can also increase the hunting pressure on rare species and non-commercial species (Bodmer and Puertas 2000). It has also been noted that where hunting communities have recently entered the market economy, commercialization can result in debt peonage (Hart 2000; Stearman 2000). Access to capital allows traders to supply new hunting technology (guns, wire snares and flash lights) to hunters, who frequently remain in continuous debts to the traders. This debt peonage serves to increase hunting intensity, as hunters continuously have to harvest and sell more wildlife to pay off debts.

2.14 MODELS AND INDICES OF SUSTAINABLE BUSHMEAT HARVESTING

As bushmeat is a renewable natural resource, it can be harvested at sustainable levels so that local extirpations of wildlife species do not occur. In addition, local people can continue to use bushmeat so as to meet dietary protein needs. According to Caughley (1985), theoretically harvested game population should be maintained at a level below carrying capacity (K). The resulting harvest is a percentage of the production level of maximum sustainable yield (MSY) this method of managing exploited species functions quite well in situations where the populations of the species are closely monitored. Rarely can the necessary wildlife population data be achieved in tropical forests due to the labour intensive nature of monitoring tropical forest wildlife populations and the current

capacities of agencies in charge of wildlife in the tropics to implement monitoring regulation programmes. Despite the daunting logistics of collecting sufficient data to analyze the sustainability of hunting in tropical forests several scientists have adopted models from Caughley (1977) or developed them independently to assess sustainability of hunting in tropical forests (Bodmer 1994; Robinson and Bodmer 1999; Novaro et al. 2000). Robinson and Bodmer identified and explained eight different models to determine the sustainability of hunting. They are; abundance, density or standing biomass comparison, stock recruitment models, effort models, age structure comparisons, harvest models, unified harvest models, production models and source-sink models. Each method has its strengths and limitations, assumptions and data inputs.

Observational data can also be a powerful index when determining the sustainability of hunting in tropical forest. There are several documented studies conducted on bushmeat markets in Central and West Africa to assess sustainability (Fa et al. 2002; Lahm 1993; Anadu et al. 1998; Martin 1983; Fa 2000). Market data is particularly relevant to rapid assessments of the sustainability of hunting when the composition of animal species sold is analyzed (Fa et al. 2004; Wilkie and Carpenter 1999; Fa 2000). Since financial returns for large-bodied animals are higher than those for smaller ones, hunters tend to exploit and sell large duikers and primates first, followed by smaller-bodied animals like rodents and blue duikers. Therefore a market or hunting system that yields or sells more small-bodied than large-bodied animals is moving towards unsustainability as hunters have depleted the larger animals and are now forced to focus their attention on the smaller and less-marketable game. It has also been reported that changes in hunting yields over time also indicate the sustainability of hunting in an area (Robinson and Redford 1994). If a steady decline in hunting yield over time is observed, it is usually a sign that hunting is not sustainable. This approach makes two assumptions: that the hunters are putting at least the same effort into hunting through out the observed period as they did at the start of decline. That is to say the area is not new to exploitation as a new hunting area will show a decline as the harvest balances with the potential yield and as hunted animals become wary of human predators (Hofer and East 1995).

CHAPTER 3

GENERAL INTRODUCTION TO CAMEROON

3 GEOGRAPHICAL LOCATION

Cameroon is located in central Africa, extending from the Gulf of Guinea to Lake Chad, the country lies between latitude 2° to 13° North and 8° 30' to 16° 10' East longitude (Amou'ou et al, 1985) (see figure 3.1). The country covers a surface area of 475.385 km² and has a coastline of 402 km (Sayer et al. 1992). Cameroon has a triangular shape with a North-South length of 1400 km and a maximum width from East to West of 800 km (Amou'ou et al. 1985) and bounded to the South by the Republic of Congo, Gabon and the Atlantic Ocean to the West by the Republic of Nigeria to the North by Lake Chad and to the East by the Republic of Chad and Central African Republic.

The most recent national population estimate (UNFPA 1999) established a demographic figure of about 14.700.000 inhabitants against 7.663.655 inhabitants in 1976. The annual growth rate between 1995 and 2000 was estimated at (2.7%) (UNFPA 1999). About (65%) of Cameroonians live in the rural areas. Cameroon's location along the Equator gives it an opportunity to be one of the richest countries in Africa in terms biological diversity. In Cameroon, the marine and coastal ecosystems are the richest in biodiversity, followed by the tropical humid dense forest ecosystem. Generally, biodiversity richness decreases from the marine / coastal area in the south towards the semi-arid zone in the north. Different sectors activities take place in each of the ecosystems.



Figure 3.1 Map of Africa showing location of Cameroon

Source: CIA 2005.

3.1 HISTORY

This African nation called Cameroon today was settled over a millennium ago. The Portuguese were among the first Europeans to arrive Cameroon about 500 years ago and eventually made their way to the coastal region. They became impressed with the trading possibilities and established contact with natives of coastal Duola. When they entered the Wouri estuary, they found a variety of prawns in the region. They called the river “Rio dos Cameroes” (River of prawns) the Spanish version Cameroes later gave birth to the English version Cameroon, French version Cameroun and German version Kamerun. In the 17th century the Dutch displaced the Portuguese and established trade posts along the coast. After the Dutch many other Europeans entered Cameroon, e.g. the Germans in 1884 followed by the English and French when Germany was defeated during the First World War and all its territories overseas had to be sized and shared out. The different European countries established various administrative rules in Cameroon before independence.

3.2 INDEPENDENCE AND REUNIFICATION OF BRITISH SOUTHERN AND FRENCH EASTERN CAMEROONS

The French Cameroon became independent and became known as la Republic du Cameroon in 1960 and Ahmadu Ahidjo was made the first president of French Cameroon. Immediately after independence he granted amnesty to political prisoners. Foncha formed a government in Southern Cameroons. In 1961 a plebiscite was held in British Northern and Southern Cameroon. The Southern Cameroon voted to become part of la Republic du Cameroon. In 1962 the CFA (Communaute Financiere Africaine) became a legal tender in the Federal Republic of Cameroon. Foncha was elected vice-president of the Federal Republic of Cameroon. In 1963, Cameroon became a founding member of the OAU (Organisation of African Unity). In 1965, S.T. Muna formed the Cameroon United Congress (CUC) and A.N. Jua was made Prime Minister of West Cameroon. In 1966 Cameroon became a one-party state with the Cameroon National Union (CNU) party as the sole political party although the constitution allowed for multi-partism. In 1968 S.T Muna replaced Jua as Prime Minister of West Cameroon. This was also followed by the replacement of Foncha as the Prime Minister of the Federal Republic of Cameroon by Muna in 1970. It should be recalled that 1972 was a turning point in the history of Cameroon. This was the year whereby a referendum was held in Cameroon to merge the two Cameroons. The Federal Republic of Cameroon became the United Republic of Cameroon. The East Cameroon House of Assembly, the West Cameroon House of Assembly and the West Cameroon House of Chiefs were all abolished. The office of vice-President and the offices of Prime Ministers were also abolished. The President of the National Assembly was to succeed the President of the Republic in case of the latter's death or inability to rule.

The united republic of Cameroon was sub-divided into seven provinces, two Anglophone provinces of the North and South West and the other five provinces were all made up of French speaking Cameroonians. The office of the Prime Minister of the United Republic of Cameroon was once more created in 1975 with Paul Biya Mbi Vondo appointed as the Prime Minister.

The constitution was modified such that the Prime Minister and no longer the President of the Assembly was to succeed the President of the Republic in case of the latter's death or inability to rule. In 1981, Ahidjo inaugurated Cameroon's only national oil refinery (SONARA). In this same year there was an out break of border crisis between Cameroon and its neighbour Nigeria. Cameroon had only one party system the (CNU) under Ahidjo's rule. On the 6th of November 1982 Ahidjo made a surprised resignation, as President of the Republic of Cameroon handing over power to the Prime Minister Paul Biya. Ahidjo however, remained the chairman of the Cameroon National Union Party. The year following Ahidjo's resignation, Paul Biya announced a foiled coup plot and subdivided Cameroon into ten provinces with the North and South West Provinces being the only two Anglophone Provinces. Some differences between Ahidjo and Biya led to Ahidjo's resignation as chairman of the CNU party in 1983 and his resignation led to the holding of an extraordinary congress of the CNU party in Yaounde. President Paul Biya was elected new Chairman of the CNU Party. In 1984 Paul Biya changed the name of the United Republic of Cameroon once more to the Republic of Cameroon. The Anglophone Cameroonians were not very comfortable with this change of name. The office of the Prime Minister of the Republic was again abolished and the President of the National Assembly was to succeed the President of the Republic in case of the latter's death or incapacity.

In 1984 there was a failed coup d'état in Cameroon. This led to further deterioration of relations between Paul Biya and Ahidjo. During the National Agricultural show in Bamenda, the CNU party was dissolved and a new party formed called "The Cameroon Peoples Democratic Movement (CPDM)." In 1989, the former and first President of Cameroon died in exile in Dakar, Senegal. Infact 1990 was really a turning point in Cameroon politics with the launching of the Social Democratic Front (SDF) in Bamenda. This was done against the will of the government of Cameroon. During the launching six Cameroonians lost their lives after they were shot dead by the forces of law and order. This launching re-introduced multiparty politics in the country. It should be underscored that since the launching of the multiparty politics in Cameroon to date there has been unrest in the country because of election fraud which has often led to violent anti-government protest.

3.3 CULTURE

The ethnic composition of Cameroon is quite diverse with some 240 different ethnic groups and 24 major languages. Generally mostly Christian or animist Bantu and semi Bantu groups predominate in the forested southern half of the country. The Northern pastoral zones are dominated by mostly Moslem or animist Hamitic Fulani, Arab Choas and Sudanese Negros. Cameroon has two main official languages French and English with the French being the first official language. Among the many languages spoken in Cameroon, the main ones are Arabic, Bamoun, Ewobdi, Fulfulde and Bamileke. Makossa is the main music around the coastal zones of Cameroon but is gaining more grounds in other parts of Cameroon and Africa. Other brands of music commonly heard in bars and on the streets are; Bitkusi, Bend skin and within recent days Christian music mostly from Nigeria. Cameroon has famous musicians like Manu Dibango, Petit Pay, Sergo Polo, Ben Decca, El Chic Echondong, Lounge-Lounge just to name a few.

There are also several types of foods eaten by the different ethnic groups in Cameroon. Cassava leaves are one of the main important ingredients usually appearing on menus as faille. Different tribes or ethnic groups have different foods commonly taken on a daily basis e.g. the Bakwerians at the foot of Mount Cameroon have the “bible, kwa-coco or timanabusa” as their staple diet, whereas most of the north westerners and people from the western and northern provinces take “achu”, cocoyam and “fufu corn” and grains as their staple diets respectively. Meanwhile natives of the southern and eastern provinces have cassava and plantain as their staple diets. In large towns like Yaoundé, Douala and seaside towns of Limbe and Kribi, roasted chicken and fish are commonly sold. With slightly over two million inhabitants today, Douala is also Cameroon’s economic capital and the largest city of the region. There are interesting traditional activities that come up once every year among different tribes in Cameroon e.g. the annual Bamoun dance, the canoe race held in Limbe in the South West Province, the Ngondo festival, a great rendez-vous of the Sawa people with their history and tradition and the famous Mount Cameroon race of hope in Buea.

The people of the Western and North West provinces also exhibit very interesting cultural festivals annually. Among the country's best known writers are novelists like Mongo Beti, Ferdinand Oyono, Kenjo Jumban and play writer late Dr. Bate Bessong. These people have sold the image of Cameroon through writing and helped exposed the relationship between Cameroon and the colonial masters.

3.4 TOURISM

Cameroon has so many tourist attractions, ranging from the volcanic Mount Cameroon in Buea, the Manadara Mountains in the North to the beautiful beaches in Kribi, Mile 6 beach Limbe and numerous natural water falls like the Abi fall in Mbengwi Momo division, the Menchum fall in Menchum division. There are also numerous natural parks such as the Waza and Benoue in the North and Zoos with a rich diversity of animal species present. In 1980 about 10.000 tourists visited Cameroon's national parks of which (70%) were French. However, within recent years more tourists visit parks and zoos in the country. Cameroon's rich natural tourist attractions are yet to be developed.

3.5 ECONOMY

In 1984 a new Cameroonian investment code was adopted. It had as its main goal to favour and stimulate economic growth. The main source of Cameroon's revenue is still agriculture (Banana, Rubber, Cocoa, Cotton, Coffee and Oil palm) as the main products. About (78%) of Cameroonians are employed in the agricultural sector and make their livelihood from agricultural products. The industrial development is mainly concentrated in the coastal region while crop production is carried out else where in the country. The Biya government inherited the fifth Five Year 1981-1986 Plan from the Ahidjo government. In the first two years of the plan, real economic growth of (6.5%) was achieved close to the (7%) projection.

The first economic problem which confronted Biya was the economic crisis. Before 1987 visible signs of economic crisis were noticed, Cameroon had experienced a generalized economic growth. There was a significant level of investment of public funds and many people were employed into skilled and semi skilled professions. There was also an increase in production of goods and services and prices of raw materials in the world market were encouraging. From 1987 onwards the worldwide phenomenon of the economic crisis hit Cameroon. There was a drop in the production capacity of the plantations. Further investments were not carried out and farmers became disgruntled with the pay for their produce. There was a cut in civil servants' salaries and retrenchment of workers followed. This led to high unemployment in the country and in 1994 the situation was further worsened by the devaluation of the cfa franc. Cameroon's economy has not really been on its feet since the economic crisis stroked the country, people still live in misery, unemployment rate is high, crime wave is high and this has within recent years made local people to put up more pressure on natural resources thereby leading to the unsustainable exploitation of natural resources in the country. In February 2008, there was a violent nation wide strike to protest increase in the price of petrol and most food commodities that led to hundreds of deaths. This forced the Cameroon Government to increase civil servants' salaries by (15%).

3.6 CLIMATE

The Southern and Northern regions of Cameroon are two distinct climatic areas. On the coast, the average annual rainfall ranges between 250 and 400 cm and in the inland south between 150 and 250 cm. The western slopes of Mount. Cameroon receive 600 to 900 cm of rainfall in a year. The mean temperature ranges from 22°C to 29°C along the coast. In the south, there are two seasons the dry season, which runs from November to March, and the raining season, which starts from March to the end of October. The northern part of the country has a more comfortable climate. The total rainfall has been reported to drops from 150 cm a year in the central plateau to 60 cm northward near Lake Chad and the mean temperature range between 23°C to 26°C although it can reach 50°C in the far north. The dry season in the north starts from October to March.

3.7 NATURAL RESOURCES

Forest resources: Timber is one of Cameroon's most valuable exports. Large quantities of mahogany, ebony and teak were being exported in the early 1990s. The annual timber cut amounted to 14.6 million cubic meters. The economy of Cameroon is dependent primarily on agriculture and timber production, although receipts from petroleum exports also constitute a major source of government revenue. Wildlife is diverse and abundant and includes monkeys, Chimpanzees, Gorillas, Antelopes, Lions, Elephants and numerous birds and reptiles species. Other resources include bauxite, iron ore, fisheries, hydropower and a variety of non-timber forest products (NTFPs).

3.8 ENVIRONMENTAL SITUATION

The economic crisis that stroke Cameroon since the early 1990s has resulted to the country's inability to invest in its health, education and employment sectors. Today it is common place to find common water-born related diseases such as cholera, typhoid and dysentery in most rural areas of the country since rural communities use streams and rivers for cooking and drinking. Unsustainable exploitation of natural resources is also a common practice within the rural areas today resulting to massive desertification, poaching, over-fishing, deforestation and overgrazing. Located within the Congo basin, Cameroon has a tropical forest biomass that is second only to the Amazon in South America yet the forest is dwindling every minute because of the unsustainable rate of exploitation. Animals of all species suffer from the hands of poachers as the forest is opened up by logging companies for timber thus giving access routes to poachers. The high pressure put on forest resources combined with the weak enforcement of national forestry and wildlife laws, has within recent years resulted to a massive decline in animal populations and biodiversity loss in Cameroon's forests.

3.9 STUDY AREA

3.9.1 Creation and legal status of the Banyang-Mbo Wildlife Sanctuary

The government of Cameroon gazetted the Banyang-Mbo Wildlife Sanctuary on March 12, 1996 as the first and only wildlife sanctuary in the country following preliminary results of a research by Wildlife Conservation Society (WCS), which highlighted the biological richness of the forest. The Banyang-Mbo Wildlife Sanctuary was since 1939 existing as the Banyang-Mbo Council Forest Reserve. When its status changed, a major portion of land which comprises the southern area of BMWS was added. Certain species of animals including all relevant IUCN red-list animals were placed under special protection. The decree specified that the Leopard, African forest Elephant, Giant Pangolin, Chimpanzee, Drill, Water Chevrotain, forest Buffalo, all Tortoises, the dwarf, long snouted and Nile Crocodiles shall be given special protection. Other species of birds, animals and plants, protected throughout Cameroon (e.g. pythons and African grey parrots) are also found here. Upon the creation of the BMWS, all the stake-holding villages maintained their user rights. The user rights, notably to fish and collect forest products remain authorized as long as the conservation objectives are not compromised (Article 5. of Decree 96/119). Currently the management of the sanctuary remains under the administration of the local people with technical assistance from Wildlife Conservation Society and supervised by the Ministry of Wildlife and Forestry.

3.9.2 Physical Environment

The Banyang-Mbo Wildlife Sanctuary created by Prime Ministerial Decree No. 96/199 of 12 March 1996 covers an area of approximately 662.000 hectares and is located between latitudes 5°8′-5°34′N and 9°30′-9°47′N (MINEF 1998a; Willcox 2002, Willcox and Nzouango 2000, Inyang 2002, 2003; Tataw et al. 2001). The BMWS is situated within the three sub-divisions of Nguti, Kupe Manenguba and Upper Banyang in the South West Province of Cameroon. However, a few sanctuary villages in the eastern part fall under Melong sub-division in the Littoral Province.

The Banyang-Mbo Wildlife Sanctuary is presently the only wildlife sanctuary in the country. It is surrounded by fifty-five village communities drawn from five ethnic groups; the Banyang, Mbo, Bakossi, Bassosi and Banyue with a total population of about 25.000-30.000 people (Inyang 2003; Tataw et al. 2001; Willcox and Nzouango 2000; Nchanji 2001; Oslisly et al. 2000). There are however, only twenty-four villages with direct impact on the BMWS (Tataw et al. 2001). The Banyang-Mbo Wildlife Sanctuary is a biodiversity hotspot in the South West Province of Cameroon (Willcox 2002; Willcox and Nzouango 2000). Several species have been identified, these include 250 species of mammals of which 11 are endemic, 849 bird species, 140 reptile species, 190 amphibians and more than 8.460 plant species of which about 150 are endemic and a multiplicity of unidentified insects (WCMC 1994b; Birdlife International 2007).

The wealth of species has a wide ranging spectrum of ethno-zoological uses as bushmeat consumption, income sources, and uses in decoration. According to De Pierre and Vivien (1992) this region harbours one of the most diversified wildlife and endemic species in Cameroon. Despite the fact that Cameroon make up (1.6% of the African continent), the country is ranked fifth in terms of biodiversity after the Democratic Republic of Congo (DRC), Tanzania, Madagascar and South Africa (MINEF 1996) and harbours (26%) of Africa's mammals (Bessong, 1995).

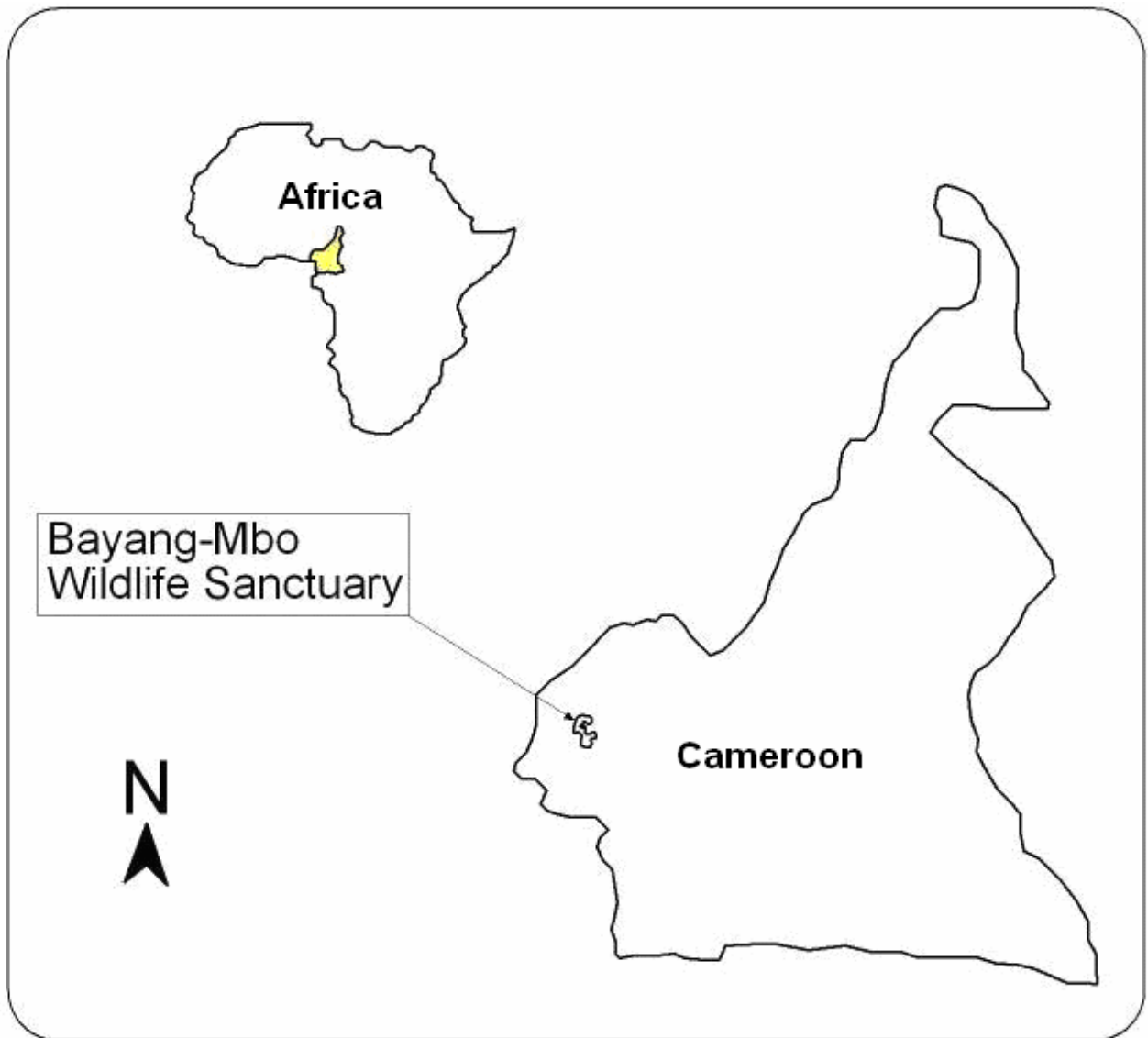


Figure 3.2 Cameroon map showing location of BMWS

Source: Adapted from Willcox and Nzouango 2000

Hunting, farming and collection of non-timber forest products (NTFPs) are the principal economic activities of the communities. Hunting is exclusively the activity for men and collection of NTFPs is chiefly that for women. Farming is shared between men and women (Inyang 2002).

The wildlife sanctuary was created with the key objective of conserving the biological diversity of the protected area by adopting a conservation approach based on the principle of community participation.

3.9.3 Climate

The Banyang-Mbo area experiences a hot and humid climate. The rainy season starts from mid-March and runs to the end of October. However, seldom is a month completely devoid of significant precipitation. Weather data in Nguti from 1993 to 2000 showed that the heaviest rainfall occurred between June and October. August with mean rainfall of 782 ± 178 mm is the wettest month while February with mean rainfall of 4 ± 3.6 mm is the driest month. The months of June to September each have more days of rainfall than others. The estimated annual rainfall is 3.497.7–4.739.0 mm with a mean of $4.082.7 \pm 486$ mm (WCS 1996). The highest rainfall peak is recorded in July to September (Nchanji and Plumtre 2001).

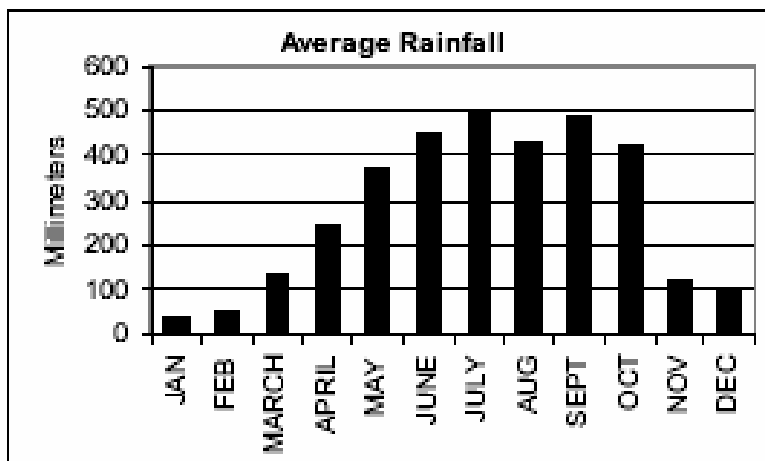


Figure 3.3 Rainfall recorded at the Banyang-Mbo area

Source: WCS 2002

3.9.4 Temperature

Relative humidity and daily temperature are fairly constant throughout the year and respectively range from (84% to 90%) and 27°C to 29°C with means of (87%) and 27°C. Annual mean temperature is 30.2°C.

3.9.5 Vegetation

Vegetation surveys are imperative since it is the vegetation that supports wildlife. Thus the existence of wild animals is dependent on the plants. The main vegetation in the Banyang-Mbo region on the lowlands, mid-altitude hills (120-1760 m), along the rivers and streams is predominantly the high diversity and stratified evergreen lowland rain forest type. In the larger portions of the BMWS through to the southern and central parts, there are tall trees arranged in three layers consisting of an upper stratum of very tall trees (*Pterocarpus*, *Soyauxii*, *T. superba*, *Irvingia gabonensis*, *Terminalia ivorensis* and *Poga deosa*). A middle stratum of shorter trees (*Treculia obvoidea*, *Diogoia zenkeri*, *Rauwolfia macrophylla*, *Protomegabrica stapfiana*, *Lophira alata*) and a lower stratum of short trees (*Raphia hookeri*, *Cararium schweinfurthii*, *Santiria trimera*, *Berlinia bracteosa*, *Azelia bipindensis*, *Gacrinia mannii* and *G. kola*). Within the lowland forest along the seasonally inundated areas is riverine forest dominated by members of the Myristicaceae, Leguminosae and *Euphorbiaceae marantaceae*, *Gingiberaceae* families and utilitarian palm, rattan palms as well as *Pandanus* species. In the northern part of the BMWS, rainfall decreases while altitude increases towards the western highlands and the evergreen forest gives way to semi-deciduous forests. Small sub-montane forest patches can be found from altitude 600-1500 m. The sub-montane forest exists only in small pockets dominated by *Podocarpus milanjanus*, *ficus spp.*, *Cyathea manriana*, tree fern, *Polyscias fulva*, *Bridelia speciosa*, *Dracaena arbocea*, and *Alanblackia gabonensis* flora species.

It has been established that in the BMWS a mosaic of different vegetation types occur consisting mostly of primary forest splashed with pockets of old secondary forest, recent secondary forest to the south and central areas and patches of sub-montane forest. The plant indicator species in the secondary disturbed forest are *Elaeis guineensis*, *Ceiba pentandra*, *Alchonea cordifolia*, *Musanga cecropoides*, *Anthocleista vogellii* and many members of Euphorbiaceae and Rubiaceae families (Letouzey 1985). In the woodland savannah areas of the BMWS there is abundance of trees including *Burkea africana*, *Terminalia macroptera*, *Combretum glutinosum*, *Poliostigma thonningii*, *Danielia oliveri*, *Lophira lanceolata*. Below the tree stratum (10-20 m) are dense tussocks of vegetation consisting of grasses such as *Andropogon gayanus*, *Panicum maxima* and herbs (White 1994).

3.9.6 Relief

The southern section of the Banyang-Mbo Wildlife Sanctuary is located west of Cameroon's highland range 1760 m extending to the north and to the west a flat lowland riparian zone 120 m (Nambu 2000).

3.9.7 Hydrology

The sanctuary is drained by numerous permanent and seasonal streams that rise from the highlands in the south and flow into the rivers Mbu, Mfu, Bagwor and Mfi, which empty into the Manyu River, a tributary of the Cross River.

3.9.8 Geology

The BMWS region is underlined by undifferentiated basement complex, which gives rise to steep, but shallow sedimentary soils derived from underlying acid crystalline rocks of granite, gneisses, schist and quartzites. During the Precambrian period, the zone was made up of marine fossils on which considerable sediments especially made up of clay resulted.

The sedimentary rocks have metamorphosed to include gneiss and micaschists, granites, chlorites, phagoclastic gneiss and calco-alkaline gneiss (Oslisly et al. 2000). The soils have a clayey to sandy clay texture. They are shallow on the hilltops and steep slopes of the western Cameroon highland range. Uncovered, the soils are clothed by a thin layer of organic matter that is readily leached by rains as the area is cleared for agriculture and other land uses.

3.10 DEMOGRAPHIC AND CULTURAL LANDSCAPE

Four major ethnic groups, the Banyang, the Mbo, the Bakossi and the Bassosi tribes (Figure 5.1) surround the Banyang-Mbo Wildlife Sanctuary. There are a total of 55 villages within and surrounding the sanctuary with varying degrees of impact on the resources of the sanctuary. These villages have either primary (claim traditional territory within the sanctuary) or secondary (hunt, fish, and gather non-timber forest products within the sanctuary). Of the four major ethnic groups within or surrounding the BMWS, the Banyang are primarily hunters, farmers and gatherers. The Mbo are primarily hunters and gatherers, the Bakossi and Bassosi ethnic groups are primarily cash crop farmers of cocoa and coffee. The women of these ethnic groups concentrate on food crop subsistence farming.

The Banyang people rely on cocoa, oil palm production, hunting, fishing and food crop farming and gathering of (NTFP) such as bush mango (*Irvingia gabonensis*), njansang (*Ricinodendron heudelotii*) and eru (*Gnetum africanum*) for their daily subsistence and income. The Mbo depend on hunting, fishing and gathering of (NTFP) and oil palm production for their livelihood. This study focuses on the Banyang and Mbo, which span the north western, northern and eastern boundaries of the Banyang-Mbo Wildlife Sanctuary because they take the primary role in hunting within and around the BMWS and the bushmeat trade is becoming highly commercialized (Tataw et al. 2001; Walsh 1998). According to Willcox and Nzouango (2000), the Mbo and Banyang people place high cultural value on many animals within the forest. The “leopard dance” in the Banyang tribe is the most powerful traditional dance reserved only for chiefs and when serious problems are encountered in the village (Tataw et al. 2001).

The focal costume of the dance includes the skin of a Leopard, which due to the present scarcity (or possible extinction) of Leopard has been substituted with genet pelt. In the Mbo area the Elephant has great importance in the society. Many decorations and costumes include parts of the Elephant. However, this cultural behaviour is greatly endangered due to the current trend that these animals are now hunted for commercial purposes not only for traditional ceremonies.

The Mbo and Banyang tribes both believe in “totem” animals. It is commonplace to hear of villagers transforming into their totem animal during the night or when there is great distress in the village (Tabi personal com). These animals include Elephants, Chimpanzees, Gorillas, Crocodiles, Buffaloes, and Leopards. If one of the totems is killed in the bush, the person concerned will become gravely ill and possibly die if they are not taken to a traditional doctor and given a new animal. However, this once strong cultural belief has weakened to such a degree that hunters show no mercy to these totem animals and kill them if they are capable due to a market for their trophies and meat (Tanyi personal com).

3.11 ECONOMIC ACTIVITIES

The Banyang-Mbo wildlife sanctuary is a forest that supports a population composed of four ethnic groups. The major source of dietary protein is bushmeat and fresh water fish. Fishing is an activity predominantly undertaken during the dry season when the rivers are low and slow moving as most employ nets for this activity (Willcox and Nzouango 2000; Walsh 1998). Large domestic animals such as cows do not survive well here due to the presence of tropical diseases and the fact that the region is tropical forest (Inyang 2001; Tataw 2001). Moreover, the pastoral lifestyle is not and has never been part of the culture of the ethnic groups living within the sanctuary. Smaller domestic animals such as goats, pigs and chickens are reared, but not intensively. According to the local cultures of these people, they are kept for emergency income or traditional ceremonies such as marriages, funerals, “born house”, sickness etc.

Previous research indicates that the principal economic activities in the Banyang-Mbo area are hunting, farming and collection of non-timber forest products (NTFPs). Hunting is exclusively an activity for men while women carry out the collection of non-timber forest products. According to Inyang (2002), Willcox and Nzouango (2000), hunting is carried out all the year round with peaks in July and August. There are about 429 hunters, excluding non-resident outside hunters, engaged in hunting in and around the wildlife sanctuary (Inyang 2002; Willcox and Nzouango 2000). Some of these hunters are occasional or part-time hunters who hunt mainly for subsistence, particularly to make quick cash for the provision of basic household needs while others are professional or full-time hunters whose income is generated exclusively from hunting. The game meat is sold to bushmeat dealers in open local markets or through private arrangements with intermediaries and is finally supplied to hotels and restaurants in the towns where there is a high demand for it.

Farming has been reported to be a shared activity between men and women, with the men concentrating more on the production of cash crops like cocoa and coffee while the women generally produce food crops such as cassava, maize, beans, cocoyam, and yams chiefly for subsistence (Inyang 2002). The men often assist the women in clearing the farm plots from January to February and in the cultivation of major food crops like bananas and plantain in March and April using traditional slash and burn shifting agricultural method. Trees are cut and only a few are left to provide shade and protection for the crops.

The collection of non-timber forest products like bush mango (*Irvingia gabonensis*), eru (*Gnetum* spp.), bush pepper (*Piper guineensis*) and njansang (*Ricinodendron heudelotii*) are viable income sources for women in this area. men are gradually becoming interested in the collection of NTFPs, especially of bush mango, because of its added economic value. The Banyang-Mbo Wildlife Sanctuary with an estimated population of 25.000-30.000 inhabitants (1987 census) seems to be exerting economic pressure on the forest resources within the sanctuary. According to Nambu (2000), unsustainable hunting is presently estimated at about 2.5 times. The lack of roads to facilitate alternative lifestyle has caused a majority of the families in the lower Mbo region to practice hunting and sales of bushmeat as their major occupation.

3.12 ASSESSMENT OF WILDLIFE RESOURCES WITHIN BANYANG-MBO AREA

Preliminary wildlife assessment studies have been carried out by Wildlife Conservation Society (WCS) to determine the biological richness of the Banyang-Mbo Wildlife Sanctuary (WCS 2002). Wildlife biodiversity survey results showed that the sanctuary is rich in mammals, reptiles, amphibians, birds and insects. A previous study in this area indicates the presence of a rich array of some 250 mammals of which 18 are primate species. 849 bird species, 140 reptile species, 190 amphibians and more than 8.460 plant species of which about 150 are endemic and a multiplicity of unidentified insects (WCMC 1994; Birdlife International 2005; Bessong, 1995). The following primates: Crown guenon (*Cercopithecus pogonias*) Baboon (*Papio anubis*), Mona monkey (*Cercopithecus mona*), Putty nose monkey (*Cercopithecus nictitans*), Red eared monkey (*Cercopithecus erythrotis*), Drill (*Papio leucophaeus*), Preuss's guenon (*Cercopithecus preussi*), Tantalus monkey (*Cercopithecus tantalus*), Potto (*Perodicticus potto*), Grey cheeked mangabey (*Cercocebus albigena*), Chimpanzee (*Pan troglodytes*), Allen's Galago (*Galago alleni*) and Dwarf Galago (*Galago demidovi*), have been confirmed to be utilized for food and as a source of income while some are captured alive and sold as pets within the Banyang-Mbo Wildlife Sanctuary. This is done contrary to the fact that the Drill, Preussi guenon, Chimpanzee, Potto, Leopard, Galago and giant Pangolin are protected species under the Cameroon Law No. 94\01. Besides the primates, other non-primate mammals are also hunted and consumed: e.g. Hyrax (*Procavia capensis*), Giant otter shrew (*Potamogale velox*), Blue duiker (*Cephalophus monticola*), Bay duiker (*Cephalophus dorsalis*), Red river hog (*Potamochoerus porcus*), Water chevrotain (*Hyemoschus aquaticus*), Buffalo (*Syncerus nanus*), Ogilby's duiker (*Cephalophus Ogilby*), Yellow backed duiker (*Cephalophus silvicultor*), Bush buck (*Tragelaphus scriptus*), Giant rat (*Cricetomys gambianus*), Grass cutter (*Thryonomys swinderianus*), Western ground squirrel (*Xerus erythropus*), Porcupine (*Atherurus africanus*), Giant forest squirrel (*Protoxerus stangeri*), Beecroft's flying squirrel (*Anomalurus beecrofti*), Pygmy squirrel (*Myosciurus pumilio*), Black footed mongoose (*Galeriscus nigripes*), Spotted necked otter (*Lutra maculicolis*), Large spotted genet (*Genetta tigrina*), the African forest Elephant (*Loxodonta cyclotis*) Small spotted genet (*Genetta genetta*), Cussimanse mongoose (*Crossarchus obscurus*) and Civet cat (*Civettictis civetta*).

Some of the reptiles and birds hunted for food, medicines, ornament or captured alive as pets include: long tail Pangolin (*Manis tetradactyla*), Green Tauraco (*Tauraco persa*) Monitor lizard (*Varanus niloticus*), African rock Python (*Python sabae*), Crested guinea fowl (*Guttera pulcherani*), Crocodile (*Crocodilus niloticus*), Blue spotted wood dove (*Turtur afer*), African grey Parrot (*Psittacus erithacus*), Black casqued Hornbill (*Ceratogymna alata*), Great blue Tauraco (*Corythaeola cristata*), and Tree Pangolin (*Manis tricuspis*). The green Tauraco and the Grey Parrot are presently protected under Cameroonian Law.

3.13 INSTITUTIONAL FRAMEWORK

A continuous thread to Cameroon's rich biological diversity requires a wide range of intervention from the public sector, bilateral cooperation agencies, NGOs and the local communities. Before independence special legal and administrative structures were set up in Cameroon by the colonial masters e.g. the Germans and the French to cater for the conservation of specific ecosystems and threatened and endangered species of animals. After independence the Cameroonian government created more national parks, game reserves, zoos and protected areas in a bid to further conserve and protect its natural forest resources. Following the importance the country paid on its forest wildlife resources, a sub-department of the Environment and Human settlement was created in the defunct Ministry of Planning and Regional Development in 1985. This administrative unit was later replaced in 1992 by the former Ministry of Environment and Forests which was again replaced in 2004 by the present Ministry of Wildlife and Forestry. Other important organs that are used for the conservation of biological diversity in Cameroon include the establishment of supporting collaborative mechanisms with bilateral cooperation agencies such as WWF, GTZ, WCS, LAPA (last apes protection alliance), World Fish Centre, local NGOs such Cameroon Wildlife Conservation Society etc and the local communities.

Until recently, the management of natural resources in Cameroon was by default and tradition a regulatory mechanism that provided the main framework for the conservation of biodiversity.

Recent surveys have shown that despite the fact that local communities are aware of the fact that their natural resources have to be protected, there is increase evidence of abuse and unsustainable exploitation of biological resources especially in the rural areas of Cameroon. This abusive exploitation of biological resources has forced the government of Cameroon to play a more direct role in order to reduce the rate of destruction of the biologically rich resources of Cameroon and to promote sustainable harvest and conservation of biodiversity.

Since the early 1930s, parks, nature reserves and zoological gardens were the primary methods established by the government of Cameroon to conserve threatened and endangered species and ecosystems. Also as a complimentary approach, the government has also developed partnership with a number of bilateral cooperation agencies, national and international NGOs and recently with the local communities in order to facilitate biodiversity conservation. The Ministry of Forestry and Wildlife created in 2004, has the following legal and administrative responsibilities in relation to biodiversity conservation:

- To draw guidelines on the environment
- Formulate, implement and follow up of government policies
- Establish appropriate linkages with relevant biodiversity conservation institutions and individuals
- Sensitize and educate the communities on environmental issues
- Negotiate signatories and ratification of international conventions and treaties

3.13.1 Legislation

Laws decreed in the following Prime Ministerial orders regulate wildlife harvesting in Cameroon:

- Laws No. 81/13 of 27 November 1981 on forest, wildlife and fisheries today replaced by that of 24/01 of 20th January 1994.
- Law on financial obligations for forest, wildlife and fisheries exploitation in Cameroon
- Ministerial order stipulating the open and close seasons for hunting in the whole territory

- Decree No.2313/A of 28 June, placing animals into class A, B and C and these animals have to be hunted with issuance of specific types of permits as well as the latitude of shooting. Cameroon is a party to the following international environmental conventions:
- Convention on the Protection of Cultural and Natural Heritage (Paris, 23 November 1972);
- Convention on International Trade in Wildlife and Endangered Species (Washington, 3 March 1973);
- Vienna Convention on the Protection of the Ozone Layer (Vienna, 22 March 1985);
- Montreal Protocol on the Control of Chlorofluorocarbons (CFCs) (Montreal, 16 April 1987);
- Convention on Climate Change (14 June 1992);
- Convention on Biological Diversity (14 June 1992);
- Convention on Desertification (Paris, October 1994);
- Cooperation Agreement with International NGOs (IUCN, WWF, ITTO, ATO).

Continental Conventions include:

- Convention on the Conservation of Cultural and Natural Resources (Algeria 1968);
- Bamako Convention on Waste Importation in Africa and Trans-border Movement and Management of Toxic Wastes.

Sub-Regional Conventions include:

- 1964 Accord creating the Lake Chad Basin Commission Accord on joint regulations of fauna and flora within Lake Chad
- Convention on cooperation relating to the protection and development of the Marine Environment and the Coastal Areas of West and Central Africa (Abidjan, 16 March 1981)
- Accord for cooperation and consultation among Central African states relating to wildlife conservation (Libreville, 16 April 1983) and
- African Timber Organization (ATO).

3.13.2 Administration

Natural resource policy in Cameroon is as old as Cameroon itself. Before the arrival of the first colonial administrators in 1900, natural resources were managed according to the people's law (i.e. family law). The village chiefs were the main administrators of resource management, for example when a hunting party returned to a village, all the animals killed were brought to the chief whose duty was to distribute the meat to all the villagers. When hunters went outside the village's zone they were required to first ask the permission of the chief to enter the forest of that village. If they did not, they could be punished through a number of ways such as the totem of the village (an animal that was in the forest to protect it). The hunter would not have the opportunity to shoot an animal or even if he had an opportunity to see it, they would not be able to reach it, to kill it.

After the arrival of the first colonial administrators, natural resources which had belonged to the people became the property of the first administration and a formal administrative structure evolved. People were forbidden to kill an animal, if they did not have a hunting permit from the colonial administration. Such measures created real tension and some resistance on the part of local populations. Nevertheless a new set of systems arose along with the first creation of protected areas e.g. during the German colonization, the Limbe Botanical Garden was created after World War I. This garden still exist today and serves as an example of biodiversity conservation in Cameroon.

By 1960 when Cameroon became politically independent there were already a number of operational hunting reserves in the country including the Waza, Kalamaloe, Douala-Edea, Dja, Sanchou, and Korup. However, since independence the means available for development of these biological resources have been decreasing, relative to those available under colonial regimes.

Natural resource management in Cameroon has been under the responsibility of several ministries. Since independence to present date the following ministries or departments have been responsible for natural resources management; Departments of Rural Development, Departments of Tourism, Ministry of Livestock, Fisheries and Animal Husbandry, Environment and Nature Protection and the

Ministry of Forestry and Wildlife among others. Today all natural resources belong to the state and the law punishes anyone who damages them. The Ministry of Wildlife and Forestry is charged with the management of parks and reserves and also controls the use of forest natural resources represented at the provincial level by the provincial delegates of Forestry and Wildlife with its divisional and sub-divisional units. The Ministry of Technical and Scientific Research is responsible for coordinating and developing research in protected areas in Cameroon today.

3.14 HUNTING

Hunting in any of the hunting zones in Cameroon is practiced after obtaining a hunting permit. Three types of hunting permits are issued; Small hunting for the holders of inferior gauges of size 6mm (gauge 22) and of rifle with unrifled bore (gauges 12, 16 and 20) for hunting the animals with feathers or hair (birds and small mammals). The average drive out of the rifles of variable sizes between 6 and 9 mm is destined to kill average size mammals such as the cob of western Buffalo, the cob of Bush Pig and Baboons. Professional hunting using rifles of superior gauge size 9 mm is used for the demolition of big games such as Derby Eland, Hippopotamus, Elephants and Gorillas.

3.14.1 Conditions for hunting in Cameroon

Sports hunting are granted after the hunter has fulfilled certain conditions and has met up with the following formalities: (1) The hunter must be at least 21 years of age and must be informed on the texts in force concerning fauna on the list of the animals of classes A, B and C, since the list of the animal species influences the type of permit as well as the latitudes of demolition (2) He must have completed and deposited at the service concern with wildlife an application file to obtain the sports hunting permit; (3) He must rent a zone of hunting he wants to hunt in a zone managed by the administration in charge of wildlife.

Subsistence hunting is mostly carried out with little or no conditions placed on it. This hunting type is commonly carried out by the local communities who have legal rights to live on the products derived from the forests. However, there are a number of restrictions on protected and endangered species and the use of firearms and wire snares (MINEF 1995). This hunting type is practiced mostly to meet the nutritional needs of the rural populations. Commercial hunting involves poaching of wildlife. It is carried out by professional hunters. It involves the use of wire snares as traps and short guns. The conditions needed to carry out this hunting type are:

- The hunter must be at least 21 years of age
- He must have completed and deposited at the service concern with wildlife, an application file to obtain the professional hunting permit.
- He must be informed on the texts in force concerning fauna and the list of the animals of classes A, B and C, since the list of the animal species influences the type of permit as well as the latitudes of demolition.

3.14.2 Animals protected in Cameroon by order No. 2513 of 28/06/1998 and order No. 013 MINEF of 31/05/1995.

Table 3.1 Class “A” mammals and birds in Cameroon

Mammals	Birds
Lion	Ostrich
Leopard	Batcher
Cheetah	Harrier Hawk
Caracal	Secretary Bird
Aardvark	Black Stork
Red-fronted Gazelle	White Stork
Mountain Reed Buck	Shoe Bill
Giraffe	Gray African Parrots
Water Chevrotain	
Black Rhinoceros	
Calabar Potto	
Boss man’s Potto	
Allen’s Galago	
Abyssinian B & W Colobus	
Chimpanzee	
Gorilla	
Elephant with tusk < 5kg	
Pygmy Elephant	
Manatee	
Gudalis (Ngaoundere)	

Source: Mbah 1997

Table 3.1 shows a list of species which are not allowed to be killed in Cameroon

3.14.3 Punishment of offences

Poaching according to Cameroon's wildlife law is defined as any hunting activity carried out without a permit, during the period of closed of hunting in protected areas. The poacher is anyone found at any time or any place in possession of a part, whole dead or live protected animals of class A and B. Defaulters are given a punishment fine of 50.000 to 200.000F CFA payment and an imprison term of 20 days to 2 months (MINEF 1997). These offences are doubled in a situation where the offence is repeated or in a case where the offence is committed by an authorized official of a competent or relevant administration or by a police officer or with their complicity.

3.14.4 Problems faced in implementing laws

Most of the administrative frameworks do not function adequately and policy guidelines are not respected due to:

- Under equipment of the services in charge of the fight against poaching.
- The insufficient involvement of local population into protected area management systems
- Insufficient and under-equipped personnel, poachers are using more and more modern guns to kill animals. In case of encroachment of poachers, the guards will be in trouble
- Low budgetary allocations for purchase of cars, guns and other logistical expenses
- Low degree of autonomy of provincial services

CHAPTER 4

BIOLOGICAL DIVERSITY

4 PRESENT STATE OF BIOLOGICAL DIVERSITY IN CAMEROON

One of the key strategies elaborated upon and measures adopted in Rio de Janeiro by the United Nations Conference on Environment and Development (UNCED) (popularly known as Earth Summit) was the convention on biodiversity. This important convention was adopted to halt and reverse the effects of environmental degradation in the context of strengthening national and international collaboration to promote sustainable and environmentally sound development in all countries. This convention consisting of 42 articles was one of the principal out come of the Earth Summit.

According to Article 2 of the convention on biological diversity (CBD), Biological Diversity is defined as “The variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexities of which they are part. This includes diversity within, between species and of the ecosystem. Based on the above definition, the major components of biodiversity that can be distinguished are ecosystem, fauna and flora. A non-professional however, sees biological diversity to cover both domestic and wild plant and animal species in both terrestrial and aquatic environments. Biodiversity thus serves as a source of raw material for the industries, a source of budget for maintaining balance of payment of equilibrium, a source of poverty alleviation and most importantly as a source of food for both the urban and rural people.

Geographically Cameroon is located virtually at the centre of Africa and near the equator. This location endows her with many biodiversity potentials. From north to south, there are various types of humid savannah, forest galleries, tropical mountain rain forests and dry forests. Dry savannah steppes and the yaeres prevail where the climate is drier.

Apart from these natural ecosystems, there are also man-made agro-systems made up of large Rubber (*Hevea brasiliensis*), Banana (*Musa spp.*), Palm trees (*Elaeis guinesis*), Cocoa (*Thebroma cocoa*), and Coffee (*Coffea robusta*) plantations.

4.1 SPECIES DIVERSITY

Cameroon and two other central African countries (Gabon and Equatorial Guinea) are considered as the focus in terms of biodiversity conservation in Africa (Doumenge 1996; 1998). In effect the total area of the three countries represents barely (2.5%) of Africa and yet they host (26%) of all animals in Africa and many endemic fauna and flora species. Cameroon is a nation blessed with a rich biodiversity of fauna and flora. Previous inventory surveys conducted by various researchers show that the country has a total of 542 fish species of which 96 are endemic, 190 to 200 batrachians, above 1500 butterfly species, 409 species of mammals including the world's largest and smallest animals, 165 reptiles species of the 275 found in Africa. In addition some 900 bird species of which 750 are resident and 150 migratory are present in Cameroon.

The flora component (vascular plants only) has 9000 plant species of which 156 are endemic. For timber production, about 630 species of actual or potential commercial value have been identified. They are grouped into five categories depending on their commercial value and their availability (MINEF 1998a). Twenty-six species are of high commercial value (group 1), 14 timber species currently found in local and international markets (group 2), 49 timber species abundantly found in the forest and produced mainly for local market closed to the logging zone (group 3), 522 timber species of sporadic commercial potential (group 4) and 30 mainly introduced timber species (group 5).

Table 4.1 Number of species (plants, mammals, and birds) per 10.000 km² land area

Species /10.000km ²	Mammals	Birds	Plants	Total
Cameroon	83	193	2.237	2.513
Republic of Congo	62	140	1.356	1.558
Gabon	64	157	2.197	2.418
Equatorial Guinea	131	194	2.135	2.460
D.R.C	69	153	1.817	2.039
Central Africa Rep.	53	137	921	1.111

Source: World Resource Institute (WRI) 1998-99.

4.2 IMPORTANCE OF BIODIVERSITY TO CAMEROON

Biodiversity is of tremendous importance to Cameroon as it is one of the principle sources of self employment to the rural masses and acts both as a source of protein and income to most people in the country. The forest and its resources from flora, fauna to Non-Timber Forest Products (NFTPs) provides support to indigenous professions and occupations, directly employing (84.2%) of the country's population as revealed by the last population and housing census. Specifically about (30%) of the Cameroonian population is involved in animal husbandry; about (55%) in crop production and (60%) depend on medicines locally concocted from plant extracts (MINEF 1998a). Some of the components of Cameroon's biodiversity are unique. Biological diversity is important to Cameroon as:

A source of raw material for industries: The country's industrial tissue indicates a significant dependence on the primary sector, especially in agriculture, animal husbandry and fisheries. Plants through forestry, formally and informally employ about 45.000 Cameroonians while aquatic fauna through fisheries employs about 24.136 anglers nation wide. Animals through hunting are also known to support about 10.000 people in the profession (ONADEF 1991; MINEF 1998a). Source of state budget for balance of payment equilibrium: In this respect the agricultural sector has been and still remains the priority sector in government's development strategy ensuring the country's food security, generation of foreign and budgetary resources for the Gross Domestic Product (GDP).

Biodiversity acts as a source of poverty alleviation by creating jobs to the local communities in Cameroon: Since two decades Cameroon has been witnessing both urban and rural population growth rate however, there has been a negative growth rate in the country's economy. This has resulted to an increase pressure on the country's biological resources. Looking at the general contribution to the national economy, the rural sector sustained by agriculture and livestock production, fishing and forest exploitation contributes significantly to Cameroon's Gross Domestic Product (GDP). According to Nami (1997) the sector contributed (32%) of the country's GDP in 1994.

4.3 SOCIO-ECONOMIC IMPACT OF BIODIVERSITY ON CAMEROON

In an economy with natural resources and agricultural products accounting for (93%) of its export, biodiversity loss is therefore very obvious. In Cameroon today the bushmeat trade presents a growing threat to biodiversity. The resulting network of commercial hunters and markets is closely linked to the country's dependence on primary export products including agriculture and timber which has led to land clearing and road construction without relieving poverty. This has given easy access to the unsustainable exploitation of some wildlife resources that live Cameroon too often leading to biodiversity loss e.g. Songbirds, ivory, aquarium fish, ornamental plants, medicinal plants, Chameleons, Frogs, Parrots, Butterflies, Ostrich eggs, Lizard skins, Snake skins etc. It is highly speculated that without these resources living the forests, the ecology of Cameroon would have been in a better shape today.

According to the National Environmental Management Plan (MINEF 1996a) poverty is at the centre of environmental problems in Cameroon. It is the root cause of mega fauna biodiversity loss in Cameroon. In order to ensure their livelihood the population is forced to exploit natural resources in an unsustainable manner. Constituted essentially by the absolutely poor this component of the population depends on traditional agriculture, hunting and the exploitation of biodiversity for food, shelter and health.

According to MINEF (1995) the urban population is expanding at an annual rate of (5.57%) calling for new structures such as roads and social amenities such as hospitals, schools etc. The major products exported out of Cameroon include timber and agricultural produce (cocoa, coffee, cotton, rubber, palms oil, tea) and petroleum. The exploitation of these resources also has an impact on the various components of biodiversity. In 1987 Cameroon entered a period of economic recession which has had a devastating effect on biodiversity. International lending institutions in reaction to the situation recommended structural adjustment plan, which produced negative socio-economic effects such as unemployment, down seizing of the public sector and devaluation of the local currency. This situation has contributed considerably in depleting the biological resources especially wildlife species.

Cameroon is endowed with a very rich biodiversity however, in recent decades vital ecosystems have been degraded as a result of various anthropogenic disturbances and threats of species extinction through over-exploitation, poaching, shifting cultivation agriculture, over-grazing and uncontrolled bush fires. The rate of animal species loss particularly in the forests is now reaching a threatening irreversible proportion and may continue if management remains poor and exploitation is not sustainable. By ratifying the convention on biological diversity (CBD) in June 1994 the government of Cameroon recognized that the implementation of the convention's provisions could halt and even reverse the loss of biodiversity and degradation of ecosystems for the benefit of Cameroon and the world today and in the future. Elaboration of a national biodiversity strategy and action plan by signatory countries is one of the obligations to the CBD. In fulfilment of this obligation, the government of Cameroon established an inter-ministerial committee and a Task Force with the mandate to:

- Describe the present status of biodiversity in the country as the baseline against which the impact of future actions or non-actions will be assessed.
- Make a systematic analysis of biodiversity conservation issues and options and to educate stakeholders on the role they could effectively play to meet the common goals of conservation and sustainable use of plants, animals, and micro-organisms and associated ecosystems.

4.4 BIODIVERSITY USE AND DEPLETION IN CAMEROON

Apart from timber species and to illustrate the important use of forest resources, over 500 plant species and 280 animal species have been identified as being used for household consumption within the evergreen forest zone of southern Cameroon alone (Van Dijk 1999) covering a total area of 170.000ha with about 15.000 inhabitants. The forest NTFPs are of special importance to the lives of rural Cameroonians. A great majority of people depend on the harvest of these resources for a livelihood. Generally previous studies have shown that the use of forest resources in Cameroon is not always rational and sustainable thus constituting a high threat to biodiversity. Cameroon has some endemic plant and animal species that are unique components of the country's biodiversity these include some rare resources such as (*Prunus Africana*) found in the Mount. Cameroon and Bamenda highland areas as well as some rare or endangered animal species and the anti-HIV vine (*Ancistrocladus korupensis*) found in the Korup National Park. Within recent years however, and for varied reasons there has been steady erosion and an unprecedented loss in biodiversity in Cameroon, including even those biological resources located in protected areas.

By ratifying the (CBD) in 1994 Cameroon accepted to fulfil the convention's objectives namely "The conservation of biological diversity, sustainable use of its components, fair and equitable sharing of benefits arising out of the use of genetic resources". This strategic and action plan were derived from data on the status and distribution of biological resources identified and catalogued by a multi-disciplinary, multi-institutional team and Task Force working in concert with international consultants.

The following groups constitute biodiversity stakeholders in Cameroon:

The government of Cameroon, the local communities, economic interest groups, scientific institutions, non-governmental organizations (NGOs), tourists, and the international community. Cameroon is divided into six very important ecosystem zones: The marine and coastal, semi-arid, tropical humid dense forests, montane, tropical wooded savannah and fresh water ecosystems respectively.

These ecosystems are of tremendous importance to Cameroon because they support several indigenous professions and occupations ranging from animal production, medicines and forestry activities, fishing, hunting and secondary indigenous professions resulting from the transformation of primary products. Virtually all sectors (urban and rural) of Cameroon's population use biological resources e.g. plants for building construction, fuel wood and food, animal resources are used generally for food. However, in recent years the efforts to satisfy these requirements have imposed pressure on biological diversity resulting in the following problems across ecosystems:

- Degradation of ecosystems through unsustainable exploitation of biodiversity resources
- Inappropriate exploitation techniques leading to pollution by petroleum and mining companies and poor agricultural practices. These are happening due to inadequate alternative income sources.
- There is no motivation and provision of incentives to the populations, poorly equipped structures, and the absence of buffer zones between plantations and biodiversity reserves and non-respect of regulations on exploitation of natural resources by both resource exploiters like the timber companies, poachers and gatherers.
- Weak enforcement of policy measures, legal and institutional framework to ensure effective resource management and correct the poor human resource deployment and use unplanned occupation of forest land, poorly planned urban clustering, problem of insecurity.
- Population pressure on biological resources for daily sustenance causing unsustainable harvesting of some resources.
- Lack of decentralization in the management of biological resources compounded by inadequate environmental and conservation information and sensitization, insufficient participation of indigenous people, leading to inadequate sharing of revenue generated from biological resources among different stakeholders.
- Little appreciation of resources and their residues resulting from the strong demand for products of biological diversity, insufficient inventory and inadequate forestry research etc.
- Poorly known socio-economic importance, lack of information, non-respect of cultural values and the non-participation of the population in the management of biological resources.

Noss (1991) and Franklin (1998) suggested a more comprehensive view of biodiversity that embodied dimensions of composition structure and function and their interactions. Noss (1991) outlined the hierarchies involved in the three main categories as shown in table 4.2 below.

Table 4.2 Components of biodiversity with some examples of measurable variables

Level of biological organization	Composition	Structure	Function
Gene or genome	Allelic diversity Rare alleles	Effective population size Heterozygosity	Inbreeding depression Gene flow
Population or species	Abundance Biomass	Dispersion, Population structure	Vital rates Metapopulation trends Phenology
Community or ecosystem	Functional groups Rare communities	Vegetation structure Physical features	Key ecological functions Nutrient cycling

Source: Noss 1991

Noss (1998) found out that biodiversity composition can be assessed through an age-class assessment of habitat vegetation or map showing spatial distribution of species. Function can be addressed by way of a figure depicting diets of various species found in a protected area and the use of various habitats.

Conservation biology relates to the maintenance of existing populations or organisms. From the findings made by Noss (1998) it can be suggested that conservation biology and restoration ecology should function hand in hand. Conservation biology has often focused on protection of existing habitat communities and populations. In many cases conservation biology has focused on the so-called charismatic species that attract much public interest such as the Chimpanzees and Gorillas and involved in the development and management of natural reserves.

4.5 THREAT TO BIODIVERSITY IN CAMEROON

In addition to the threat of habitat loss, the number of threatened or endangered species in Cameroon like else where in central Africa are increasing because of pollution and over harvesting for commercial purposes. Chimpanzees, Mandrills, Gorillas, forest Elephants, Buffaloes and Antelopes are coming under increasing pressure for sale as bushmeat. Drills (*Mandrillus leucophaeus*) which are one of Africa's most endangered primate species with a limited range to parts of Nigeria, Cameroon and the Bioko Island of Equatorial Guinea are under intense pressure from hunting. Recent research has concluded that though the savannah of northern Cameroon is an important wildlife habitat for the critically endangered endemic species such as the black Rhino sub-species (*Diceros bicomis longipes*) however, less than 20 individuals are estimated to be currently present due to pressure from poaching. The Democratic Republic of Congo (DRC) and Cameroon which have the richest endemic wildlife, birds and vascular plants also have the highest numbers of threatened species as seen in (Table 4.3).

Table 4.3 Threatened species in central Africa 2000

Country	Mammals	Birds	Reptiles	Amphibians	Fishes	Inverts	Plants	Total
C.A.R	12	3	1	0	0	0	10	26
Cameroon	37	15	1	1	27	4	155	240
Congo	12	3	1	0	1	1	33	51
Eq. Guinea	15	5	2	1	0	2	23	48
D.R.C	40	28	2	0	1	45	55	171
Chad	17	5	1	0	0	1	2	26
Gabon	15	5	1	0	1	1	71	94
Sao Tome	3	9	1	0	0	2	27	42

Source: Adapted from IUCN 2000a

4.6 ENDANGERED SPECIES

An endangered species according to the International Union for Conservation of Nature's (IUCN) definition is a population(s) of an organism(s) which is at risk of becoming extinct because it is either few in numbers or threatened by changing environmental or predation parameters. An endangered species is usually a taxonomic species but could be another evolutionary significant unit such as a subspecies. IUCN calculated the total percentage of endangered species to be 40 percent of all organisms based on the sample of species that have been evaluated through to 2006. Cullen et al. (2001) estimated a projected probability of extinction to be at least (20%) over the next 20 years. IUCN has also grouped all threatened species for their summary purposes. Countries which are member states to international conventions on biodiversity such as CITES and IUCN have laws that protect these species for example forbidding hunting, restricting land development or creating reserves. However, only a few of the many species at risk of extinction actually make it to the lists and obtain protection. Many more species become extinct or potentially will become extinct without gaining public notice because the laws made are never enforced or are weakly implemented. It has scientifically been established that within the past one and a half century a high number of species has gone extinct in their habitat all over the world.

Recent statistical findings by IUCN has shown that while species have evolved and become extinct on a regular basis for the last several hundred million years, recent rates of extinction are many times higher. IUCN records estimate puts the present risk of species extinction at 100 to 1000 times "background" or average extinction rates in the evolutionary time scale of the planet earth.

According to IUCN (2002) the current rate of extinction is 10 to 100 times greater than any of the prior mass extinction events in the history of the earth. It has been predicted that millions of species would become extinct in the next decades if the present rate of extinction continues or is accelerated. Whereas human activities (poaching, lumbering, agriculture, settlement and road construction) have been blamed for its enormous contribution to the endangerment of large mammal and birdlife, some pertinent ecological issues remain unanswered.

The biggest problem facing ecologists today is if key species vanish from the ecosystems at any level of the food chain what will become of the food web, food chain and the entire ecosystem in the near future? Four reasons for concern about extinction are:

- loss of a species as a biological entity
- destabilization of an ecosystem
- endangerment of other species
- loss of irreplaceable genetic material and associated biochemical components.

4.7 THREATENED SPECIES

A taxon is threatened when the population is stable but expected that threats will become a problem in the near future if nothing is done to stop the threat. According to Cullen et al. (2001), estimated projected probability of extinction is about 3-10% in the next 100 years.

According to an analysis, conducted by MINEF (1997) Cameroon has 311 mammal species of which 10 are endemic, their analysis further showed that according to species richness Cameroon stands at the 12th position by world ranking and 2nd by region, and population pressure measured by annual increase in density is 0.85 by world population pressure. It is ranked 62nd and 23rd by region; forest loss index measured by annual loss is 0.0049 and forest loss by world ranking puts the country at the 55th position and by region it is 31st in ranking. Making a comparison of the data on (Table 4.3) with that on (Table 4.4) below, (Table 4.3) was based on research by an individual while (Table 4.4) is the first nation report on the convention on biological diversity whose compilation was a product of different contributors in the Ministries of Environment and Forest, Scientific and Technical Research, experts on policy, institutional and legal framework, experts on floral biodiversity, experts on coastal and marine biodiversity and experts on forest biodiversity all working to draw up the convention document. All data on (Table 4.4) was based on judgments on the rate of implementation of the different national action plan; the National Action Plan of 1958 on sustainable forestry and agro-forestry, National Land-use Plan of 1994 on distribution of land use and sustainability, the National Environment Management Plan of 1995 on environmental protection and biodiversity

protection, National Biodiversity Strategy on forest biodiversity, Engulfing Forest Biodiversity Action Plan and Marine Agriculture of 1998 on conservation, sustainable use and benefit sharing, the special plan on agriculture and the special plan on fisheries. The last two action plans were on food security. The objectives of the different ministries involved had no continuous monitoring, short-lived action plans and disintegration of the ministries led to disparity in results and figures of species abundance on (Tables 4.4 and 4.5).

Table 4.4 Wildlife biodiversity estimates in Cameroon (N/A = not available)

Species type	Total species	Endemic	Threatened	Extinct
Mammals	409	10	27	N/A
Birds	900	11	47	1
Reptiles	250	N/A	N/A	N/A
Amphibians	190	N/A	1	N/A
Fishes	542	96	N/A	N/A
Insects	16,110	N/A	N/A	N/A
Plants	9,000	156	N/A	N/A
Micro-organisms	1,050	N/A	N/A	N/A

Source MINEF 1997

The difficulty to monitor biodiversity as shown in (Tables 4.3 and 4.4) is not only an African problem. Despite the fact that Cameroon has identified the important contributions made by forest biodiversity to the national economy, it is imperative that further studies be conducted at the various levels of biodiversity in the country (see Table 4.5). This information came as a result of compilation of reports by a selected panel from the task-force of the National Biodiversity Strategy and Action Plan that represent key ministries and the main NGOs that interfere with biodiversity processes and activities in the country. They drew up draft resolutions to key factors affecting biodiversity in the country and submitted to key policy makers within the institutions and various sectors involved in biodiversity before being approved by government.

The draft copy was then sent to UNEP head quarters in Nairobi for examination and criticism and later sent to the secretariat of the CBD which was tabled to the fourth conference of parties (COP 4) UNEP (MINEF 1997).

Table 4.5 Biodiversity loss in central Africa

Country	No of Species, No of endemic species in brackets	Species richness by world ranking & by region in brackets	Pop. Pressure index, annual increase	Forest loss index (annual)	Forest loss by world ranking & by region in brackets
Cameroon	311 (10)	12 (2)	0.85	0.0049	55 (31)
C.A.R	266 (3)	24 (8)	0.13	0.0025	73 (37)
Chad	200 (1)	61 (28)	0.10	0.0083	30 (16)
Congo	255 (2)	23 (7)	0.20	0.0021	74 (38)
Eq.Guinea	190 (0)	29 (11)	0.37	0.0076	40 (22)
Gabon	255 (2)	25 (10)	0.10	0.001	76 (39)

Source: Adapted from MINEF 1997.

Table 4.3 agrees with the number of endemism within species especially the mammals reported on both tables but disagrees in the total number of mammals found in Cameroon. It also gives a detail breakdown of different forms of wildlife in Cameroon while several others are under threat and extinction. The table shows that one species of birds is extinct, 30 species of birds are near threatened, vulnerable or endangered. There are 15.000 species of butterflies (the highest recorded in Africa so far). There is no current information on numbers of wildlife species and inventory is yet to be conducted to determine the rate of endemism and threat which gives the reason for the (N/A). As shown in (Table .6) below.

Table 4.6 Biodiversity contribution to the national economy of Cameroon

Sector	% GDP contribution
Petroleum	59.4
Agriculture	2.6
Fisheries	0.8
Wildlife	0.3
Forestry	14.7
Total	99.2

Source: MINEF 1997

CHAPTER 5

MATERIALS AND METHODS

5 MATERIALS

Permission to carry out the study in the sanctuary was granted by the director of scientific and technical research in the Ministry of Scientific Research and Innovation Yaoundé Cameroon. Two types of data were utilized in this study (primary and secondary data). A six-month study was conducted in 14 hunting villages within the two major tribes (the Banyang and Mbo) of the Banyang-Mbo Wildlife Sanctuary these villages were: (Fotabongkwa, Etawang, Ntenmbang, Etodi, Nzoa, Tangang, Tali, Defang, Barah, Akiriba, Ndom, Tinto wire, Fotabe and Ebeagwa). Four of the six study villages visited in the Mbo area were accessible only on foot whereas only three out of the eight Banyang study villages were accessible on foot the other five had seasonal motorable roads passing through them. In each of the fourteen study villages, the chief was informed some days ahead of our visit and the intention of the trip. The chief then invited all the hunters in that village for a meeting at the council hall. The meeting was scheduled on a date agreed upon by all the hunters and that was usually their local village market day. The meeting date and day was then communicated to the research team. At each of the meetings, a brief introduction was made and the intention of the research team's visit was disclosed. After some deliberations only the most experienced hunters were short-listed by that village's councillors. Experience was based on the grounds that the hunter must have shot so many animals during his hunting career. Killing of certain animals like Elephants, Chimpanzees and Leopards, bush Pigs, bush Buck and Drills were also considered and how long a hunter could trek and stay in the forest. This was however, a very sensitive issue and treated with a lot of care and confidence.

Screening for eligibility was not easily welcomed as some hunters were suspicious of the study and some thought some compensation would be made at the end of the day. However, the fact that I had worked in the area notably in Upper Banyang for some years made the hunters had some confidence in me, which facilitated our data collection.

After short-listing, six hunters were assigned to work with that village's research assistant who in most cases was well known to them. A convenient post was then arranged between the assistant and the hunters where the hunters brought their daily game for recording. All the 84 hunters and the 14 research assistants who participated in the study were each given a stipend at the end of the study

5.1 Selection of research field assistants

The criteria for selecting research field assistants were based strictly on literacy level, permanent residence in the village, communication skills, social status in their respective communities, ability to speak and understand the native language, and the willingness to work with the researcher. After the selection exercise the 14 assistants were all trained at Tinto Mbu for 3 days by a hired wildlife technician from the Sub-Divisional Delegation of Wildlife and Forestry Tinto on data recording. They were briefed on how to collect data from the hunters relating to; animal species identification, aging and sexing of animals brought in daily by hunters, using a spring weighing balance scale to weigh animals, the hunting techniques used by hunters, locations where animals were killed, destination and utilisation of the bushmeat, selling prices of the different species and the physical condition of the animals brought to the villages by the hunters.

The assistants were also drilled on the identification of animals by their pidgin or vernacular names and were encouraged to record all the animals brought in by the hunters by their pidgin and vernacular names where possible. The names were then crosschecked against a reference list for animals known to live within the Banyang-Mbo area prepared by Wildlife Conservation Society for scientific names. The field assistants were visited twice a month to collect and troubleshoot data sheets and to pay them a small stipend. Throughout the study period, the hunters' were frequently visited and drinks distributed to encourage them to report all kills brought into the various villages. These meetings built more confidence between the researcher and the hunters, and provided a forum for informal interviews and assisted the researcher to control the quality of data the assistants took down.

5.2 Selection of study villages

Fourteen villages that have hunting impact on the Banyang-Mbo Wildlife Sanctuary (Tataw et al. 2001) were selected for this study using stratified random sampling techniques. Selection ensured that most of the villages represented those that were severely affected by hunting and had bushmeat markets. They were determined through information from previous WCS project on wildlife field survey. In addition, selection gave a balance in number and representation of the problem between the two main tribes of the sanctuary as seen from the stem “Banyang-Mbo.” The selected villages were Ndom, Fotabongkwa, Etawang, Etodi, Nzoa and Tangang for the Mbo region and Tali I, Defang, Ebeagwa, Barah, Akiriba, Tinto wire, Ntenmbang and Fotabe for the Banyang region. Great efforts were made to choose the villages in a way that the whole sanctuary area was covered and also avoiding villages where a similar survey might have been conducted as seen on Figure 5.1 below.

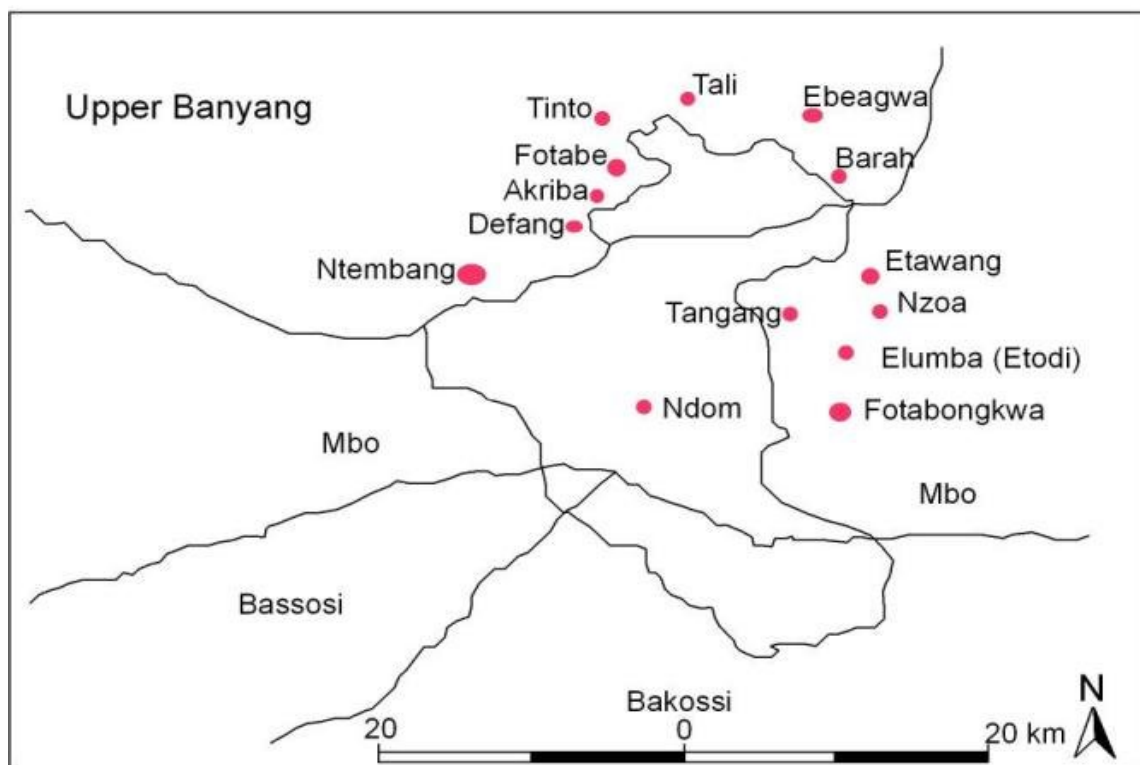


Figure.5.1 Map showing study villages, lines drawn denote divisions of ethnic groups but do not reflect to actual territories of the villages

Source: Modified from Inyang 2001

5.3 Locating hunting zones of study villages

Sketch resource map (Figure 5.2) of the villages involved in the study that were previously created during prior exercises was used. This map was subdivided into zones based on the major physical features on the map. The assistants by interrogating the hunters placed each recorded kill into one of these zones. A trip was then made to the field with the hunters to verify the location of these zones with a global positioning system (GPS) unit. These zones were then drawn as polygons on the BMWS map in Arc view so that the off-take data was spatially analyzed.

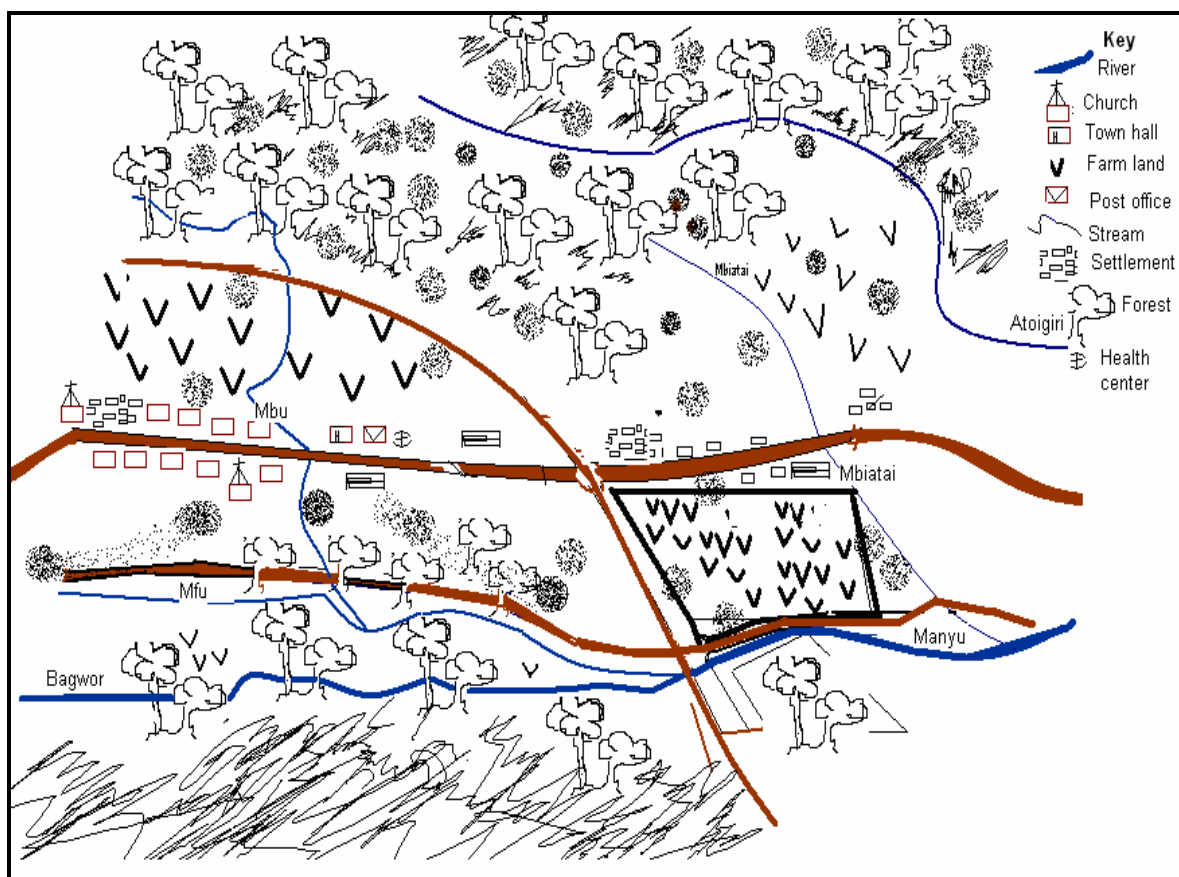


Figure 5.2 Example of a sketch map of Tinto village used to determine kill sites of animals.

5. 4 Ethical considerations

In recognition of the role hunting plays in the management of this protected area and bearing in mind the sensitive nature of the issues investigated, circular letters were sent to the chiefs of the selected villages to keep them and their subjects informed in advance about the purpose of the research and the activities involved. The interviews were conducted in strict confidence and responses treated in the same manner. However, group discussions were an open forum whereby hunters and the researcher interacted in a more open manner. General questions were asked and answers given to the hearing of every one participating. The acquaintance of the researcher to the upper Banyang area made data collection easier since the researcher was well known to most of the people following previous successful rural development projects he had carried out in the area.

5. 5 METHODS

5 .5.1 Data collection

Interviews, registering of daily hunt, sex and age identification, physical state of animal, weights, hunting techniques, destination and prices of bushmeat etc were key instruments for this case study. This method had its strength and limitations. On the one hand interviews provided an opportunity to probe deeply into the socio-cultural, socio-economic, socio-political and religious issues relating to bushmeat hunting and trade at the Banyang-Mbo Wildlife Sanctuary. According to Kumar (1999) interviews is an appropriate approach for studying complex and sensitive areas as the interviewer has the opportunity to prepare a respondent before asking sensitive questions and to explain complex ones to the respondent in person. Moreover, in-depth information can be obtained by probing and supplementary information can be gained from observation of non-verbal reactions. In recognition of these facts, the “hunters’ interview” method of data collection was employed in this survey. This is a viable and useful method for data collection for a preliminary data on fauna survey, which not only reveals primary data on faunal distribution and decline but also provides a unique insight of the economics and consumption of bushmeat.

5.5.2 Primary data

Primary data was collected during fieldwork in the months of October to April in the years 2006 / 2007 respectively. This period corresponded to the dry season in Cameroon. Many different types of primary data sets were collected e.g. interviews, focused groups discussions, checklists; recording of bushmeat sales in study villages' markets, use of GPS for location of animals killed. Data was collected on; species identification, age, sex, weights of animals were taken using a spring weighing balance scale, hunting techniques, location of kills, destination of bushmeat and utilisation, selling prices and the physical condition of the animals brought in daily were recorded.

5.5.3 Hunters' interview

One hundred and eighty-seven hunters were successfully interviewed in the 14 study villages from December 2006 to March of 2007 using a standard set of questions (Appendix 1). About 13 hunters were randomly selected from each of the 14 villages. The interviews were conducted in strict confidence in order to ensure that the hunters presented their views as freely and as honestly as possible. Arrangements were made with hunters as to where and when the interview was to take place. Hunters gave the most conducive time when they felt they would be available for interview. Interviews were initiated by requesting the participation of the hunter in a discussion concerning local wildlife. In some instances beer and / or palm wine was served in order to induce a social and informal atmosphere. Interview sessions in each village lasted for not more than a few hours. Additional information was also gained during informal conversations throughout the study period. While the researcher asked a set of standard questions to the hunters, the assistant for that village was taking down notes.

Efforts were made not to ask any mis-leading questions and deliberate suggestive ones were asked to test accuracy of the hunters' knowledge and their willingness to disagree with the interviewer. Interviewees were initially requested to give the names accompanied with a description of individual wildlife species that are present or previously occurred in their normal hunting areas.

This was recorded in their vernacular language. The following details were asked for each species: whether the animal is scarce now and also before, seasonal variation, time and number killed since the last 3 to 5 years, whether diurnal or nocturnal in habit, hunting methods used on each species, consumption and marketing of each species. In addition hunters were asked whether it was possible to view any skulls, skins or other parts that are often retained for trophies, religious purposes or medicines. Further discussions were initiated on bushmeat economics and attitudes towards and customs involving wildlife in general. The information obtained from the interviews were compared with that collected from available literature for cross validation and then subject to a content analysis as described by (Gillham 2000).

5.5.4 Focused group interview

The chiefs, councillors, some prominent hunters and other stakeholders were targets of the focused group discussions in all the study villages. The discussions were held at the local council halls or the chief's palaces in each of the study villages. The main topic of discussion centred on traditional beliefs and wildlife hunting. Questions relating to village taboos, religious beliefs, rituals and politics influencing wildlife harvesting were discussed and notes were taken down in each of the villages. At the end of the study the notes were compiled and critically examined by the researcher.

5.5.4 Socio-economic data

Data sheets were provided to each research assistant in all the study villages to record the needed information from the hunters for the study (Appendix 2). When each of the six hunters brought in any animal he was asked to give the pidgin name and local name of the species. This was done with the aim of testing the hunter's knowledge on identification of the species of animals he killed and to find out if he actually knew the difference between the animals protected by law and those not protected. The naming was also to test the hunter's knowledge of the correct pidgin and local names of the harvested animals. It was noticed that hunters were sometimes confused between animals e.g. sometimes they wrongly called the black footed mongoose

“Fox” and the Cussimanse mongoose was sometimes called “Tiger” in most of the study villages of the Banyang-Mbo Wildlife Sanctuary. They were also asked to attempt to sex and age the animals to see how accurately they could estimate the sex and ages of the animals they killed. It was again noted that only a few of them could actually do so. Data on the utilisation and commercialization of bushmeat was also recorded for each hunter.

5.5.6 Secondary data

Published literature on the status of wildlife biodiversity at the Banyang-Mbo Wildlife Sanctuary is currently scanty therefore to obtain information needed; reliance was placed on the collection of published articles and unpublished reports of field expeditions on wildlife surveys (Inyang 2001; Fotso 2005; Willcox 2002; Willcox and Nzouango 2000 and WCS 2000). Data were also collected from conservation projects and wildlife research institutes libraries:

- The Limbe Botanic and Zoological Gardens (LBZG) Libraries, Limbe
- The University of Buea library, Buea;
- The Provincial Delegation of Wildlife and Forestry, Buea;
- The Sub Divisional Delegations of Wildlife and Forestry, Nguti and Tinto;
- The WWF Limbe Office;
- The WCS Limbe Office;
- Berlin Institute for Zoo and Wildlife Research, Berlin;
- The Brandenburg University of Technology Cottbus Library, Cottbus.

5.6 DATA ANALYSIS

Biomass of harvested animals was calculated using actual weights recorded by assistants (Table 6.1). In some instances no weight was recorded because the carcass was smoked, field dressed or rotten. In these cases the recorded weights for adult males, adult females, juvenile males, juvenile females and infant males and infant females for each species were averaged to replace unrecorded weights.

Data were analyzed using descriptive statistics, frequency distribution tables, percentage frequency distribution tables, pie charts, bar charts, and chi squared test was used to test the degree of significant differences between certain parameters. Microsoft Excel and statistical package for social sciences (SPSS) version 11 were used for the analysis. The spatial data were analyzed in Arc view. To estimate the total hunting impact on the BMWS, a survey of hunters was conducted in the fourteen study villages. To estimate off-take for an individual hunter, the number of animals killed, biomass of animals killed, destination and price data were divided by the total number of hunters that participated in the study ($n = 84$). The data for one hunter was multiplied by the total number of hunters in the Banyang and Mbo areas ($n = 429$). Maximum sustainable harvests for species were calculated using Robinson and Redford's (1991; 1994) production model. The harvest is considered the maximum number of individuals of a species that can be removed in a year without changing the size of the standing stock at that current density.

The model states that

$$P_{\max} = (D \lambda_{\max}) - D = (\lambda_{\max} - 1) D \quad (1)$$

where λ_{\max} is the maximum finite rate of increase, D is the density of the species expressed in number of individuals per km^2 and $P_{\max}(D)$ is the maximum production of the species at the current density. To calculate accurately sustainable harvest levels, (60%) of animal production was assumed for very short-lived species (< 5 years), (40%) for short-lived species (5 - 10 years), and (20%) for long lived species (> 10 years) (Robinson and Redford 1991; 1994; Fa et al. 2001; Fimbel et al. 2000). This categorization places Emin's giant rats into the "very short lived" category, all duikers and brushed-tailed porcupines into the short-lived category.

All primates and red river hog into "long-lived" category, if the observed harvest (number of animals per km^2/year) exceeds the longevity percentage of $P_{\max}(D)$, the harvest is considered unsustainable. Since density data were not available for primates, rodents and small carnivores within the BMWS or neighbouring protected areas, in order to estimate whether or not the hunting of these species is sustainable, an adapted form of Robinson and Redford's (1991; 1994) model was employed.

The model assumes maximum production (P_{\max}) to occur at (60%) of carrying capacity (K), assuming the species are density dependent.

Therefore

$$P_{\max} = (0.6 K \lambda_{\max}) - 0.6 K = (\lambda_{\max} - 1) 0.6 K. \quad (2)$$

By utilizing K , this adaptation of the model estimates P_{\max} without population density data. Fa et al. (2001) calculated production levels P_{\max} for Central Africa wildlife based on the maximum rate of population increases, published average density of species rather than K and the density that produces the maximum sustained yield. This was achieved through exhaustive research of current literature. As good estimates of densities or carrying capacity of species other than duikers were not available for the BMWS. Fa et al.'s (2001) estimates of animal densities were employed to estimate the sustainability of hunting for the species harvested in the BMWS as most of the species found in the BMWS appear in publications. The harvest expressed in the number of animals per km^2 was calculated from the complete hunting zones which included the entire northern portion of the sanctuary and land outside the protected zone up to the villages themselves.

5.7 DATA EXCLUDED FROM THE ANALYSIS

During the study period, animals recorded less than or equal to four times were not included in the analysis as these few animals are not representative of our hunters' normal catch as a whole (Appendix 4).

CHAPTER 6

RESULTS

6 HUNTERS' INTERVIEW

A greater percentage (43%) of the hunters interviewed in the 14 study villages of both the Banyang and Mbo tribes were between the ages of 31 and 45 years respectively. Hunters within the age bracket of 60 years and above constituted the least (8.3%) percent. Most of the hunters (78%) from both tribes were married. Results from analysis of data also showed that most hunters (48%) had between 3 and 5 children respectively. It was also interesting to note that the majority of hunters from both tribes were literate (Appendix 7). During the interviews a greater percentage (46%) of hunters revealed that currently they mostly killed rodents, whereas (38%) acknowledged that they kill duikers and (16%) revealed that they mostly kill primates (see Appendix 7). It was also found out that most hunters (51.9%) from the two tribes sold rodents most followed by duikers (42.2%). As to the species most frequently seen in the forest, majority (57.8%) of the hunters interviewed agreed that they see rodents most frequently whereas (24.6%) of the hunters alleged that duikers were frequently seen in the forest. A small percentage (16%) of hunters said they saw primates most frequently.

It was agreed however, by most of the hunters (35.8%) that primates were the most abundant group of animals found in the forest within the Banyang-Mbo Wildlife Sanctuary some ten to twenty years ago. Whereas (33.7%) and (30.5%) of the total number of hunters interviewed were of the opinion that duikers and rodents were most abundant in the forest within this area 10 to 20 years ago respectively. The hunters variously (31%, 24.5%, 22.9% and 21.6%) agreed that leopards, drills and other monkeys, elephants and chimpanzees were scarce within recent times in the Banyang-Mbo area respectively. It was also interesting to note that majority (53%) of the hunters understood what the term protected species meant but nevertheless, (46%) of these hunters did not know which animals were protected in the area since they could not really identify the different animal species.

All the hunters in both the Banyang and Mbo villages agreed that religion and ritual values had a big part to play in the killing of certain animals like the leopard, monkeys, chimpanzees and elephants within their areas. A majority also agreed to the fact that politics influences the killing of animals within this sanctuary. As to the role of the Ministry of Forestry and Wildlife, on regulating of hunting in the Banyang-Mbo area, most (32%) of the hunters did not know the role of this ministry in their area. It was also noted that a great proportion of the hunters (76.4%) had been confronted by wildlife agents once or several times for killing a protected species however, (66.4%) of the hunters pointed to the fact that the presence of wildlife agents did not have any impact on their hunting activity. It was also revealed by a majority (85%) of the hunters from both tribes that collaboration between wildlife officials and the hunters was extremely poor see (Figure 1). Hunters also revealed that they hunted because they were unemployed and hunting was the easiest alternative source of income because of low investment.

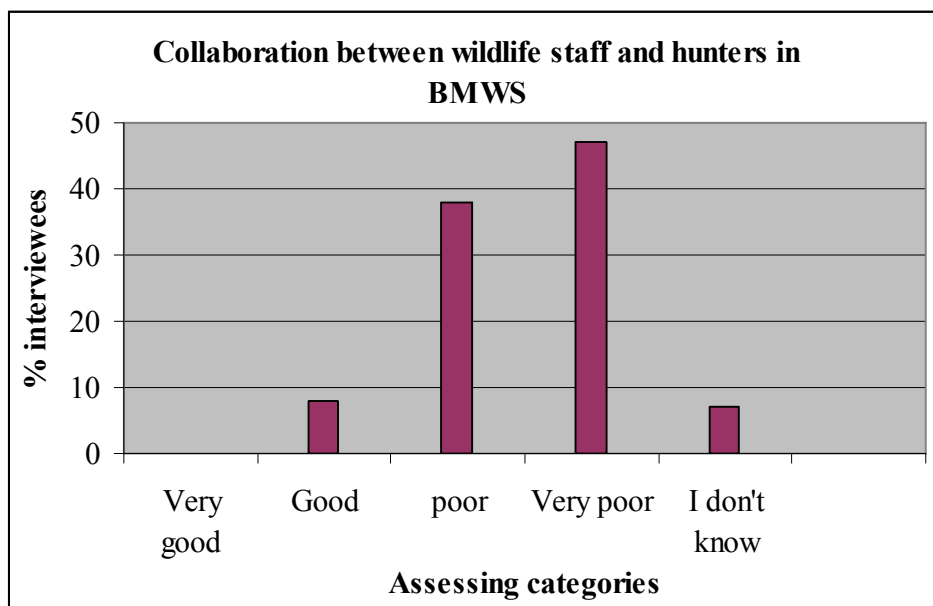


Figure 6. 1 Collaboration between hunters and wildlife agents in BMWS

When asked which wildlife species hunters would prefer to eat, chicken topped the list at (44% followed by brush-tail porcupine at 18%; pangolin and domestic pig 11% and 8%) respectively came next.

Table 6.1 Species kill preferences of interviewed hunters (n=187) with shotguns and rifles in the BMWS region in the southwest province of Cameroon

Common name	Frequency of responses for short guns	Frequencies of responses for rifles
Ogilby's duiker	7	-
Brush-tailed porcupine	5	1
Red river hog	28	13
Forest Buffalo	3	2
Marsh cane rat	23	12
Water chevrotain	2	-
Blue duiker	2	-
Pangolin	1	1
Leopard	2	4
Greater white nose monkey	2	-
Mona monkey	1	-
Elephant	1	44
Bay duiker	1	1

Domestic meat choices, (58%) were preferred more than wild game (42%). If possible hunters would prefer to shoot red river hogs (37%) when hunting with shotguns. (Table 6.1). The percentages change with type of weapon used and hunters will preferably target elephants (53%) when using rifles.

6.1 TOTAL OFF-TAKE FOR THE STUDY PERIOD

A total of 3,176 individual animals were recorded killed from within 44 species over a 6-month period by 84 hunters that participated in the study (Table 6.2). The total number of animals killed in the Banyang area was 1,888 and the Mbo hunters killed in total 1,288 animals over the study period.

Table 6.2 Total recorded off-take and biomass for hunters (n = 84) for the study period

Common name of animal	Scientific name	Off-take	
		(numbers)	Biomass (kg)
Water Chevrotain	<i>Hyemoschus aquaticus</i>	70	741.24
Dark Mongoose	<i>Crossarchus obscurus</i>	113	199.13
Forest Genet	<i>Genetta spp.</i>	22	58.3
Giant Forest Squirrel	<i>Protexerus stangeri</i>	17	17.4
African Civet	<i>Viverra civetta</i>	28	208
African Palm Civet	<i>Nandinia binotata</i>	95	340
Cane Rat	<i>Thryonomis swinderianus</i>	110	712
Drill	<i>Papio leucophaeus</i>	24	313
Brush-Tail Porcupine	<i>Atherurus africanus</i>	431	1,939
Bay Duiker	<i>Cephalophus dorsalis</i>	86	1,430
Blue Duiker	<i>Cephalophus monticola</i>	722	3,693
Bush Pig	<i>Potamoschus porcus</i>	72	4,794
Cobra species	<i>Naja spp.</i>	5	15
Giant Rat	<i>Cricetomys gambianus</i>	180	283
Red-Eared Monkey	<i>Cercopithecus erythrotis</i>	49	179.26
Pangolin species	-	193	543.6
Squirrel species	-	47	26.58
Ogilby's Duiker	<i>Cephalophus ogilby</i>	335	3,746.01
Green Mamba	<i>Dendroaspis jamensoni</i>	28	76.7

Golden Potto	<i>Arctocebus catabarensis</i>	12	19
Bush Fowl	<i>Gutera plumifera</i>	21	33.4
Mongoose species	-	70	261.09
Hornbill	<i>Ceratogymna atrata</i>	9	17.22
Tortoise species	-	21	46.98
Python	-	7	98
Monitor Lizard	<i>Varanus niloticus</i>	14	70
White-nose monkey	<i>Cercopithecus nictitan</i>	133	979
Gabon Viper	<i>Bitis gabonica</i>	13	48.8
Dwarf Crocodile	<i>Osteolaemus tetraspis</i>	42	329.05
Crowned Guenon monkey	<i>Cercopithecus pogonia</i>	12	52.87
Mona Monkey	<i>Cercopithecus mona</i>	184	927.8
Red Collared Mangabey	<i>Cercopithecus torquatus</i>	5	32
Bush Buck	<i>Tragelaphus scriptus</i>	6	170
Grand Total		3.176	22.397.43

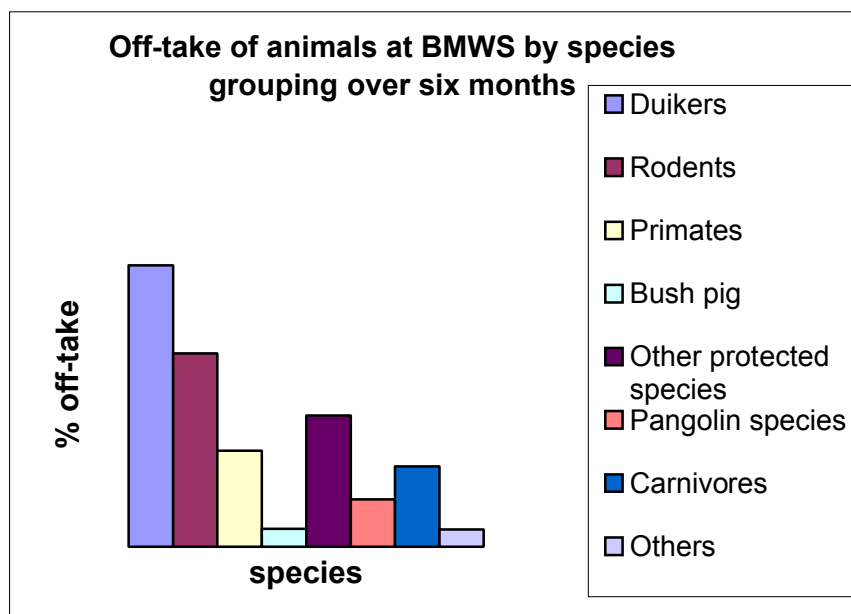


Figure 6.2 Percentage raw counts of off-take by taxonomic groups over 6 month of study

When these animals were placed according to taxonomic groups (Appendix 4), the results clearly showed that duikers had the highest off-take (34%) followed by rodents registering (22%) of the total harvest over the six-month study period. Primates represented the only other significantly larger group with (11%) of the total harvest whereas other protected species within the wildlife sanctuary recorded (15%) of the total animals killed during the six-month study. The least affected of the larger animals were the bush pigs. However, other species mostly birds; amphibians and some reptiles also registered very low harvest rates.

6.2 TOTAL BIOMASS RECORDED

A total of 22.397 kg of animal body mass were harvested by the hunters during the six-month study period (Table 6.2). The Banyang area recorded a total of 13.476 kg of bushmeat by weight while the Mbo area recorded a total of 8.921 kg.

In cases where the weights were not recorded (due to field dressed animals, rotten or smoked animals, those consumed in the bush or those that exceeded the capacity of the weighing balance), average weights were calculated from the recorded weights for adult males and females and juvenile males and females. In other cases where records totalled less than or equal to four for a particular species, ages and sex were considered to produce accurate averages. Weights were also adapted from previously published weights (Kingdon, 1997). The high range of animal weights was attributed to the adult males while the low ranges of weights were due to females and juveniles.

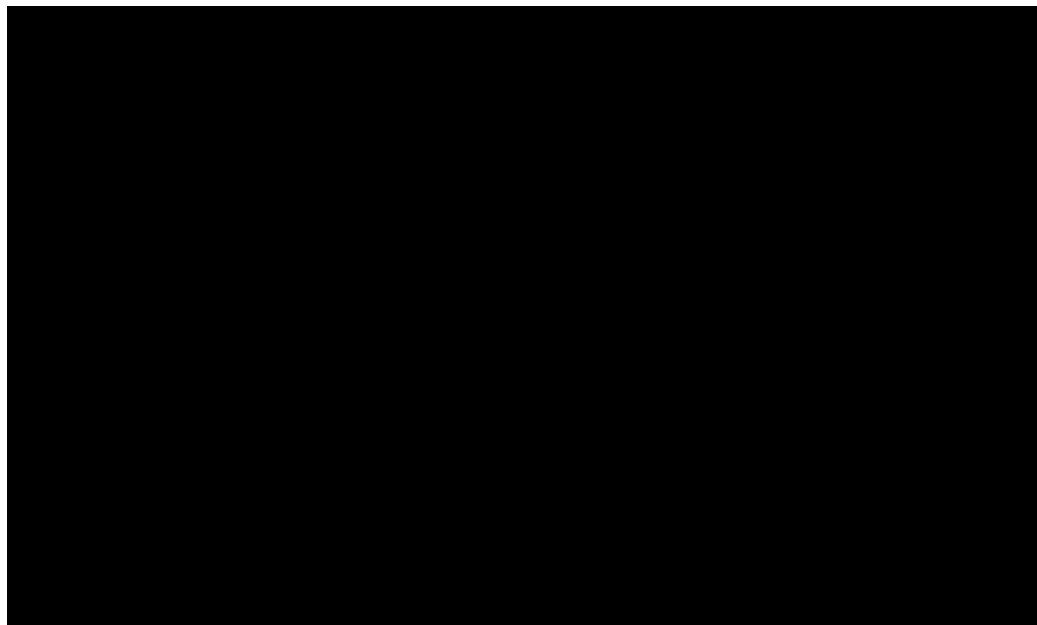


Figure 6.3 Biomass by taxonomic groups over six-month study.

The Banyang hunters harvested more animals and had more biomass than the Mbo hunters. This result is explained in part to the fact that the Banyang people tend to kill larger animals (Plate 6.1) such as large duikers (Ogilby and Bay duikers) and bush pig than the Mbo hunters.



Plate 6.1 Wife and children of a hunter preparing a large red duiker outside a bush hut for smoking in eastern Cameroon.

Source: Karlamann: 2000

Comparing the total biomass harvested for a particular taxonomic group with counts data, dramatic differences were observed. While duikers comprised (34%) of the total harvest, they also constituted the highest (37%) of the total biomass. Rodents that comprised the second largest off-take only constituted (12%) of the total biomass. Bush pigs with only (2%) of the count constituted (20%) of the total biomass while primates and other protected species stayed relatively the same.

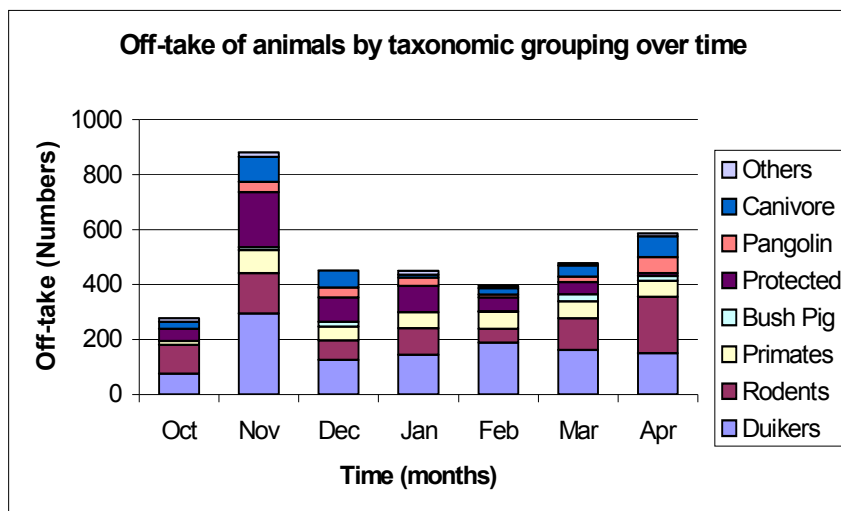


Figure 6.4 Off-take of animals by taxonomic grouping over study period

6.3 TOTAL OFF-TAKE OF PROTECTED SPECIES DURING STUDY PERIOD

Data for off-take in numbers and biomass of protected species showed that primates (monkeys) were most affected by hunting constituting (73%) off-take and (59%) biomass followed by Water Chevrotain (13%) off-take and (20%) biomass then Dwarf Crocodile (8%) off-take and (9%) biomass respectively.

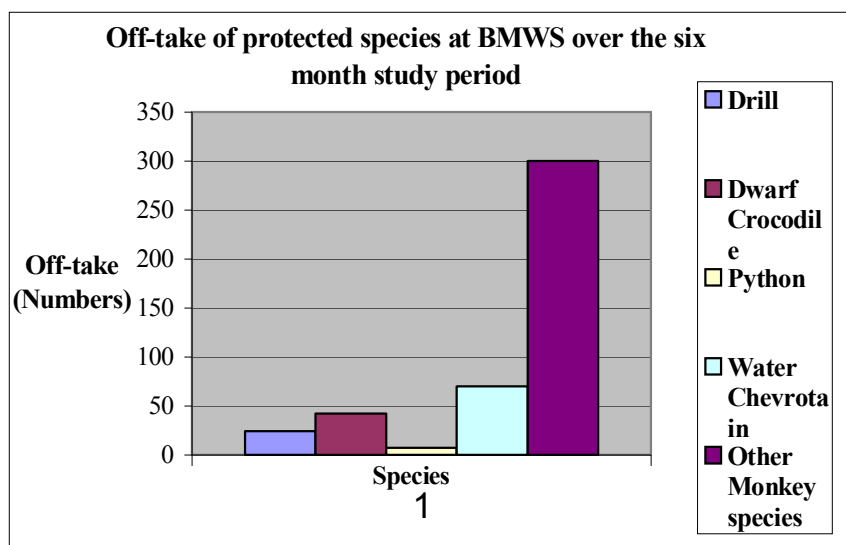


Figure 6.5 Total off-take of protected species

Pythons were least affected as they registered only (1%) of the total off-take and (3%) of total biomass (Figure 6.5) above.

Table 6.3 Extrapolation of total off-take (numbers) and biomass (kg) for n = 429 hunters for the whole of BMWS area over six month period.

Common	Scientific name	Off-take (No.)	Biomass (kg)	Extrap. of off-take (n = 429) hunters	Extrapolation of Biomass (kg)
Water Chevrotain	<i>Hyemoschus aquaticus</i>	70	741.24	358	3.785.62
Dark Mongoose	<i>Crossarchus obscurus</i>	113	199.13	577	1.017.1
Forest Genet ^b	<i>Genetta spp.</i>	22	58.3	122	298
Giant Forest Squirrel	<i>Protexerus stangeri</i>	17	17.4	87	89.1
African Civet	<i>Viverra civetta</i>	28	208	143	1.062.3
African Palm Civet	<i>Nandinia binotata</i>	95	340	485	1.736.43
Cane Rat	<i>Thryonomis swinderianus</i>	110	712	562	3.636.31
Drill	<i>Papio leucophaeus</i>	24	313	123	1.599
Brush-Tail Porcupine	<i>Atherurus africanus</i>	431	1.939	2.201	9.903.1
Bay Duiker	<i>Cephalophus dorsalis</i>	86	1.430	439	7.303.21

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Blue Duiker	<i>Cephalophus monticola</i>	722	3.693	3.687	18.861.1
Bush Pig	<i>Potamoschus porcus</i>	72	4.794	368	24.484
Cobra spp ^c .	<i>Naja species</i>	5	15	26	77.1
Giant Rat	<i>Cricetomys gambianus</i>	180	283	919	1.445.32
Red-Eared Monkey	<i>Cercopithecus erythrotis</i>	49	179.26	250	916
Pangolin spp ^c .	-	193	543.6	986	2.776.24
Squirrel spp ^c .	-	47	26.58	240	136.5
Ogilby's Duiker	<i>Cephalophus ogilby</i>	335	3746.01	1,711	19.131.4
Green Mamba	<i>Dendroaspis jamensoni</i>	28	76.7	143	392.2
Golden Potto	<i>Arctocebus catabarensis</i>	12	19	61	97.04
Bush Fowl ^b	<i>Gutera plumifera</i>	21	33.4	107	171.8
Mongoose spp ^c .	-	70	261.09	358	1.333.42
Hornbill	<i>Ceratogymna atrata</i>	9	17.22	46	88.5
Tortoise spp ^c .	-	21	46.98	107	788.7
Python	-	7	98	36	501
Monitor Lizard	<i>Varanus niloticus</i>	14	70	72	358
Greater White-Nosed	<i>Cercopithecus nictitan</i>	133	979	679	5000
Gabon Viper	<i>Bitis gabonica</i>	13	48.8	66	249.23
Dwarf Crocodile	<i>Osteolaemus tetraspis</i>	42	329.05	215	1.681.13
Crowned Guenon Monkey	<i>Cercopithecus pogonia</i>	12	52.87	61	270.01
Mona Monkey	<i>Cercopithecus mona</i>	184	927.8	940	4.738.41
Red Capped Mangabey	<i>Cercopithecus torquatus</i>	5	32	26	163.43
Bush Buck	<i>Tragelaphus scriptus</i>	6	170	31	868.21
Grand Total		3.176	22.397	16.232	114.955

^aExtrapolations calculated by dividing total harvest by number of hunters (n= 84) participating in the study and then multiplying by the total number of hunters in the Banyang and Mbo areas (n=429)

^bHunters could identify each animal species as present in the BMWS but local names did not differentiate between species

^cHunters could not identify species of these animals

The results obtained from this study showed that one hunter harvested on the average 38 animals with a combine biomass of 267 kg over the six-month study period. On extrapolating the results got

for one hunter by all the hunters ($n = 429$) hunting in the Banyang-Mbo Wildlife Sanctuary it was observed that 16.232 animals were estimated to have been killed giving a total biomass of 114.959 kg (115.61 tons). This gives an estimated average annual harvest of 194.633 animals with a biomass of 1.372.826 kg (1.373.34 tons) respectively.

6.4 SEASONALITY OF HUNTING IN THE BANYANG-MBO AREA

The peak season for both bushmeat off-take and biomass during the study period occurred in the month of November 2006. There were also small peaks during the months of January, March and April for off-take counts but biomass was low during the months of March and April. During January of 2007, both the biomass and off-take charts showed a small peak. It was however, gathered from the hunters that the highest peaks for both off-take and biomass occur during the months of July and August.

When looking at the animal harvest by taxonomic groups over time (Figure 6.2) it was observed that there was a remarkable difference in off-take numbers of duikers and rodents through out the study. Off-take of duikers was higher than that of rodents in 2006. However, in 2007 off-take of rodents exceeded that of duikers in the last months of the study. Primates' off-take was high with a small peak in November of 2006 but remained relatively constant from December 2006 to the end of April 2007. Extraction of bush pig was relatively low through out the course of this study with no peak extraction. Off-take of pangolin and reptiles was also relatively low through out the study period.

There were more reports of an abundance of monkeys in the rainy season. The reverse is true for Potto and Galagos. This can be explained by the fact that in the rainy season, the vegetation is lush and green. When food is available, different monkey groups come together forming a large heterogeneous group. Most primates in tropical forests include a large amount of fruits in their diets. Apart from birds, primates have been known as the main dispersers of forest fruits and seeds. In tropical forests most mammal species have at least partially frugivorous diets.

Most forest trees e.g. bush mangoes (*Irvingia gabonensis*) produce fruits during the rainy season and all the primate species are often found around such trees to eat the ripe fruits as a food source because of its high sugar content which serve as a good source of energy. Some mammals have been shown to reproduce only when fruit availability is high while others exploit less preferred food items when fruits are scarce.

Non-primate mammals were also hunted more in the rainy season. Reported abundance during this season could be connected to an easy hunting effort. Animals are easily spotted because of the close canopy, and the target animals do not hear the scaring crackling noise caused by dry leaves of the approaching hunter. For such reasons a higher number of animals are killed in the rainy season and as such, there were conflicting reports of animals seen more in the rainy season. Duikers, Red River Hog and Porcupine were abundant in the rainy season. Their abundance was related to the advent of fruits during this period. As monkeys feed up the trees, they forage on those that fall on the ground.

The presence of monkeys on a tree was indication of duikers below. The abundance of Civet cats was biased towards the dry season. Their footprints were seen around burnt areas as they feed on partially roasted snails and insects. The presence of this species was limited to the secondary forest only. Hyraxes were recorded killed more in the dry season. There were reports of these animals not venturing into the rains. The collection, hunting and trapping of amphibians and reptiles were mostly carried out during the rainy season. (*Mochlus fernandi*) referred to as Monitor Lizard and Ornate Monitor Lizard (*Varanus ornatus*) were recorded killed in abundance during the dry season.

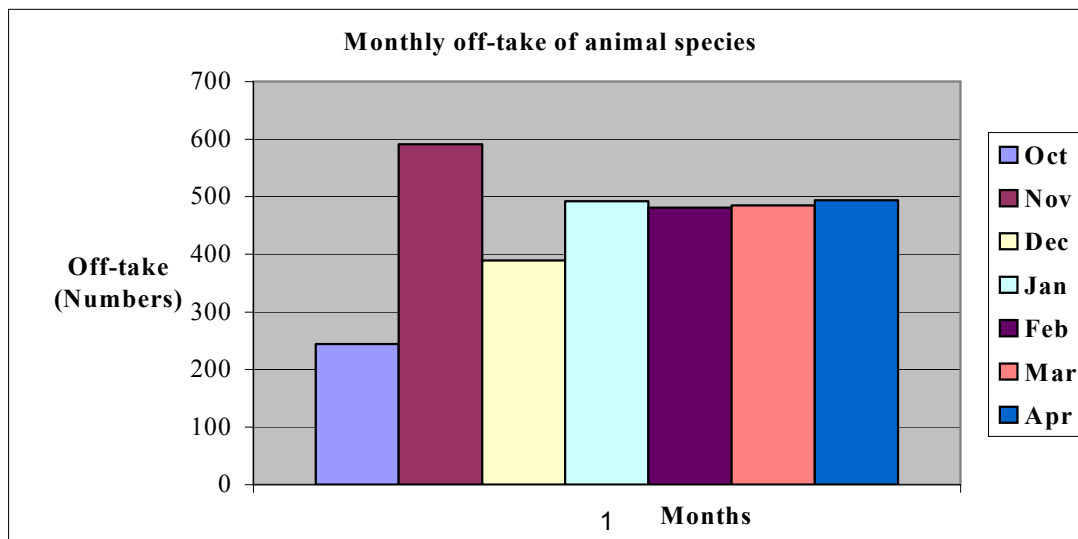


Figure 6.6 Monthly off-take of animals at BMWS over study period

The peak period for both biomass and off-take occurred during the months of November and January respectively. The chart also indicates a small peak for off-take during the Month of April 2007. Hunters in both regions of the wildlife sanctuary were interviewed in an attempt to explain the peaks. Hunters explained that during the months of July and August the rains are quite heavy. This allows hunters to easily stalk their prey since there is no dry leaf litter. Also it was gathered that during this time there are many fruiting trees and hunters can hide around these fruiting trees and shoot animals as they come to feed on the fruits. The heavy rains also allow those who employ wire snares to see the paths of the animals thereby showing the optimum place to pin a wire snare.



Plate 6.2 Wire snare used for trapping ground dwelling animals in Cameroon

The ground is quite soft at this time so the stick which is attached to the wire is easily driven into the ground. This makes July and August to have the highest peaks for both off-take and animal biomass extracted at the Banyang-Mbo area. The peak in November is due to hunters preparing for the holiday season in December and early January. The small peak in January may be due to poverty as most hunters have spent all of their finances during the holiday period.

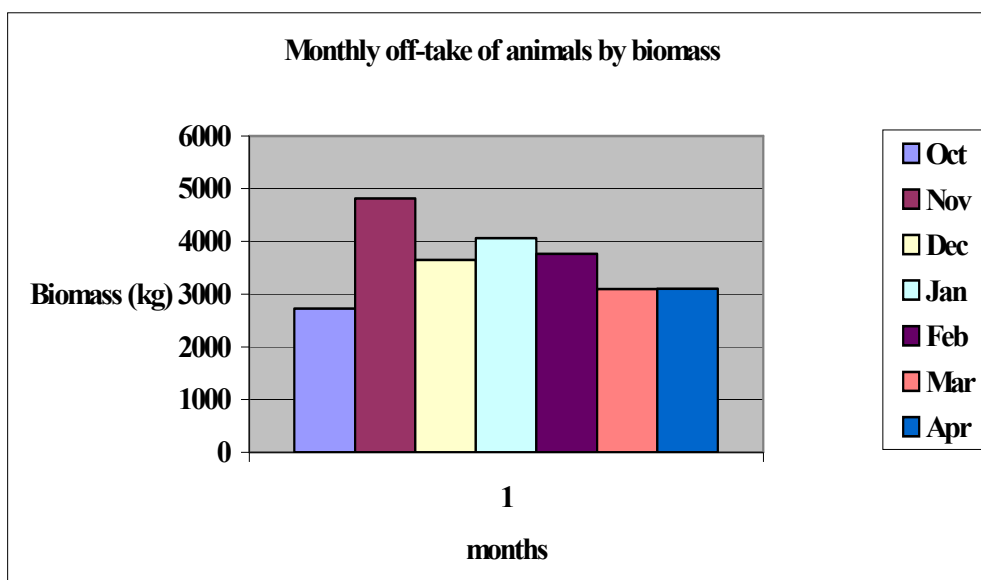


Figure 6.7 Monthly off-take of animals' biomass over the study period

The bar chart above shows the trend of monthly extraction of species by biomass at the Banyang-Mbo Wildlife Sanctuary over the six-month study period. The results show that the highest peak for animals' biomass was in the month of November 2006. There was also a significant extraction of animals by biomass during the month of January 2007. There was however, a steady downward trend in animals' biomass from February to April 2007. This downward trend in biomass can be explained by the fact that during these months, smaller-bodied animals especially rodents, small carnivores and Pangolin species constituted much of the off-take.

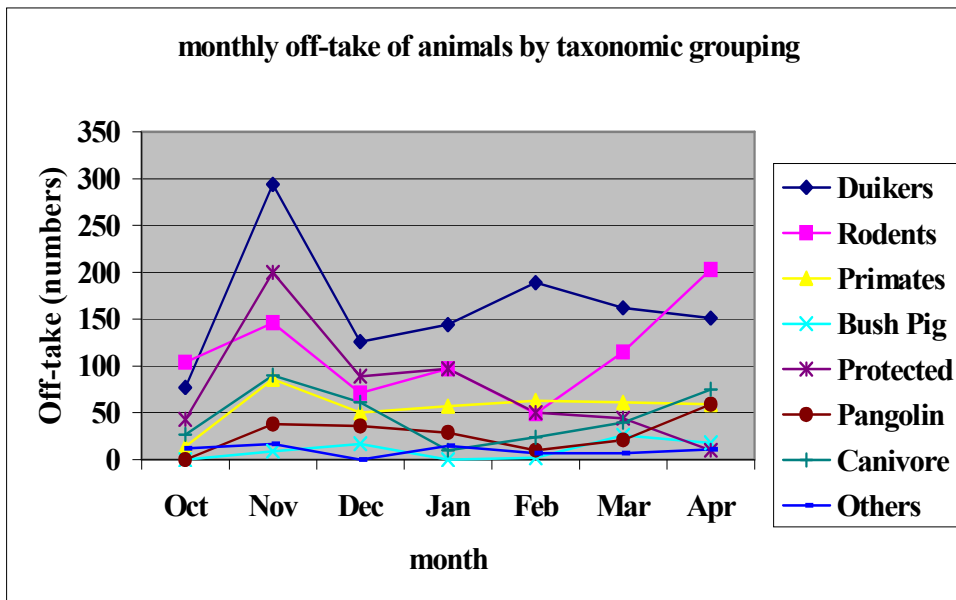


Figure 6.8 Monthly off-take by taxonomic grouping

The above graph illustrates the trend of removal of animals by species groupings. When looking at off-take by animal groups, it can be observed that in 2006 larger bodied animal groups like duikers constituted a greater portion of the harvest. However, towards the end of the study in 2007 from February, there was a steady decline in the number of duikers in the total off-take. Whereas there was a steady increase in the number of smaller bodied animals like rodent in the total harvest of hunters.

Primates' off-take remained relatively stable from December 2006 to April 2007 while there was a gradual increase in the number of carnivores recorded by the assistants from January to April 2007. There was also a gradual increase in the number of Pangolin species present in the total off-take. It was interesting to note that there was a downward trend in the off-take of other protected species from December 2006 to April 2007. Other species groups such as birds; snails, some reptiles and amphibians were least recorded in the off-take from October 2006 to April 2007. This could be due to the less importance paid to these groups as they are mostly consumed by the hunters' families.

6.5 VARIATION IN HUNTING BY DAY TIME

Most hunting activities at BMWS are carried out during daylight. The common practice is to leave the village early in the morning and return at the end of the day. Night hunting is also practiced when the hunters leaves the village or hunting hut by sunset and continue hunting until late in the night or early in the morning. Headlamps or torchlight are used during night hunting. Night hunting is more successful in hunting non-primate mammals than primates. Variation in hunting time all depends on the type of animal the hunter intends to hunt. Hunting of monkeys was never carried out in the night. This also applied to birds, which are all diurnal animals. Nocturnal species like Potto (*Perodicticus potto*) Allen's galagos (*Galago allen*), small Genets (*Genetta genetta*), Civet cats (*Civettictis civetta*) duikers, Red River Hogs (*Potamochoerus porcus*) and Porcupines (*Atherurus africanus*) were preferably hunted in the night than during the day. Red River Hog is nocturnal in habit but is scarcely shot during night hunting. The reason is that hunters identify particular species according to the reflection from the iris of the eyes. The eyes of this animal do not reflect in the night. In addition, the possession of an eyelid does not expose the eyeballs of this animal and as such does not reflect the rays of the hunter's lamp. During night hunting, the hunter locates a good vantage point where he notices particular species come to feed or drink water. This method was very successful in hunting Porcupines. A successful hunter was able to come home with a good number of animals at the end of a night hunting expedition.

6.6 DISTRIBUTION OF HARVESTED ANIMALS BY SEX AND AGE RATIOS IN THE TOTAL CATCH

Analysis of data showed that more males (47%) were killed than females (43%). The unknown sexes (10%) were either rotten, too young to determine the sex or it was difficult to determine the sex of the animal in question. Such animals included (the Monitor Lizard (*Varanus niloticus*), Giant forest Squirrel (*Protexerus stangeri*) and Dwarf Crocodile (*Crocodilus niloticus*)). While adults comprised (69%) of the total harvest, juveniles constituted (23%) and infants made up (8%) of the total game killed during the study period (Table 6.4)

Table 6.4 Percentage composition by sex and age ratios of species in total catch

% composition of species by sex in the total catch (n = 1376)		
Males	Females	Unknown
47	43	10
% composition of species by ages (n = 1376)		
Adults	Juveniles	Infants
69	23	8

A Chi square t-test showed that there was no significant difference at ($P \leq 0.05$) in percentage sex ratio composition between males and females of game meat harvested by hunters at the Banyang-Mbo Wildlife Sanctuary. There was however, a significant difference at ($P \leq 0.01$) between the males, females and the unknown sex in percentage composition of the harvested game meat. A significant difference at ($P \leq 0.05$) was also observed between adults and juveniles and adults and infants in terms of age composition of the catch. However, there was no significant difference at ($P \leq 0.01$) between juveniles and infants in terms of percentage age composition in the harvested game registered.

6.7 HUNTING METHODS

Almost all male members of the population practiced hunting and trapping. Hunting is considered as a recreational as well as economic activity by the people in and around the Banyang-Mbo Wildlife Sanctuary. In fact a proficient hunter may end much regard from his friends and extended families for which he provides. Ordinarily hunting is never a female pursuit but hunting of amphibians was very common among women and children.

Table 6.5 Numbers of individuals hunted in each sex and age class with guns or wire snares in the BMWS of the southwest province Cameroon (Animals captured at least 50 times by each weapon type)

Common name	Gun					Wire snare				
	M	F	U	X ²	P	M	F	U	X ²	P
Bay duiker	47	39	0	1.31	-	60	50	6	0.02	-
Blue duiker	448	274	0	1.03	-	80	74	5	1.53	-
Ogilby's duiker	119	215	1	2.36	*	134	89	11	0.04	-
Brush-tailed porcupine	273	150	8	2.35	*	201	150	72	3.44	*
Drill	19	5	0	0.06	-	-	-			
Emin's giant rat	-	-				86	40	30	8.13	**
Greater white-nosed monkey	89	44	0	3.75	**	-	-			
Mona monkey	86	97	1	0.06	-	-	-			
Pangolin	98	94	1	0.14	-	82	86	24	1.04	-
Red-eared monkey	25	24	0	1.23	-	-	-			
Water chevrotain	32	37	1	0.83	-	-	-			
Dark mongoose	64	49	0	1.03	-	47	50	16	1.05	-

^aM = male, F = female, U = unknown.

^bUnknown sexes (rotten carcasses or could not be identified by assistant) are excluded from the analysis.

^cSex ratios are considered significantly different from the expected 1:1 ratio if $P < 0.05$ and $P < 0.001$

Short guns were commonly used and all species of animals were at least hunted using a gun. Monkeys were commonly hunted with guns and cases of monkeys caught in traps and by dogs were very low during the study period. Living partly an arboreal / terrestrial mode of life, Preussi guenons (*Cercopithecus Preussi*) and Drills (*Papio leucophaeus*) were common species hunted with dogs and were easily caught in wire snares. These species were also reported to invade farmlands and cause havoc to cultivated crops. There were hardly any cases of Chimpanzees (*Pan troglodytes*) caught in traps during the whole study period.

In contrast to monkeys, guns, traps and dogs were all involved in hunting non-primate mammals. Terrestrial animals caught in traps were very common. Species easily caught in traps were duikers, Water Chevrotains (*Hyemoschus aquaticus*), Porcupines, Red River Hogs and Giant Rats. The main use of dogs in hunting is to locate and corner animals so that the hunter can follow and make the kill himself either with his gun or machete. A good example is the case of the drill hunting whereby dogs discover a troop of drills and drives them into one tree. Drills do not have the ability to jump between trees, so the hunter blast away the drills until the whole troop is decimated. Poisoned baits were very commonly used in trapping cane rats and monkey species in Nzoa village.

Most young hunters who did not own personal guns favoured trapping. An eighteen year-old hunter was proud of owning up to 300 wire snares. Older hunters owned higher numbers of wire snares. Most hunters did not welcome trapping with wire snares because it kills virtually every ground dwelling species indiscriminately but nothing could be done to halt such activity. Trapping involved less expertise and was said to be less tedious and more ground dwelling animals were caught in traps than using the gun in most of the study villages.



Plate 6.3 Wire snare set along a fence built to guide animal movement

Being slow moving creatures, reptiles were mostly butchered with machetes and guns were scarcely used in hunting them. They were occasionally caught in traps. Picking of tortoises was a very common practice but they occasionally fell into traps as well. Children commonly caught water tortoises in fishing nets.

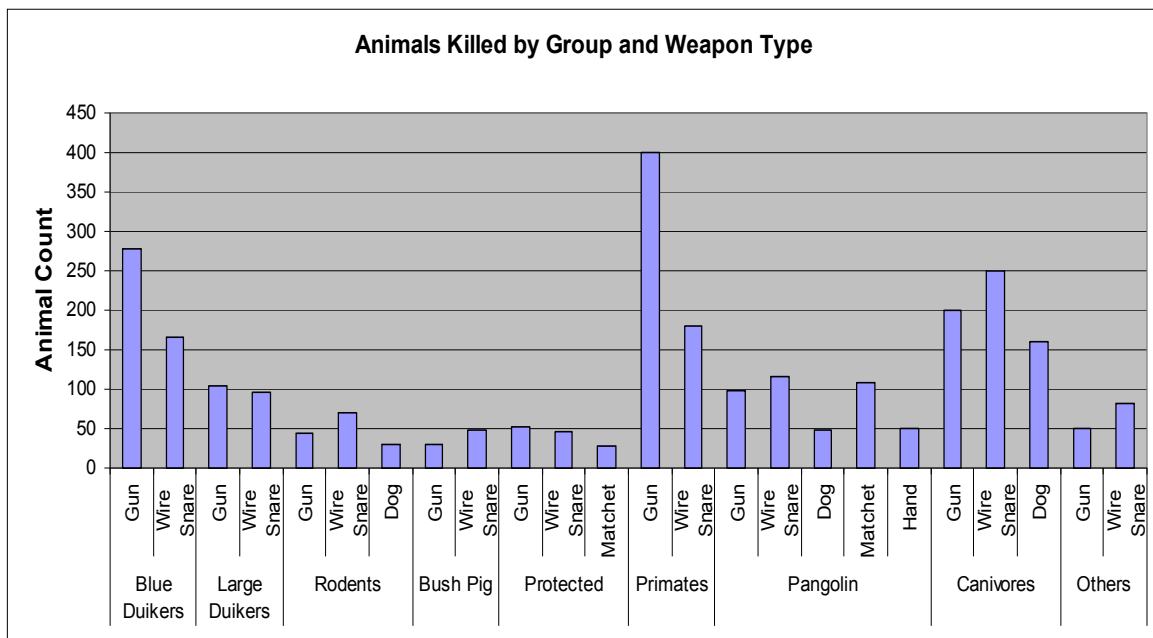


Figure 6.9 Counts of animal taxonomic groups killed by weapon types

Analysis of data indicated that the weapon used most frequently by hunters was the short gun as these were weapons of choice for (39%) of all recorded kills (Figure 6.9). These guns which require hunting permits and licenses issued by the government are rarely enforced. The guns and shells are brought in from neighbouring Nigeria through Mamfe, which is a major bushmeat trading town. Mamfe is located some 40 km from the Banyang-Mbo Wildlife Sanctuary and the road is passable throughout the year. This route supplies both the Banyang and Mbo hunters. Another trade route is through the Korup National Park on foot and then to the Mbo hinterlands through the villages of Ntale and Mungo Ndor. The guns can also be brought in through the North West Province from Bawuru into Akwaya then Widikum and finally into Upper Banyang. The guns and shells (Plate.6.4) are sold to locals by traders at 25.000-40.000F CFA (US \$51.69-82.7) and shells at 500 to 700F CFA (US \$1.043-1.46).



Plate 6.4 locally made bullets used by hunters at the Banyang-Mbo Wildlife Sanctuary

Wire snares which comprise (19%) of all recorded kills are commonly sold in the open markets in Cameroon despite its total ban in Cameroon. A meter of wire snare sells at 350F CFA (US \$0.730). One meter of wire can be used to make five snares depending on the size of the intended prey as seen in (Plate 6.5) below.



Plate 6.5 Wire snare used in trapping ground dwelling animals

Pit traps which constituted (25%) of kills recorded are also commonly made in Nigeria and Cameroon. There are different types of pit traps meant to trap different sizes of animals e.g. the iron foot traps used for trapping smaller games and box traps mostly made of wood and commonly used by children to trap rodents and birds.

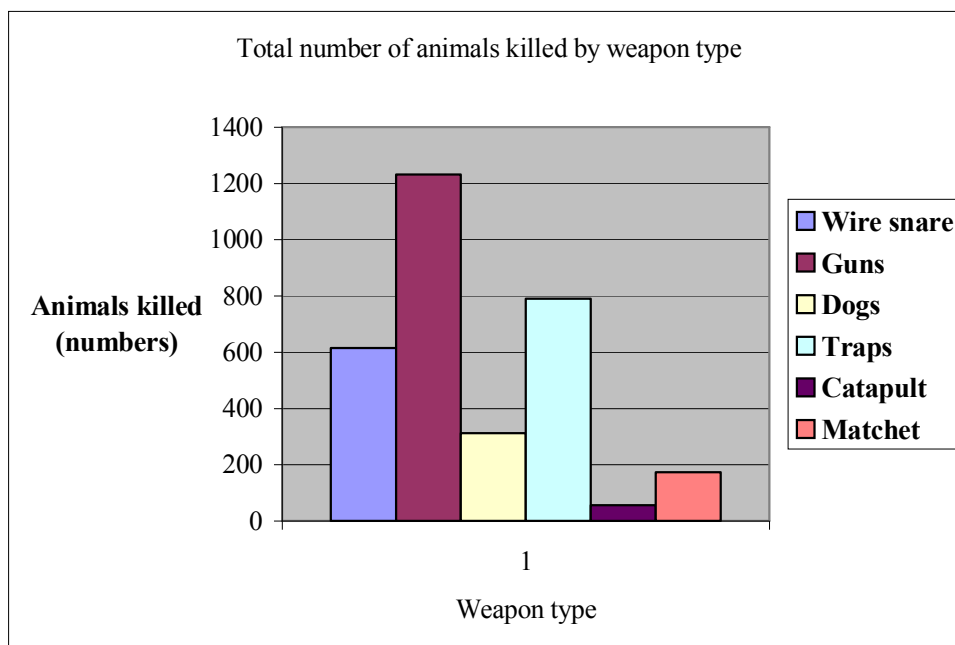


Figure 6.10 Weapons of choice used in hunting at the BMWS

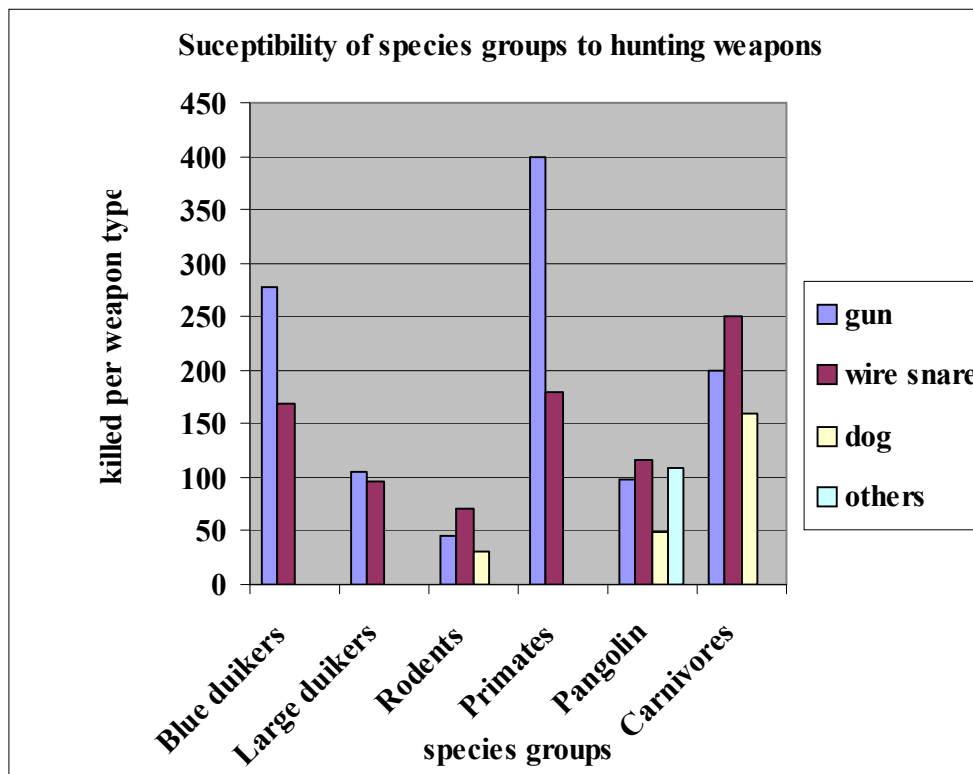


Figure 6.11 Susceptibility of species groups to different types of hunting weapons

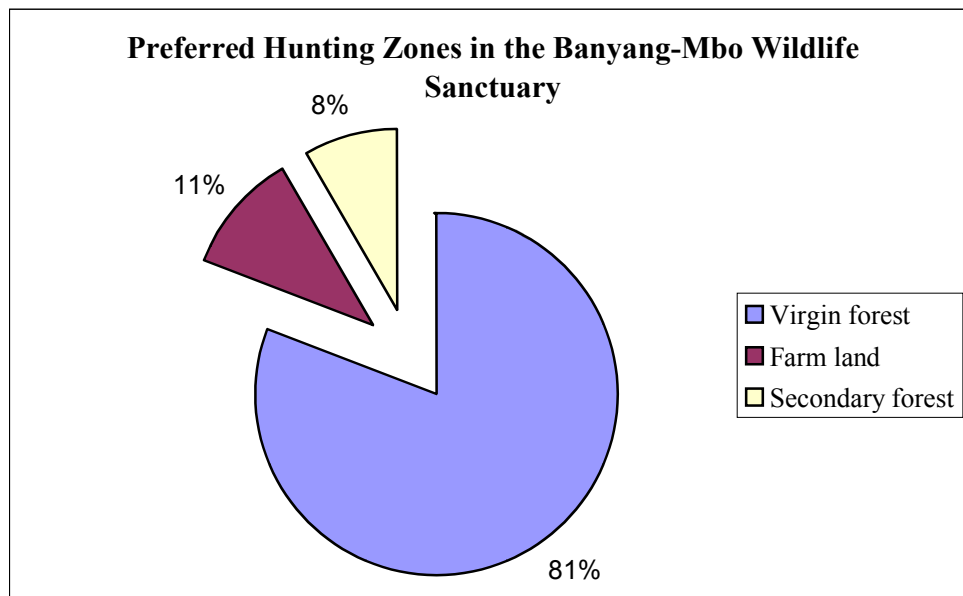


Figure 6.12 Frequency of hunting in different zones of the BMWS

From the above figure it is observed that the major hunting grounds (81%) are located in the virgin forest otherwise called “black bush”. However, some of these black bushes still remain in proximity to the villages but most hunting grounds are located inside the virgin forest. The figure also shows that the least hunting activities are carried out on hunting grounds located in the secondary forest however; a reasonable amount of hunting is carried out in farmlands.

6.8 SPATIAL DISTRIBUTION OF KILLS WITHIN THE VILLAGE HUNTING ZONES

A map was generated using Arc View and GPS points to show spatially where animals were killed throughout the study area (Figure 6.13). It should be noted here that only the study villages (n =14) are represented on this map. The large empty spaces on this map are most likely the hunting zones of neighbouring villages. Considering only the study villages; hunting was most concentrated in Mbo east (Nzoa, Ndom, Etodi and Etawang). In the north western and northern Banyang area, hunting was less concentrated per zone. Each of the villages involved in this study hunted inside the Banyang-Mbo Wildlife Sanctuary. The following villages close to the boundaries of the sanctuary carry out intensive hunting inside the Banyang-Mbo Wildlife Sanctuary (Ndom, Etawang, Barah, Ntenmbang, Etodi, Fotabongkwa, Tangang, Elumba and Nzoa) while those further away from the sanctuary boundaries (Akiriba, Tali, Fotabe, Defang, Ebeagwa) mostly hunt outside the sanctuary.

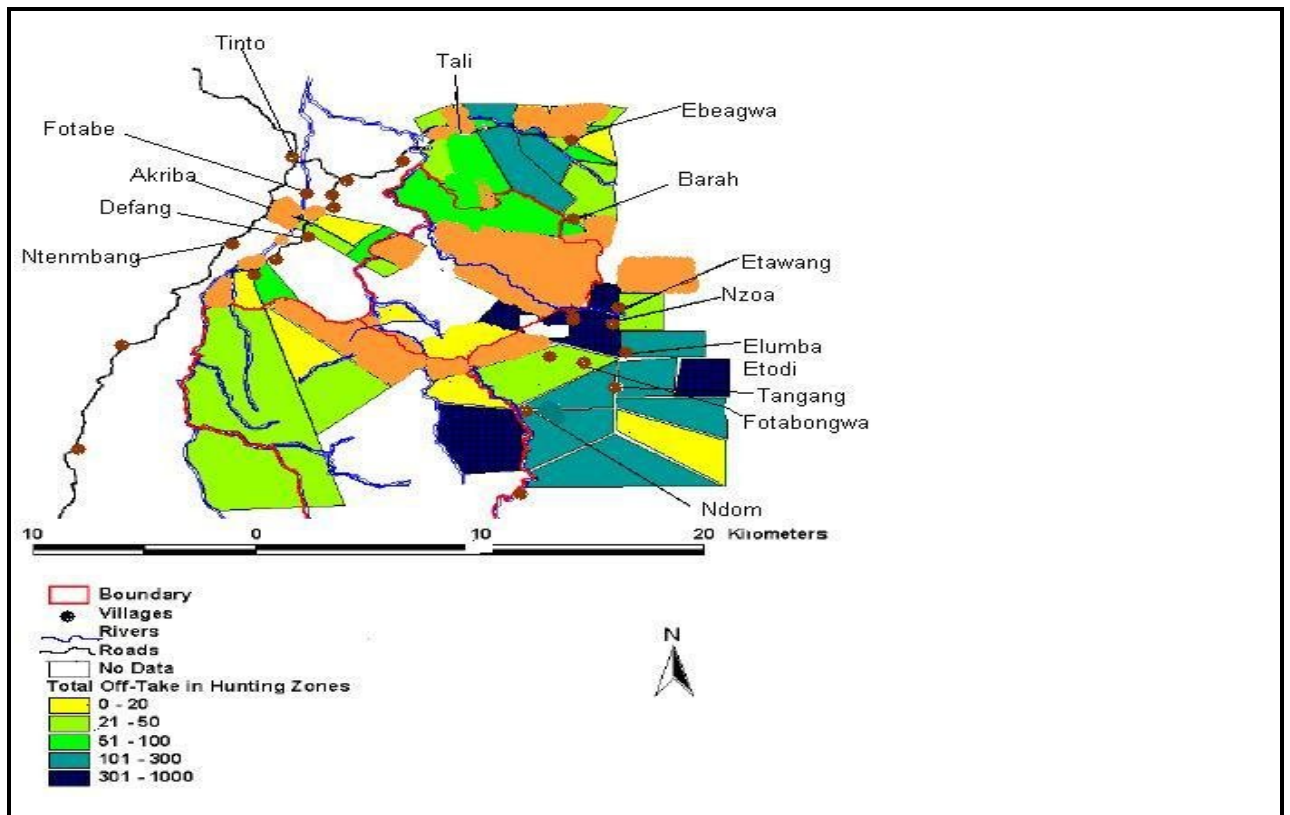


Figure 6.13 Counts of total number of animals killed per hunting zone during the study period

In order to highlight the distribution patterns of wildlife hunted for home consumption and sale, the study area was divided as follows (table 6.6):

Table 6.6 Distribution of wildlife out-take according to village zones and vegetation type

Zone	Villages close to zone	Vegetation type
I	Ntenmbang, Akriba, Fotabe, Tinto (NW)	Low land rain forest
II	Tali, Ebeagwa (NE)	Low land rain forest
III	Barah, Nzoa, Etawang (E)	Mid altitude rain forest
IV	Elumba, Etodi, Tangang, Fotabongkwa (E)	Montane rain forest

6.8.1 Mammalian primate distribution pattern in the BMWS area

Off-take records revealed that the monkey species particularly the Putty Nose Monkey (*Cercopithecus nictitan*), Mona Monkey (*Cercopithecus mona*), and Red Ear Guenon (*Cercopithecus erythrotis*), together dominated the primates' off-take in all the zones. Drills and the only killed Chimpanzee were harvested in mid-altitude rain forest zone III, while bush baby (Potto and Galago) were common in lowland rain forest zone I and a few baboons killed were restricted to the montane rain forest zone IV.

6.8.2 Large mammals' distribution pattern in the BMWS area

Throughout the BMWS area, the bulk of off-take and sale of large mammals consisted of the Blue duikers (*Cephalophus monticola*) and Bay duikers (*Cephalophus dorsalis*), showing their wide distribution in all the four zones, although different species prefer particular vegetation covers. The Water Chevrotain (*Hyemoschus aquaticus*) was more common in the lowland and mid-altitude vegetation zones I, II and III. They also occurred in smaller numbers in the other areas. Although the incidence and off-take of other large mammals are low in the whole BMWS, the forest Elephants (*Loxodonta cyclotis*) and Buffalos (*Syncerus nanus*) were reported more in the mid-altitude rain forest zone III.

6.8.3 Small mammals' distribution pattern BMWS area

Throughout the BMWS area Porcupine accounted for most of the income derived from off-take. Additional income for households in the montane zone IV was derived from the Hyrax. In the rest of BMWS, high off-take levels are taken from the Giant Rat, the Pangolin, the Cane Rat, and Squirrels (*Xerus erythropus*, *Protexerus stangeri*) indicating their being uniformly present.

6.8.4 Reptiles, tortoises and giant snail off-take and sales in the BMWS area

Various reptiles are hunted and sold in villages throughout BMWS. The off-take levels are fairly high, uniformly higher in the lowland and mid-altitude rain forest zones but low in the montane forest. On the other hand, the numbers of the giant forest snail (*Archachatina calchatina marginata*) and those of tortoise (*Pelusios adansoni*) sold are less except when taken to the savannah zone. The reptiles of importance in the MBWS areas are forest Iguana (*Osteolaemus tetraspis*), the order serpents: 4 families and 25 species of snakes, the Monitor Lizard (*Varanus niloticus*) and the Nile Crocodile (*Crocodilus niloticus*) these were represented in small numbers in all the zones of the reserve.

6.9 FREQUENCY OF HUNTING AT THE BANYANG-MBO WILDLIFE SANCTUARY

Hunting activities were carried out from October 2006 to April 2007 by both the Banyang and Mbo hunters either daily (15.56%), once a week (14.36%), twice a week (29.71%), four times a week (25.00%) or once monthly (4.71%) and irregularly (13.15%). However, this does not reflect the hunting habits of these hunters as most of them are engaged in other activities like collection of NTFPs and farming. Most of the hunters revealed that hunting at this time of the year is not very successful because the leaves are dry and animals can see far and are always on alert when they hear any noise. The results show that most of the hunters (25%) are however, active for most of the week.

Table 6.7 Census of the hunters in all of the BMWS, villages (Adapted from Willcox and Nzouango 2000).

Regions	Villages	Hunter Population	Total Population 1987	
Mbo	Elumba	13	136	
	Etawang	11	65	
	Etodi	22	280	
	Fotabongkwa	15	431	
	Hunyampe	23	256	
	Ndom	17	81	
	Nzoa	12	210	
	Tangang	36	500	
	Sub-Total (1)		149	1959
Upper-Banyang	Akiriba	27	277	
	Barah	11	62	
	Defang	23	441	
	Ebeagwa	31	289	
	Edjuingang	30	133	
	Fotabe	13	483	
	Tali I	26	859	
	Tali II	32	357	
	Tinto I&II	9	714	
	Ntenmbang	29	398	
	Sumbe	49	594	
	Sub-Total (1)		280	6594
	Grand Total		429	8553

Source: Willcox and Nzouango 2000

6.10 UTILIZATION OF BUSHMEAT

During the analyses of data on utilization of bushmeat, it was discovered that there was a marked difference in the data set of the two ethnic groups. For a better understanding and to make the information more useful, we decided to present the data separately (Figure 6.14 and 6.15) below.

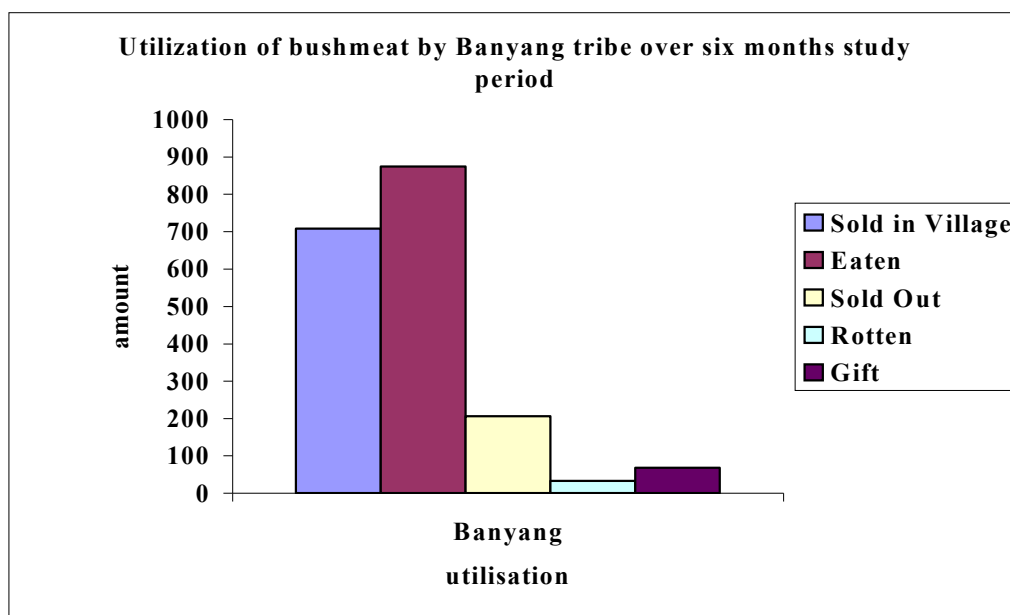


Figure 6.14 Final destination of bushmeat in the Banyang study area

The charts on bushmeat utilization for the Banyang and Mbo ethnic groups respectively showed that in the Banyang area, hunting was mostly carried out for subsistence need (45%) or to sell the meat (38%) locally in the village in the form of pepper soup, fried bushmeat or fresh to those who do not hunt (cash crop farmers). Only 11% of the total harvest was sold out of the area to passengers in private vehicles and public taxis travelling to larger towns (Mamfe, Lebialem, Dschang, Kumba, Douala, and Bamenda). Four percent of the total registered harvest in the Banyang area was given out to visiting relatives and family friends or to the assistants who helped the hunter to remove the bushmeat out of the forest. It was observed that only (2%) of the total catch was completely rotten and not edible in the Banyang area.

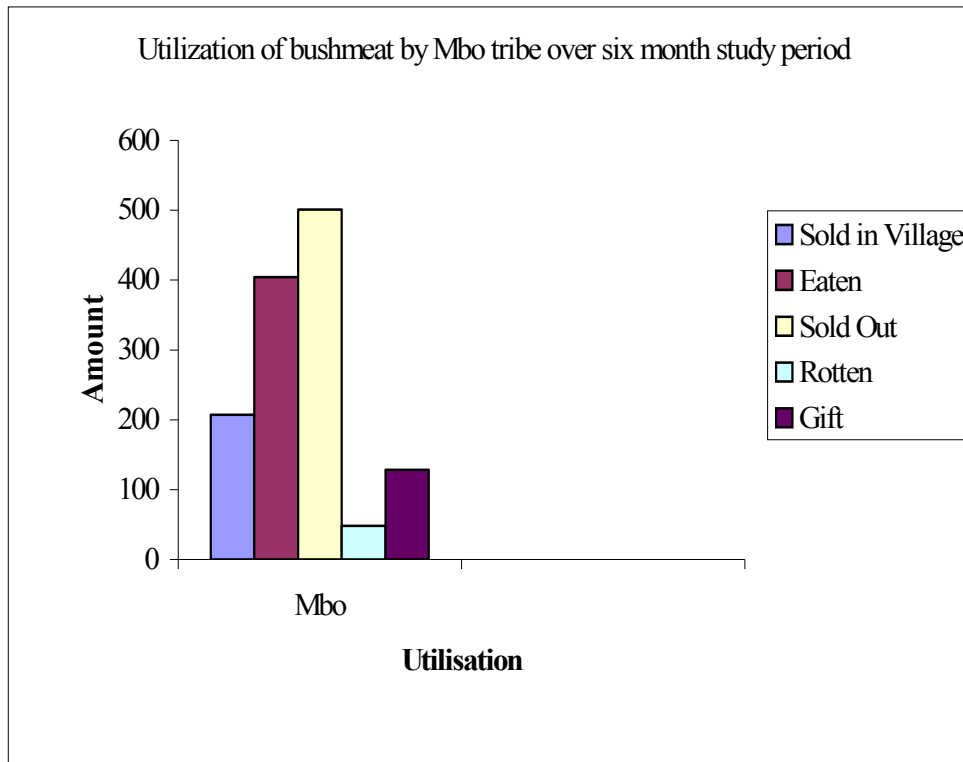


Figure 6.15 Final destination of the bushmeat in the Mbo study area

In the Mbo area most of the registered total catch (39%) was sold out of the villages at various bushmeat markets to out side traders from the Littoral and Western provinces. Thirty one percent of the total harvest in this area was consumed by the hunters and their families. The meat consumed mostly comprised of animals that could not be readily bought by bushmeat traders (Bird species, Squirrel species, Tortoise species, Snakes, Giant Rat or half-rotten beef). The Mbo hunters sold only (16%) of their total harvest within the villages. Ten percent of their total bushmeat harvested was given out as gifts to friends and family members. Some of the larger animals were consumed in part by the hunters, given as gifts or sold within the village.

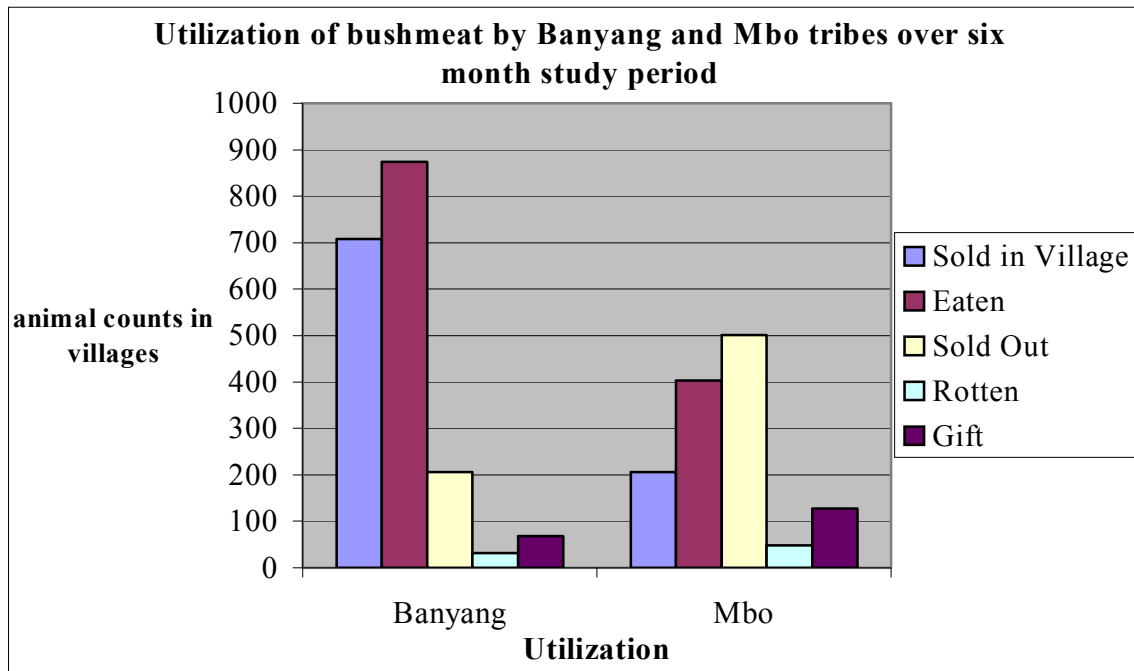


Figure 6.16 Comparative utilization of bushmeat in Banyang and Mbo study areas

From the result of the analysis, the Banyang people hunt mostly for personal consumption (45%) or sell locally (38%) within the villages. Only (11%) of their total harvest was sold out of the area to drivers and passengers travelling in public taxis to larger towns (Dschang, Mamfe, Tinto, Fontem, Kumba and Widikum). Four percent of the bushmeat was also given to visiting relatives and friends from bigger towns and assistants who helped the hunters to carry the bushmeat out of the forest.

Completely rotten bushmeat constituted only (2%) of the total catch. Generally the Mbo hunters sold out most of their meat (39%) at the central market (Elumba) to outside traders from the Littoral, Western and Southwest Provinces. The hunters and their families consumed (31%) of the meat whereas (16%) of the total catch was sold within the villages. The meat consumed comprised animals that are not readily bought by traders such as Mongoose sp. Giant Rats, Squirrels, and half-rotten animals. The Mbo sold out (16%) of their meat locally because most residents in this area are hunters, therefore there is no local market for bushmeat. The hunters gave out (10%) of the harvested bushmeat to love ones.

Bushmeat distribution network in the Banyang area

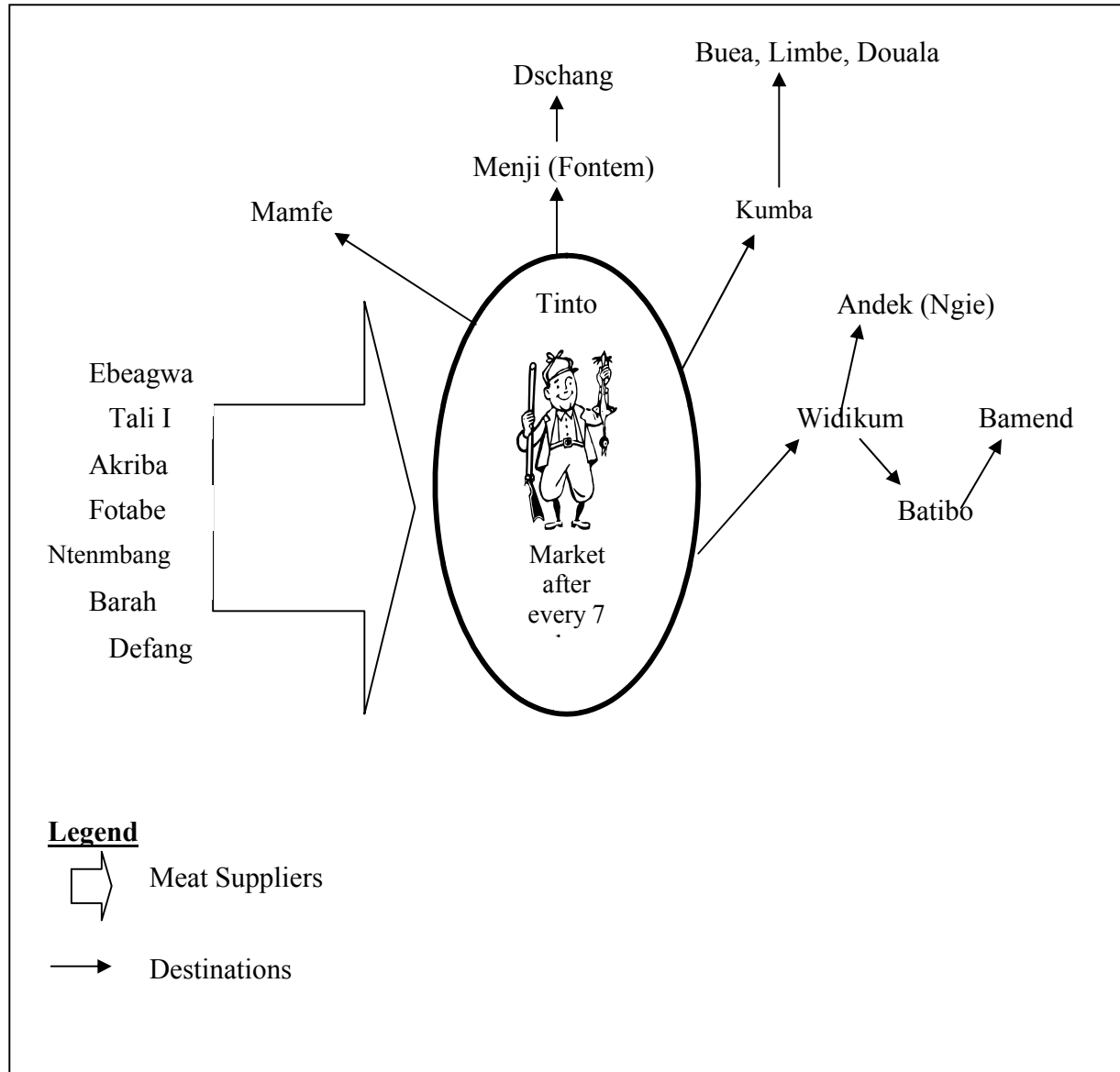


Figure 6. 17 Bushmeat distribution network at the Banyang study area 2006/2007

Mbo hunters have almost the same end destinations (larger cities and towns) where the bushmeat is supplied, generally the Banyang hunters stand on a better advantage to supply bushmeat much further than the Mbo hunters because of access to motorable road.

There are year round access roads linking Upper Banyang to most big towns like Kumba, Mamfe and Dschang. This eases transportation of bushmeat from this area to as far as Douala, Yaoundé, Bafoussam and Bamenda.

Most of the Mbo area is enclave with roads that are functional mostly during the dry season. However, bushmeat traders from the big towns come on market days and buy. During the raining season the Mbo hunters consume most of their harvest locally.

Bushmeat distribution network in the Mbo area

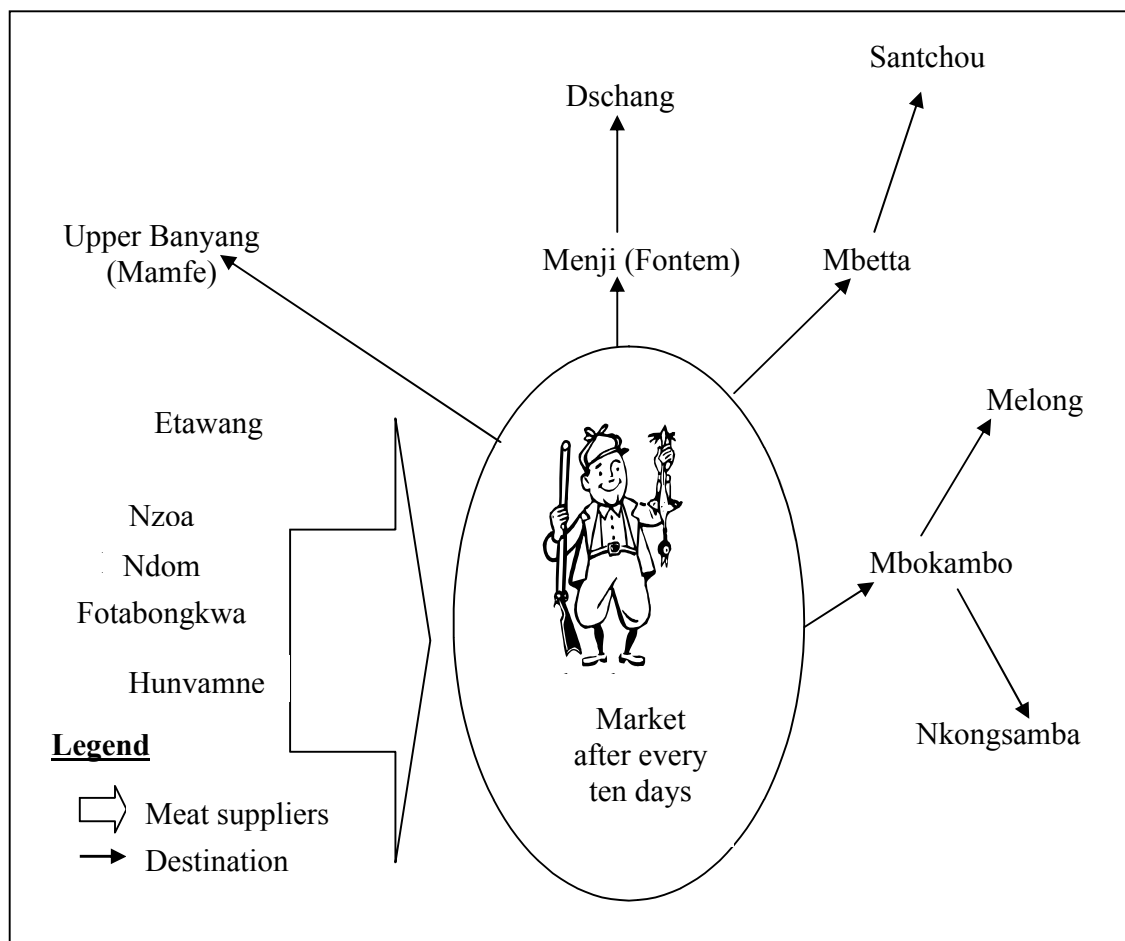


Figure 6.18 Bushmeat distribution network at the Mbo study area 2006/2007

6.11 PHYSICAL CONDITION OF BUSHMEAT WHEN RECORDED BY RESEARCH ASSISTANTS

The assistants recorded the physical condition of the animals as they were brought to the villages. The data were analyzed separately due to differences between the two ethnic groups (Figure 6. 19) below.

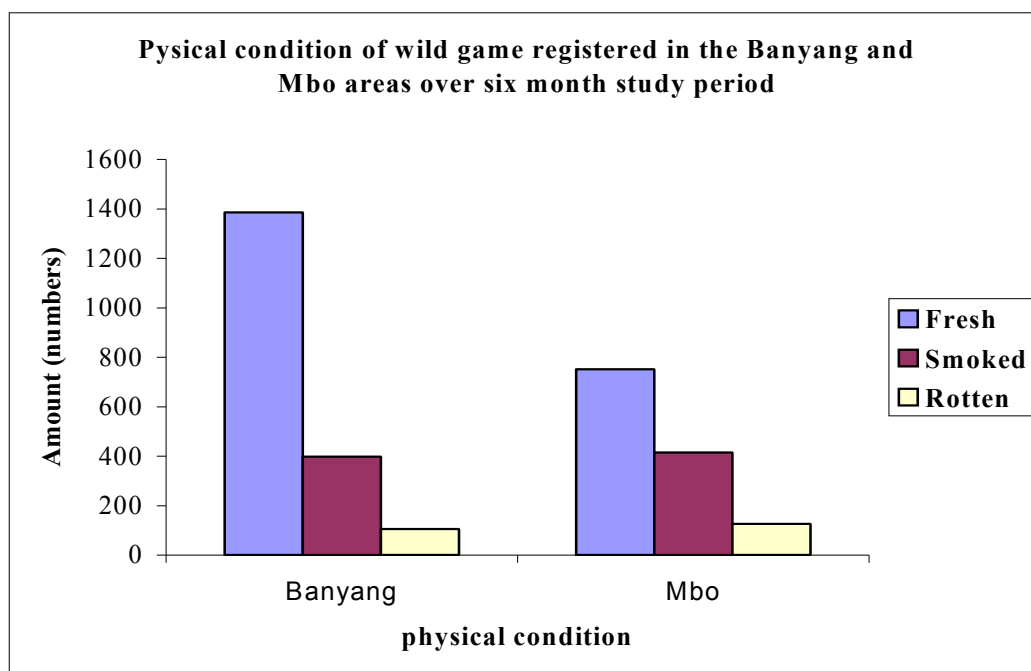


Figure 6.19 Physical condition of bushmeat when brought to Banyang and Mbo villages

Analysis of data revealed that the Banyang hunters brought in predominantly fresh game meat (73%) into the villages. Rotten game meat, which was still consumed in many of the cases, constituted the least component of the Banyang tribe hunters. Smoked game meat made up (21%) of the harvested wildlife brought to the Banyang villages. The Mbo hunters brought home (58%) of their catch fresh as is the case with most hunting areas in Cameroon. (See Plate 6.6 below) Smoked game meat constituted (32%) of the total catch.



Plate 6.6 Fresh guenons being carried by a hunter to the village at in the Eastern Cameroon

Source: Karlamann: 1998

6.12 THE SOCIO-ECONOMIC IMPORTANCE OF HUNTING

The two ethnic groups utilized their bushmeat harvests differently (Figures 6.16). While the Banyang hunters primarily sold their catch within the villages or consumed it in the household (83%), the Mbo sold most of their bushmeat to outside traders (39%). It was also relevant to analyze the utilization of the different species by the hunters as certain species of animals were used for different economic and food purposes. The four most harvested species were used for different purposes. The ungulates, blue and Ogilby's duikers were primarily sold to external markets whereas brush-tailed Porcupine and Pangolin were mostly consumed or sold locally.

At the end of the study period, hunters who participated in the study earned 11.405.100F CFA (US \$23.540.697) in total. When this is divided by the total number of hunters who participated in the study ($n = 84$) and by the total number of months of data collection, it was found out that one hunter earned 22.629F CFA (US \$46. 69) on average per month. This gives an annual income of 2.71548F CFA (US \$560.276) per hunter.

The average minimum salary of a high school leaver professional Ecole Normal Supérieure (ENS) teacher civil servant in Cameroon is estimated to be about 125.000F CFA (US \$258) per month which means that he earns an annual income of 1.500.000F CFA (US \$3,095). When the two occupations are compared it is seen clearly that hunting is not an economically viable occupation for the people in the Banyang-Mbo Wildlife Sanctuary area. The average prices for different commonly recorded species of bushmeat per kilogram were compared with the current prices per kilogram of domesticated animal protein sources in Kumba and Mayemen (Table 6.8). The most expensive bushmeat per kg is cheaper than the lowest priced alternative. The largest animals in terms of biomass from this study are bush pigs and large duikers. Price data are not available for these animals as no records of sales were entered for them rather they were consumed or given as gift. If the price of Mona Monkey with that of fresh beef is compared it is 425: 2000F CFA. One kg of fresh beef is 4.7 times more expensive than one kg of bushmeat. Table 6.8 below shows the prices of some game meat and domesticated animal meat.

Table 6.8 Comparative average prices in francs CFA per kilogram of wild game meat and other domesticated animal protein sources in and around the study area.

Name	Whole Adult	Price/kg
Red-eared monkey	3,500	642
Brush-tailed porcupine	2,500	500
Blue duiker	4000	650
Ogilby's duiker	7000	725
Bay duiker	7,500	750
Greater white-nosed monkey	3,500	642
Water chevrotain	5000	400
Cane rat	3000	406
Mona monkey	3,225	425
Pangolin spp.	1,500	600
Frozen chicken		1.400
Fresh beef		2000
Fresh fish mackerel		800
Frozen bar fish		900
Pork		1.800
Goat		2.500

6.13 SPECIES GROUPS MOST AFFECTED BY HUNTING AND BUSHMEAT TRADE AT THE BANYANG-MBO WILDLIFE SANCTUARY

Duikers were the most affected taxonomic group during the six-month study period, constituting up to (34%) of the total wildlife game registered killed in the study villages. Rodents constituting (22%) of the total catches of hunters in the fourteen study villages were the second group of animal species that were most hunted during this study.

Monkeys were the third group of animals that were affected by hunting during this study comprising (12%) of the total animals recorded killed by the research assistants. The carnivorous species followed making up (10%) of the total animals harvested during the study.

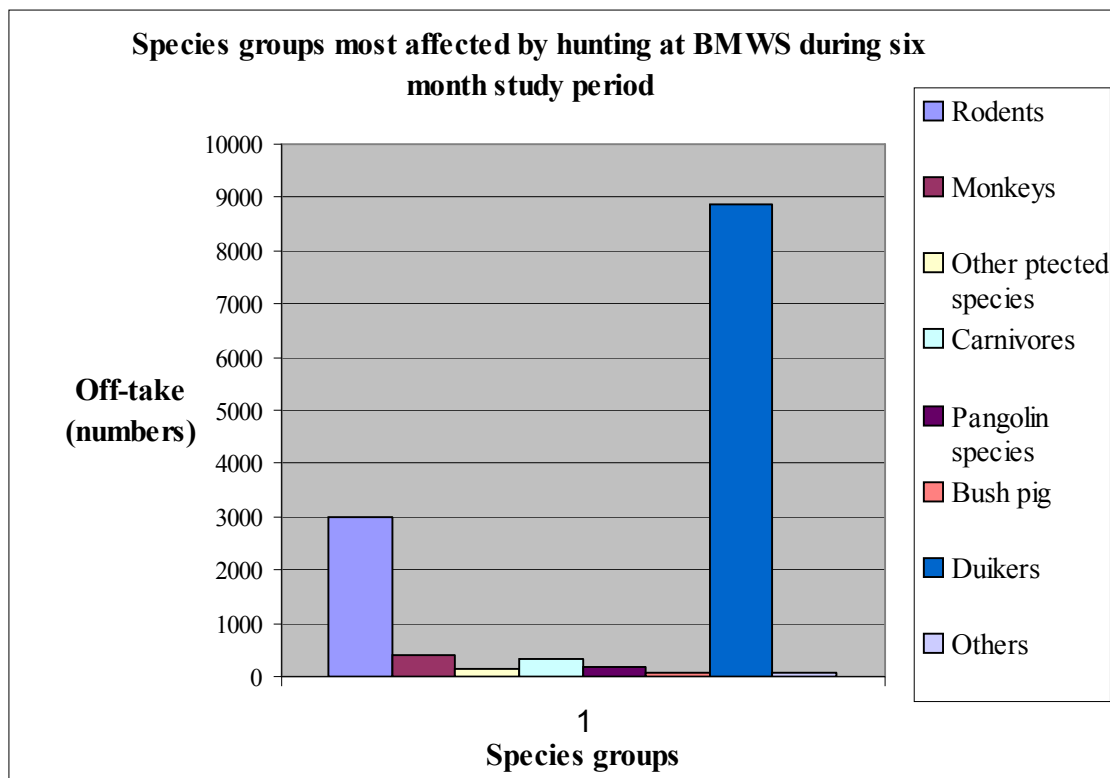


Figure 6.20 Taxonomic groups most affected by hunting over the six-month study period

Other animal groups that were also affected included Pangolin spp. (6%) other protected animal species such as Water Chevrotain, Dwarf Crocodile and Python constituted (5%) of the total harvest registered in all the study villages. Other taxonomic group species such as Hornbill, Cobra spp., Gabon viper (*Bitis gabonica*) and Green Mamba (*Dendroaspis jamensoni*) were least affected by hunting. In addition, bush Bucks (*Tragelaphus scriptus*) were not affected by hunting during this study.

Nevertheless, some animal species which were highly preferred by the hunters were never recorded killed in any of the study villages. Reasons advanced were that these animals were scarce in the whole area and there were fears that such animals might have been locally extinct in the area. Such animals included the Leopard (*Panthera pardus*), Golden cat, Chimpanzees (*Pan troglodytes*) and the African Elephants (*Loxodonta africana cyclotis*).

CHAPTER 7

DISCUSSION

7 TOTAL OFF-TAKE AND BIOMASS FOR THE BMWS

The study produced data for 84 hunters in fourteen villages. This data will be useful for management decisions if it can project to the other villages and hunters in the area. Off-take and biomass averages were calculated for one hunter and then extrapolated for the total number of known hunters in the area. During a previous WCS study the villages were grouped into three categories according to their impacts on the sanctuary: direct, indirect and minimal. Direct impact villages are those that claim to have traditional territory inside the Banyang-Mbo Wildlife Sanctuary. Villages with indirect impact are the ones which have certain rights to exploit the resources within the sanctuary area e.g. fishing, hunting and gathering of non-timber forest products (NTFPs) but do not own land within the sanctuary. Minimal impact villages are those who have relatively little impact on the sanctuary. Four hundred and twenty-nine hunters were estimated for the whole BMWS by a previous WCS project hunters' census survey as seen in (Table 6.7).

From the extrapolation the off-take of wildlife species for the whole of Banyang-Mbo Wildlife Sanctuary is estimated at 16.232 animals for 6 months or about 32.441 animals per annum. The extrapolated biomass for 6 months for the whole region is 114.959 kg (115.00 tons) and an annual biomass of about 22.880.4 kg (228.8 metric tons). When off-take data was compared with those of similar central African rainforest (Lobeke Wildlife Reserve) in the Southeast of Cameroon, the Dja Wildlife Reserve and Takamanda Forest Reserve, some similarities were observed in off-take rates of blue and red duikers. Also a similar preponderance of the small to medium-size mammals over the larger size wildlife in the off-take data reported here had been reported in studies carried out elsewhere by other forest wildlife ecologists (Fa et al. 2001; Ayeni et al. 2001; Willcox and Nzouango 2000; Willcox 2002).

Such wildlife off-take pattern is implied to be the first evidence of decimation of big-game species through over-exploitation/hunting as was the case reported by Fitzgibbon et al. (1995) who found out that 13.600 animals are harvested from Arabuko-Sokoke forest in Kenya each year. Also in a similar study conducted by (Bennett 2000) it was revealed that 23.513 tons of game meat is harvested by subsistence hunters per year. In yet another study in the Tahuayo low land Peru, Bodmer et al. (1994) recorded a total of 1.273 animals killed annually from a 500 km² area of which (14%) was used for local consumption and 86% was sold for more than US \$1700 per year. In a similar study conducted in Serengeti Park Tanzania by (Hofer et al. 1996), observed an estimated total of 159.811 animals giving (11.950 tons) harvested annually. The results in this study when extrapolated to annual harvest they compare well with those obtained by (Hofer et al. 1996). In similar studies, Ayeni et al. (2001) and Fimbel et al. (1999) found out that one hunter averages 1.065 blue duikers; 0.716 red duikers and 0.918 blue duikers and 0.836 red duikers per month respectively. At the Banyang-Mbo Wildlife Sanctuary, one hunter averages 1.230 blue duikers and 0.175 red duikers per month. This implies that one hunter averages 14.760 blue duikers and 2.1 red duikers per year. The result of this study seems to agree very closely with those of the previous authors.

The results also indicated that one hunter killed on the average 1.340 rodents per month. This implies that one hunter extracts on average 16.08 rodents in a year. If these off-take numbers are extrapolated for the 429 hunters residing at the Banyang-Mbo Wildlife Sanctuary then we shall be having averagely 574.86 rodents extracted every month and 6.898 rodent species removed from the forest on a yearly basis. The average off-take of primates by a single hunter at the Banyang-Mbo Wildlife Sanctuary according to our results stands at 0.663 per month. This means that averagely one hunter kills 7.596 primates in one year implying that 429 hunters will remove on the average 3.413 primate species annually. This result also agree with a similar result obtained by Ayeni et al. (2001) who reported an average of 0.713 primate species killed by one hunter in and around the Takamanda Forest Reserve in the South West Province of Cameroon. Taking into consideration the fact that primates are slow to reproduce and take longer periods to care for their infants, removing them from the forest at this rate in a year is an unsustainable practice. If the rate of removal far exceeds that of replacement this can lead to serious threads on these animal species.

Generally when the average number of protected species killed by one hunter was calculated for the study period, it was discovered that for each month of the study period, one hunter harvested 0.906 of protected animal species. This implies that on a yearly basis 10.878 protected animals are killed by each of the hunters participating in this study at the Banyang-Mbo Wildlife Sanctuary. If this number is extrapolated for the 429 hunters estimated to be present in and around the sanctuary, then in one year the 429 hunters will be killing 4.664 of the protected species. Removal of these high numbers of such threatened and endangered species from this forest is very unsustainable and risky to the ecosystem. This can partly be explained by the fact that some animal species like the Leopard, golden Cat and the Buffalo are reported to be locally extinct in this area due to high hunting pressure.

The results obtained from this study strongly confirm previous observations made by Diangha (2000) who also reported a high hunting pressure on the wildlife of this area. Galagos were more abundant in the off-take records than the Potto. Identification was difficult owing to their similarity in behaviour and morphology and for such reasons data on numbers killed were not accurate. Non-primate mammals were more plentiful than the monkeys. Their low numbers could be attributed to their slow rate of reproduction which could not viably replenish a population exposed to intensive hunting. Their decline therefore may be indicative of over exploitation. The elephants and buffalos were occasionally reported to cause considerable crop damage. Although elephants were reported present around Elumba, Tali and Nguti, hunters considered that their numbers are depleted in comparison with the population 10 years ago. In the absence of sufficient data on the status of the forest, it is difficult to determine whether decline is attributed to loss of habitat, over hunting or a combination of both.

Although duiker species, Cane rats, Cussimanse mongoose and brush tailed Porcupines probably constituted a large proportion of bushmeat harvested, their decline was not observed from the responses owing to their higher densities. Buffalos were known to most of the villages visited but like the elephants seem vulnerable to local extinction or serious decline. The seemingly patchy distribution of this species in Banyang-Mbo Wildlife Sanctuary may be influenced by its natural restriction to areas where some grassland can be included in its home range.

Field observations identified footprints around Tali I and Ebeagwa. We were made to understand that the Leopard, mistakenly called 'Tiger' once occurred within the sanctuary. However, none of the interviewees was able to give convincing evidences that it once occurred in the area except an elderly man who claimed to have seen the animal as a child. The occurrence and status of the Leopard in the area therefore remains inconclusive. The golden Cat (*Felis aurata*) may also occur in this region and being similarly elusive, may be confused with Leopard. The yellow back duiker and the bush Buck though reported shot by some hunters, their status remains doubtful. Water Chevrotain was not found around Barah, Defang, Etodi, Etawang, Nzoa and Ebeagwa. Even in areas where they were found, they were very scarce as hunting pressure on this species is very high. Because it is being threatened, it is protected by Law No. 94/01 of 20th January 1994, MINEF.

Amphibians and reptiles were found in all the villages sampled but their abundance was low compared to mammals. Similar results were obtained by Ayeni et al. (2001) in a similar study at the Takamanda forest reserve in the same region as the BMWS. This is perhaps because it is not a common delicacy among the people and is not commonly collected. Locating Snakes, forest Crocodiles, Ornate Monitor Lizard and Tortoises was very difficult. Because there are no community based or government-imposed closed seasons, hunting took place through out the year although not always at the same intensity. The dry season sees a decrease in hunting activity because at this time the canopy is more open and the crackling leaf litter on the forest floor enhances animals' sighting of an approaching hunter and disappear away.

During this period, footprints and tracks of animals are also difficult to identify and trapping and snaring frequency are reduced. In villages where hunters were also involved in farming, clearing, burning and planting was done during this time of the year. Felling of palm trees and tapping is the main occupation during this period. Hunting during the rainy season is well favoured than the dry season. Hunting intensity is increased during this period. The number of bushmeat harvested during a particular period can be indicative of the intensity of hunting in the area. During any season, time dedicated to hunting depended largely on the individual hunter's preference. Food abundance can also be an indicator of the number of animals present in a particular area.

During the rainy season, bush mango (*Irvingia gabonensis*) collection reaches its peak around the Banyang area and men, women and children are involved in this act. Bush huts are re-enforced and new ones are erected. More people stay in the forest, and meat for cooking comes from the natural source. During the day the men are involved in bush mango collection and at night they go hunting. Children also involve themselves in a lot of snaring and trapping. Hunting of all classes of animals is highest during the rainy season. Monkey species, Red River Hogs, and Duiker species are seen and killed more during this season. While Baboons, Cussimanse mongoose, rock Hyrax are seen more in the dry season. Consumption and commercialization of wildlife (bushmeat) is one of the few examples of marketable products accessible to rural people and often represents an important part of the economy. Although hunters sell bush meat for local consumption, it is at markets that the higher prices are secured.

Wild animals were exploited for food (bushmeat) from all the villages sampled. A similar observation was made by Eves et al. (2002) in a wildlife expedition survey in Central Africa Republic. The fact that, bushmeat leaves the area may result in the sacrifice of protein value of meat that otherwise would have been consumed locally. It may also have a considerable influence on the amount of hunting by snaring and trapping taking place and therefore a decline in animal abundance.

Bushmeat is consumed, sold both inside and outside the villages. There are essentially two classes of animals that enter the commercial market:

- (a) The larger-bodied animals like Blue duiker, Ogilby duiker, Red river hog, and the Monkey species, which are normally hunted with wire snares and guns and provide a good rate of economic return (kg / time spent in hunting or kg / cost of hunting, including gun hire and shells costs);
- (b) The smaller animals like Squirrel species, Giant rat, Cussimanse mongoose, Giant otter shrew, Pangolin species that are only snared and therefore easy to catch but not as valuable. Animals of the first class are more likely to enter the commercial market whereas those in the smaller class are more likely to be consumed by the hunter and his household. The markets rely on ungulates, primates and rodents, and to a lesser extent on carnivores. Civet cats and Genets were scarcely sold outside the villages but rather butchered and sold as pepper soup slices within the villages.

Increased sales of rodents suggested that ungulates and primates are now scarce in the area. Given this choice, hunters will hunt larger ungulates first, then primates, and lastly rodents with increasing efforts and decreasing economic returns. Village markets are held frequently throughout the area and are well attended by the people of the surrounding villages. Markets are often located in villages within close proximity to main roads and it is here that a commercial trade in bushmeat created by the consumers from outside the area begins operation. Traders usually attend these markets to pick up animal carcasses. The comparative amounts of bushmeat sold on markets and that which is consumed locally is not certainly known.

Reports from and observations made at two bushmeat pick up points identified: Tinto and Elumba indicated that outside traders visit markets once a week. Bushmeat traders from larger towns regularly come to these markets to buy bushmeat and take to towns such as Kumba, Mamfe, Menji, Dschang, Douala and Melong. Two other pick up points identified were, Tali I and Etodi. Hunters prefer to sell to commercial bushmeat buyers than to sell locally and even to cities dwellers in passenger taxis than locally in the villages because it is more profitable.

7.1 SEASONALITY OF OFF-TAKE BY SPECIES GROUPS

Changes in hunting yields might indicate the status of animal populations. It is important to count the changes in yields of various species over time, not just a raw count or raw weight. Raw counts and raw weights may stay relatively the same or decline steadily over time but species composition of the catch may be drastically different (Robinson and Redford 1994, Fa et al.1995). While examining the seasonal changes in off-take for species groups (Figure 6.8) it was clear in 2006 that off-take of large and blue duikers were greater than those of rodents. However, during the last months of the study i.e. March and April of 2007; rodents' recorded a higher off-take in the total catch than duikers. Hunters prefer to kill blue and large duikers because of their high resale value. If this trend were to continue, the composition of the catch would primarily be rodents. It implies that preferred animals are in great danger.

Other factors were recognized to influence this change e.g. fluctuations in prices of cash crops or a difference in the productivity of crops, causing people to modify their behaviours. There have been no major cultural or societal changes in the societies of the Banyang and Mbo people from 2006 to 2007. Major changes in culture or society does not factor into the change in harvest of wildlife species composition.

7.2 HUNTING OF PROTECTED SPECIES

All primates and other threatened and endangered species within this wildlife sanctuary are protected by the Cameroon law and enlisted on the IUCN red-list. Regardless of this during our study there was a steady recording of these animals by the research assistants in the data sheets. However, the number of protected species recorded may be a bit low as it is believed some of the hunters still may have hidden protected animals from the assistants. While examining the total recorded kills of the protected species (Figure 6.5), primates especially other monkeys other than drills were clearly the most captured protected animals at (73%). (This includes all captures, not just those greater Water Chevrotain followed at (13%) and the Dwarf Crocodile represented (8%) of the total extraction. An animal endemic only to Western Cameroon, Eastern Nigeria and Equatorial Guinea the Drill, was recorded killed in (5%) of all protected species cases reported. Some of the protected species were never recorded killed during this study. These included the forest Elephant, Leopard, the Nile and long-snouted Crocodile, Giant Pangolin and forest Buffalo.

Upon interrogating hunters in the region, it seems that the Giant Pangolin and Leopard may have been locally extinct in this area. Buffalo signs were still readily visible in the Banyang-Mbo Wildlife Sanctuary and there were reports of both the Nile and long-snouted Crocodiles in the larger rivers. Hunters revealed that they do not usually kill Buffaloes as most do not have a proper rifle that can kill these animals. They revealed that if a Buffalo is shot with a shotgun and is not killed outright, the Buffalo can turn on the hunter and either seriously wound or kill him.

7.3 FACTORS INFLUENCING HUNTING IN THE BANYANG-MBO WILDLIFE SANCTUARY

Apart from the road network that could make hunting a lucrative business in the Banyang-Mbo region, other factors that could influence hunting are the market, distance from source areas, and vulnerability to harvest, cultural practices and hunting technology. All the Banyang villages (excluding Barah) have a road that is motorable through out the year. This gives an opportunity for the residents to sell various products, mainly cash crops to the markets in larger towns. The road gives an opportunity to experts (agriculture, rural development and livestock workers) to work in the area which tends to diversify the activities of the people. Most of the southern Mbo area has access by foot path.

It is very difficult to transport heavy agricultural produce such as coffee and cocoa (50 kg per bag at an average of 10.000F CFA (US \$21 for coffee). Comparatively bushmeat weighs next to nothing (a fresh male Mona Monkey averages in weight 6.34 kg and sells at an average of 4000F CFA (US \$8.1) if we were to carry the equivalent weight of a bag of coffee of fresh Mona monkey then it would sell at 25.360F CFA (US \$53). This estimate is only for fresh meat. If we were to take the equivalent of smoked meat whose weight is lower the gain would drastically increase. Another important factor that may influence hunting is the lack of jobs in the urban centres forcing people to return to the villages and hunt. A third factor may be that hunting is considered a quick way to earn money with little investment unlike farming which is a long process before the financial gains are realized.

7.4 IMPACTS OF HUNTING TECHNIQUES ON WILDLIFE

Short gun hunting is the most common form of hunting in the Banyang-Mbo Wildlife Sanctuary. Guns killed representatives of all species groups. Guns are used during the day to shoot virtually any animal on site. Guns are also used at night to kill selective species.

The second most common hunting method in the BMWS is wire snaring. In similar studies it was found out that wire snaring indiscriminately killed virtually all species of terrestrial wildlife across central Africa's rainforests. (Noss 1998a; 2000; Fimbel et al. 2000; Hofer et al. 1996). This method of hunting is illegal in Cameroon and throughout the greater parts of West and Central African region. Although not the case in the BMWS, wire snares may be the most widely used hunting method in central Africa as it is relatively unskilled and the procurement of materials to manufacture snares is cheap (Noss 1998a).

Dogs are the fourth most preferred weapon type after traps for hunting in the BMWS. Dogs kill certain species of rodents and small carnivores out-rightly but they are normally used to track animal species for the hunter to subsequently kill with a gun or machete. Drills the endangered species endemic only to south eastern Nigeria, southwest Cameroon and the island of Malabo in Equatorial Guinea are particularly susceptible to hunting in which dogs are employed. Drills lack tails and proper balance to jump in between trees to escapes hunters. The BMWS hunters consider Drills to be the most stupid species of wildlife. They usually refer to them as "the dull monkey weh dem no fit jump from tree to tree". Certain weapons appear to be well selective for different sexes of species harvested. Guns killed significantly more males of blue duikers, great white-nose Monkeys and brush-tailed Porcupine than females. Wire snares significantly select male marsh cane rats and females of the Ogilby's duiker and the dark mongoose. This result differs from other studies in central Africa.

A study in the Central African Republic (CAR) found wire snares to significantly select females of blue duikers, red duikers and brush-tailed porcupines (Noss 2000). The sex ratios of these species for wire snare were not significantly different in the BMWS. Differences between these sites could be attributed to the small sample size collected in CAR (30 blue duikers, 32 red duikers and 7 brush-tailed Porcupines) and the relatively large sample size analyzed in the MBWS study (Blue duikers 722, Red duikers 335 and Brush-tailed Porcupine 431). Off-take surveys conducted in three villages in Gabon, showed that female Blue duikers and male primates were killed most often (Lahm 1993).

Regardless of sample size analysis of sex ratio in harvest is difficult and problematic especially when it concerns the African tropical forest animals whose sex ratio morphology is not well documented. Hunting in Central and West African forests is non-selective by humans as they attempt to harvest each and every edible or eatable animal encountered. The obscured sex ratio of the randomly harvested sexually dimorphic species will only represent the sex ratio in the wild if the area is new to hunting. By depleting the lower ratio of any sexually dimorphic wild population this situation will amplify itself over time if the same ratio is maintained in the harvest. Therefore sexually dimorphic species are prone to over-harvesting if a higher proportion of the lower value in the sex ratio is harvested more than the higher value. Therefore hunters may be seriously altering the sex ratio of the sexually dimorphic greater white-nose Monkey in the MBWS as significantly more males are harvested than females. The reduced male population would leave many potentially reproductive females' eggs unfertilized. However, without quantifying the actual sex ratio of greater white-nose in the wild, this conclusion is sketchy at best. Hunting techniques already select different species and possibly sexes of wildlife at the BMWS. Wire snares are not selective for any terrestrial animal and are completely illegal in Cameroon. Regardless of their illegality they are the second most important hunting method. Short guns hunting using dogs are decimating arguably the most endangered primate in Central and West Africa the Drill. Although certain weapon types appear to be selective for certain sexes of the harvest, it is difficult to draw conclusions from the data without the actual wild sex ratios.

7.5 SUSTAINABILITY OF HUNTING AT THE BMWS

A standard quantitative way of assessing the sustainability of wildlife off-take is to construct a 'harvesting' model, which identifies the maximum sustainable off-take a population can tolerate without experiencing changes in key demographic characteristics. The most common models are harvesting models of wildlife utilization that predicts the maximum sustainable off-take (the harvest quota) that a particular population or species can tolerate without population decline. However, harvesting models may require extensive, long-term demographic data (Getz and Haight 1989, cited in Hofer et al. 1996). Such data can be difficult to obtain for large long-lived species.

Even in situations whereby such data are available it is unclear whether predictions of competing harvesting models could be distinguished (Caughley 1985). Harvesting models are further limited by the fact that they consider each species in isolation and neglect the impact of utilization on ecosystem dynamics. The assessment of sustainability of hunting in other cases is more complex and in the absence of data and models remains a quantitative first approximation. Other models posed the question whether from a strictly economic view point consumptive use of wildlife at maximum sustainable off-take is the most profitable form of wildlife utilization. Based on records obtained so far from field surveys it can be concluded that whereas the Banyang-Mbo Wildlife Sanctuary is rich in wildlife biodiversity, animals are sparsely distributed. They are rarely encountered in fair numbers; neither are their vocalizations heard by villagers as reported a few decades before.

Running simply the Robinson and Redford model (1991, 1994) using off-take numbers from the BMWS and published densities from literature species such as the Drills appear to be harvested sustainably at current levels. However, it is extremely doubtful if this is the case. Older hunters utilizing the BMWS claimed that in the past Drill troops numbered 30-100 individuals and currently if one is lucky enough to find a troop it only consists of 2 to 5 individuals. Therefore the wild population of Drills at BMWS has most likely been reduced to such a low level that the model shows a false-sense of sustainability.

Probably the few Drills appearing in the harvest are the last remnants of the wild population and will actually soon be extinct from BMWS. This caveat may also be true for red-eared Monkeys and Africa civets. Hunters confirmed the local extinction of Leopards (*Panthera pardus*) in the mid 1970s and the Giant Pangolin (*Manis gigantea*) in the early 1980s from the region. This extinction can only be attributed to over-hunting. Leopards were actively hunted in the past for use in traditional ceremonies and traditionally to sell the pelts. The killing of a Leopard also raised the social status of the hunter in the community. Giant Pangolins are large animals, weighing from 33 to 37 kg with a distribution localized around areas with abundant termite mounds (Kingdon 1997).

These slow moving animals are highly susceptible to hunters and their meat is said to taste the same as that of smaller Pangolins, which is preferred meat. The local extinction of the Giant Pangolin can be attributed solely to bushmeat hunting. Extirpation of wildlife from ecosystems will cause severe damage to the system (Maissels et al. 2001). The loss of the large carnivores such as the Leopard may have already seriously affected the dynamics of the former prey species. Off-take and harvested biomass of certain species have drastically decline over time in the BMWS. As long as the same hunting effort is placed into hunting over time and there are no major social changes in commodities, a decline in hunting yields usually indicates hunting is not sustainable (Robinson and Redford 1994). Species composition has also changed over time in BMWS. Proportions of large-bodied species such as red duikers and primates have declined in the harvest. Conversely proportions of small-bodied animals such as rodents and carnivores have increased.

A shift in species composition from preferred marketable larger-bodied to less-preferred smaller-bodied animals indicate that hunting of the large-bodied animals is not sustainable and the wild population maybe moving towards extirpation as reported in similar studies across west and central Africa by animal ecologists (Vickers 1991; Robinson and Redford 1994; Fa et al. 1995; Wilkie and Carpenter 1999; Fa 2000). All the two measures for sustainability of hunting employed for this study show that current hunting levels in the BMWS might not be sustainable. All species of wildlife are under immediate threat due to over-hunting. More local extinction may occur in the near future. Hunters currently do not perceive over-hunting as a problem. They believe that God created wildlife as food for humans and will continue to provide them all the time. However, some older hunters have realized that certain species have become scarce or extirpated in recent times. This is also not perceived as a problem as they claim there are plenty of other animal species in the forest to hunt. The concept of a forest without bush-beef is inconceivable.

7.6 ACTUAL REVENUE GOT BY SELLING BUSHMEAT BY BMWS HUNTERS

When the revenue obtained from selling bushmeat was calculated, it was observed that one hunter averages 22.629F CFA (\$47) per month. It was estimated that annually hunters in and around the East, North and North West of the Banyang-Mbo Wildlife Sanctuary earn a total of 13.686.200F CFA (US \$285,621.40). Studies in the Dja Wildlife Reserve gave a much higher income for one hunter per month: 30.075F CFA (US \$62.80) Ngnegueu and Fotso (1996) and 25.703F CFA (US \$53.6) (Muchaal and Ngandji 1995). In the Banyang-Mbo Wildlife Sanctuary, this is clearly much lower. The reason for this difference may be that in the Dja Reserve, hunters have access to markets with the logging company (Pallisco) and cities such as Sangmelima and Yaoundé (Delvingt 1997). The price for a Blue duiker at these markets is 5.000F CFA (US \$10.44).

The average price for a Blue duiker in the Banyang-Mbo Wildlife Sanctuary is 3500F CFA (US \$7.31). This difference in market price for the animals may account for the difference in hunters' monthly income. Since hunters in the Banyang-Mbo region have no access to the larger markets, hunting is not as lucrative as it is elsewhere in Cameroon. If alternative income sources are found for the Banyang-Mbo Wildlife Sanctuary hunters, it may be easier to change their livelihoods away from hunting. This can greatly divert hunting pressure on fauna resource. A critical examination in our study showed that the Mbo people generally sell bushmeat to outside buyers. This can easily be seen as commercial hunting but if the socio-economic structure is examined closely it may be appropriate to consider this kind of hunting subsistence hunting (Robinson 1996). The financial gain is used mainly for the subsistence needs of the hunters' families. These hunters do not accumulate a surplus of money as all of their revenue is used only for survival and therefore it is not a lucrative activity for the hunters. The people who actually gain financially from bushmeat hunting are the intermediaries (middle men). The price for bushmeat in the villages is relatively low and may more than double when the meat is sold in major towns and cities of Cameroon.

7.7 FACTORS INFLUENCING BUSHMEAT ECONOMICS AND TRADE IN BMWS

There was a clear disparity between the prices of bushmeat and other alternative animal protein sources. Even though bushmeat appears to be cheaper than the alternative animal protein sources most of these alternatives are not available in the villages surrounding the BMWS. Frozen meat or fish cannot be preserved in most of the villages as they lack electricity. Cattle are not reared because they are prone to disease in the lowland African rainforests. Most villages own sheep, goats, chicken and pigs. These are however, not reared intensively and in many cases serve as a bank for rural families. Domestic livestock is sold when the family is in financial need. Traditionally livestock is consumed only on major holidays or used to entertain important guests. Hunters preferred to eat domestic (56%) meat rather than bushmeat (44%) as their first choice when interviewed.

Interpretations of these results are difficult as responses varied when the hunters gave reasons for their choices. They found certain animals the tastiest, they were tired of eating bushmeat everyday and domestic meat was a nice change. The hunters were not used to domestic meat as they only ate bushmeat they eat domestic meat only on holidays or it takes pleasure eating notorious crop-raiding animals. Two wild animals constituted the majority of the preferred bushmeat, Brush-tailed Porcupines and Pangolins (16% and 11% respectively). The flesh of these animals is considered “tasty” and the skin is also very tasteful when cooked in pepper soup source well spiced. This could be attributed to the morphology of these species as both are covered with hard protective spines or scales and when they are removed it yields a thick skin.

This preference is further corroborated by both the price and utilization data. Pangolins and Brush-tailed porcupines are the first and fourth most expensive bushmeat per kg respectively. They tend to be either consumed by the hunter or sold locally rather than entering the external market. About (80%) of Pangolins and (43%) of Brush-tailed porcupines are consumed locally. The species earning the highest revenue for the hunters the Ogilby’s and Blue duikers do not appear preferable to hunters, since they never appeared in the taste preference responses.

They were used mostly for commercial purposes as (59%) of Ogilby's duikers and (63%) of Blue duikers were sold to outside buyers. Hunters' taste preferences do not appear in any of the current bushmeat literature of Central and West African tropical forests. Retailers believe their consumers prefer Cane Rats, (79.9%) followed by *Cephalophus maxwelli*, (41.5%) then the Brush-tailed Porcupine, (26.7%). Multiple responses were given by some of the respondents, thus the percentage is based on the frequency of responses to the number of respondents. Therefore it is difficult to rank the preferred species based on their calculation.

It is interesting to note that in both the tropical rain forest and dry woodland and grasslands of Cameroon the most preferred species of bushmeat is the Porcupine. Njiforti (1996) reported a similar trend in a study conducted in the north of Cameroon. Bushmeat retailers in BMWS and Cameroon as a whole consider the Brush-tail Porcupine as a preferred species. The conditions of the animals when sold did not seem to influence the price.

The differences in prices between smoked and fresh animals appeared negligible. As a result of this the retailers chose to buy smoked meat so as to reduce the overall transportation and cost. The economics of the bushmeat trade in the Banyang-Mbo region is complex; many different factors may contribute to the bushmeat trade. These include taste preference, species sale-ability and the availability of alternative sources of meat. As cheap forms of alternative animal protein are not available in the BMWS communities, it is unclear if local consumers would purchase these commodities, causing hunters to change their lifestyles as the market for their meat evaporates. Therefore the elasticity of bushmeat demand in BMWS is still in question. Currently bushmeat is the cheapest source of meat and it is the only option for local consumers. One way to regulate hunting within this area is to limit the influence of outside bushmeat traders in the area because as long as outside buyers continue to influence the market in the Banyang-Mbo Wildlife Sanctuary villages, hunters will continue to hunt bushmeat. Other factors responsible for bushmeat trade include: the financial costs of equipping hunting expeditions, opportunity costs, wages for members of the hunting expedition, financial losses due to the inability to carry out alternative forms of employment during periods of hunting logistics, problems of transportation of wildlife products to the market,

hunting success in relation to hunting effort, penalties in case of detection and arrest by law enforcement agents and expected revenue based on current market prices.

A number of studies illustrated that accessibility, financial costs of appropriate equipment and staffing, travelling and transportation of products out of the hunting area strongly influences off-take and hunting impact. Hofer et al. (1996) discovered in a similar study that market hunting in the Serengeti National Park Tanzania could be considered unsustainable for some wildlife species. Just like in this study, Hofer et al. 1996 concluded that unchecked illegal market hunting would restrict wildlife off-take to unsustainable levels.

7.8 POTENTIALS FOR MANAGED HUNTING OF WILDLIFE IN BMWS

Hunters in this area view all wildlife as either a threat to their crops (Inyang 2001) or as food. Regardless of the perception hunters have about the Banyang-Mbo Wildlife Sanctuary, it could be difficult to manage hunting in this area. According to the 1987 national census there are about 8.553 people in the sanctuary area.

This population rely on approximately 660 km² of land to farm; collect non-timber forest products (NTFPs) and hunt. This equates to approximately 12 people per km². According to Robinson and Bennett (2000), approximately 1 km² of tropical forest can support 1 person relying on bushmeat without detrimental effects on biodiversity. It is however, impossible that this area can ever meet both the bushmeat requirements of this society and conserve wildlife. Hunters' impact the entire BMWS as confirmed when hunting zones were measured. This was further corroborated during the mammal census of the BMWS as snares; spent cartridges and hunting camps were found throughout the sanctuary in a study conducted by (Bechem and Nchanji 2000). Therefore it would be very difficult to designate no-hunt "source" zone to supply hunted "sink" zones. The enforcement of such a system would be almost impossible as access to this area is open to all and the "tragedy of the commons" would be repeated once again (Hardin 1968). Regulation of hunting through closed season and species restrictions are also common methods to manage hunting.

This system works quite well when sufficient wildlife staff is employed to actively monitor harvests and densities of populations and enforce the seasons and quotas. According to Wiegleb (personal comm.) enforcing animal rights could be another better way to manage hunting in Cameroon.

This also could be another interesting method but without alternative sources for bushmeat to derive either the necessary dietary protein or income generated by bushmeat hunting; instituting animal rights would only help to impoverish the communities the more and deprive them of animal protein. In the BMWS there are less than four wildlife field staff to handle all the forest issues, they do not have the capacity to undertake such a task as they lack the basic logistics. The only option which can and has worked in Neotropical forests with relatively low human densities is through community-based co-management of the sanctuary. Regardless of the high level of monitoring and enforcement necessary to implement managed hunting systems based on seasons and quotas it would be impracticable in the BMWS. As virtually all species are hunted at unsustainable rates. Reasonable sustainable quotas and seasons would be difficult to set. Hunting of all species except rodents would have to halt until sufficient data for surviving wild population is collected.

7.9 OTHER UTILIZATION OF WILDLIFE

The main purpose of hunting is to gain meat to consume or sell; other methods of utilization seem to be entirely incidental to this and if this is the case, then they are unlikely to have any significant influence on animal density. Animal skins which had been dried were recorded in many occasions; the African Civet, bush Buck and large spotted Genet were recorded in Defang. Skulls of bush Buck and Chimpanzee were also recorded at Akriba and the skins of Nile crocodile and forest Crocodile were recorded in Ebeagwa and Fotabongkwa. The skins of Red-eared Monkey, dried ears, teeth and tusks of Elephants were recorded in Tinto I and Tangang. Shells of Tortoises were recorded in six of the fourteen sampled villages. Feathers of grey Parrot, green Tauraco and Eagles were used for decoration and recorded in many of the study villages. The use of animal parts for traditional medicine and magic was not uncommon.

7.10 COMMON TABOOS RECORDED IN THE AREA

The Elephant, Leopard and Buffalo are not often killed because they are believed to be peoples' totems. If a person has a spiritual bond with certain species of animals, they may not be able to kill or eat it e.g. the Elephant, Leopard, Buffalo and Chimpanzee. If such an animal is killed the individual may also be found dead. It is also believed that an individual bitten by a Monitor Lizard will eventually suffer from leprosy.

7.11 NATIONAL POLICY

The trend toward increased hunting and wildlife collection has been encouraged by the weakness of the central government in enforcing wildlife regulations and the forestry laws. Sanctions on illegal behaviour can easily be avoided by judicious bribing. Hunting, trapping and wildlife collection are rational behaviours where the resource is abundant and poorly controlled, other economic activities do not provide sufficient economic returns and ready markets are readily inaccessible.

Government policies with regard to the forest sector are complex and often contradictory. While powerful sectoral Ministries (Finance and Economy) have a strong say in policy there is little collaboration among different Ministries and considerable overlap of portfolios. Officially, the government is committed both to the development of a permanent forest estate sustainably managed over the long term and to the development of community forests. However, it is also explicit government policy to use the forests to replace petroleum as the engine that drives the Cameroonian economy which clearly leads to a short-term view and unsustainable exploitation. As a result of vastly increased commercial logging operations Cameroon has become one of the tropical countries with the highest rates of forest loss. Sustainable logging has not reached bushmeat as yet and unsustainable mining of the forests is expanding rapidly. In the early 1990s, the International Union for Conservation of Nature (IUCN) estimated that the rate of deforestation in Cameroon's dense forests was 10 to 11 times higher than the rate of regeneration.

There is a very low rate of tax collection and supervision of the forest industry in Cameroon is highly inefficient. There is little government control over the forest sector forest guards lack equipment and their salaries are low. It is clear from the large sums of money available in this sector that it could be effectively policed and controlled. However, the situation suits the current institutional set-up. Logging is not controlled because there is little political will to do so. Thus while the government's explicit policy is long-term sustainable management of a permanent forestry sector the implicit policy is almost the reverse of this. This implicit policy encourages uncontrolled exploitation of the forest sector and is a strong contributory factor to biodiversity loss. Short-term unsustainable use of the natural-resource base is encouraged under the laws regulations and practices and is a potent contributor to biodiversity loss.

7.12 NATIONAL LAWS

The government of Cameroon has enacted three laws that have nationalized all land and all natural resources. The 1974 and 1976 land tenure laws effectively abolished traditional land tenure systems. The formal procedures for obtaining official title to national land set out in these laws are so tortuous, lengthy and expensive that few can afford it. In the 24 years that have elapsed since enactment of the laws, only 2.3 percent of rural lands have been registered to private title mostly by civil servants. Furthermore, in order to obtain a title, land must be "mise en valeur," meaning that there can be no title to an intact forest.

The forest must be transformed into a cocoa farm or similar productive use before the title is granted. Though illegal, traditional systems of land tenure still flourish. Similarly, the 1994 forest law nationalized all natural resources, including all plants and animals. Villagers have usufruct rights including collection of specified non-timber forest products, trapping and some limited use of timber. The principal resources timber and wildlife belong to the state and can only be harvested with permission granted through the issue of concessions, licenses or special permits. This alienation of land and resources is a source of considerable insecurity and is not conducive to sustainable management of resources.

The relationship between tenure and sustainability is complex (Ruitenbeek and Cartier 1998). Insecure tenure often leads to unsustainable use of resources.

However, well-defined property rights do not guarantee sustainable management; they are probably necessary but not sufficient. Cameroon is a party to CITES and under this Convention the export of endangered species is either banned or controlled through the allocation of quotas. Exports under quotas as in the case of African Grey Parrots, ivory, Lizard skins and other endangered species are controlled by the National Scientific Authority which issues a certificate of origin and certifies that a shipment is within the quota limit allowed by international convention for trade in endangered species (CITES). All these restrictions are capable of producing high prices in export markets. These CITES quotas are routinely exceeded. Even when bans are in place as was the case with ivory in 1997; exports still take place with fraudulent documents.

When attempts are made to tighten international regulations, the trade immediately become more decentralized and harder to control. For example, when the CITES parrot quota for Cameroon was abolished and all exports were made illegal, birds were exported via the national airline from Douala to Libreville, from Libreville to Casablanca and from Casablanca to Spain on a chain of regional flights, thus avoiding international controls. The fact that those who are responsible for monitoring the quota allocation also control the export of these valuable items from Cameroon leads almost inevitably to fraud and abuse. There is virtually no supervision or control of harvesting resulting from the proliferation of special permits. The consequence is loss of wildlife biodiversity in Cameroon. The 1994 forestry law in theory exposes the principle of community forests. However, the law and its provisions are grossly flawed; communities do not possess title and management is still subject to supervision by the Ministry of Wildlife and Forests. As was the case with the 1974 land legislation, the law is also being subverted by civil servants who are registering “community forests” for their own use generally for sale as logging concessions and illegal exploitation of wildlife.

In sum, the primary land and resource laws of Cameroon are inconsistent with long-term sustainable use of natural resources. Well-intentioned legislation has been corrupted so that it aggravates, rather than prevents the loss of wildlife biodiversity. Against this background of legislative inadequacy is a history of economic decline, resulting in several consequences. Declines in world prices for commodities such as coffee and cocoa, traditionally grown by peasant farmers and the collapse of technical assistance schemes for these growers have resulted in the abandonment of these crops and the search for more lucrative alternatives and bushmeat hunting and wildlife trading are two such alternatives.

7.13 NATIONAL INSTITUTIONS

7.13.1 Government institutions

The government structure treats the natural resource base as a source of immediate and diverse revenue opportunities rather than as a resource to be managed over the long term. The resulting policies are revenue and control-based, uncoordinated and inefficient. They do not provide the basis for rational or sustainable management of wildlife resources. The enforcement of wildlife and forestry laws is the responsibility of provincial and divisional staff. These institutions have suffered a reduction in staff under the provisions of the Structural Adjustment Program. Operating budgets have also been reduced because of the inclement economic climate. One of the earliest government actions under structural adjustment was to sell off all official vehicles. Consequently the field offices of all branches of government suffered major losses in efficiency, effectively crippling their ability to function away from urban centres. Guards whose functions are to control forest exploitation are forced if they want to do their job to beg lifts from the very people they are supposed to control. This is not conducive to efficient law enforcement. There are many Ministries whose mandates touch to a greater or lesser extent on the environment. A lack of inter-Ministerial coordination is a pronounced feature of the Cameroon government. Often coordination even among different administrative branches within the same Ministry is lacking.

For example, the administration charged with allocation of logging concessions does not have a liaison to the administration in charge of protected areas and does not even have maps of protected areas. Frequently therefore logging concessions are allocated within protected areas.

7.13.2 Social institutions

Changing social institutions and culture play a role in wildlife biodiversity loss. Beliefs about wildlife that promote biodiversity loss include on the one hand, traditional beliefs that the supply of animals in the forest is inexhaustible “bush beef no di ever finish” all evidence to the contrary notwithstanding and on the other hand, the replacement of traditional taboos by Christianity.

Taboos ensured that certain species and forests were protected but Christianity sees these taboos as evil and primitive. In their place is the Bible, which is not on the whole a conservation-minded document. Like much of sub-Saharan Africa over the last decade, Cameroon has been subject to large population movements. The most important of these has been a mass movement of rural people to the cities. Cameroon is soon likely to become a predominantly urban country rather than a predominantly rural one. Currently it is 45 percent urban, 55 percent rural (Oben, personal comm.). Strong regional migrations have resulted from over-population for economic reasons or both. Immigration is a feature that tends to weaken and dilute traditional ways. Immigrants are usually economic migrants; workers in the logging or agro-industrial companies, traders or hunters and their activities are often imitated and adopted by the local communities.

Social instability caused by mass population movements is a driving force behind wildlife biodiversity loss. Since the domestic animals are expensive to raise people now turn more to bushmeat hunting. The population of Cameroon has doubled over the last two decades. Today, (44%) of the population is under the age of 15 and only (5%) is over 60 (Cameroon National census 1997). Demographic pressures have important social consequences in the Far North and Western Provinces in particular.

Else where the consequences are mainly economic: too many people chasing too few productive occupations. Natural resource exploitation is a logical economic choice for this young population with few employment opportunities in the formal sector.

At the village level, anything beyond usufruct or subsistence harvesting is regulated in theory by the issue of special permits. Traditional hunting, which is a usufruct use, utilizes tools that are classified as illegal. Thus virtually all hunting is illegal and difficult to monitor and control. The combination of a centralized and somewhat impoverished administration, nationalized land and resources and controlled by issuance of permits presents a situation that encourages evasion of the law and a short-term view. Secured rights over resources may not guarantee sustainable use but are a necessary prerequisite.

7.14 NATIONAL ECONOMICS

A World Bank study (1994) showed that in the capital city of Yaoundé, which suffered the effects of the economic crisis least, the level of per capita consumption is 10 percent lower than it had been 30 years previously. Rural areas already quite poor, have suffered most. The number of rural households below the poverty line rose from 49 percent to 71 percent during the eight-year period. In January 1994 there was an external adjustment in the form of a 100 percent devaluation of the CFA francs, aimed at increasing Cameroon's competitive position in the international markets which had been lost because of an overvalued currency. A principal beneficiary of currency devaluation was the logging industry stimulated by an effective halving of labour and operating costs. The boom in the timber industry and the explosion in logging date from 1994. A general decline in commodity prices in the 1980s sharply reduced the profitability of smallholder crops such as coffee and cocoa. Over the last five years, the price of Robusta coffee has continued to decline. The price of cocoa has stabilized but cocoa producers were also negatively affected by the liquidation of SODECAO, the state cocoa development agency that provided fertilizers, fungicides and technical assistance to peasant cocoa farmers.

As cocoa became unattractive as a cash crop, communities were forced to find other sources of income and abundant available natural resources were an obvious choice for exploitation. The growth in bushmeat markets is a relatively recent phenomenon within Cameroon. France Ville reported that bushmeat was “rare” in Yaoundé around 1984. However, today it is common with an estimated influx of 2.3 tons per day into the four principal bushmeat markets of Yaoundé (Wilkie and Carpenter 1998). The consumers of this meat are private persons and restaurants. The principal causes of this change which appears to be supply-driven are the development of road communications permitting transport of the meat depressed economic conditions and low employment availability which encourage diversification into alternate economic activities and rapid and uncontrolled urbanization. The cultural and symbolic association that the new urbanites have for bushmeat is another explanation for its consumption it is associated with the village environment as well as rituals and festivals. The desire to partake of bushmeat despite its high cost the dubious sanitation conditions under which it is sold and the use of hazardous chemical preservatives such as formaldehyde can be accounted for by taste, diet, curiosity, conviviality, tradition, status and nostalgia and transcends social levels and ethnic origin.

7.15 INTERNATIONAL CONTEXT

The international contexts in which these processes of fauna biodiversity loss are operating include both regional and global factors. While bushmeat serves a predominantly domestic market, large numbers of Cameroonians and other Africans living in France and other countries, as a result of the colonial and cultural heritage also like to consume bushmeat constituting a small but highly selective market. Specialized restaurants supply these needs. Bushmeat orders are placed in ice chests or plastic bags and sent by air to Madrid, Paris, Brussels, Berlin or Geneva.

7.16 LIMITATIONS TO STUDY

The fact that the principle activities are essentially informal and illegal makes accurate data collection particularly difficult and time-consuming. It was also very difficult recording animal kills especially those of the protected species because the hunters were reluctant to declare their catch for fear of being persecuted by the law prohibiting hunting of these animal species. This skewed down the data and hence the exact figures of animals killed during this study were not gotten. In some of the villages, the research team was not welcome as they were suspected to be agents of the government sent to track down hunters. The villagers were reluctant to have any discussions concerning hunting of animals and did not allow pictures of hunters carrying killed animals to be taken. This in some way affected the quality of field data collected in general. One very important factor that limited data collection was lack of sufficient funds. This also contributed to limit the quantity and quality of data collected and problem between the researcher and the assistants.

CHAPTER 8

CONCLUSION AND RECOMMENDATIONS

8 CONCLUSIONS

Field information and data from hunters support the idea that some wildlife species at the BMWS are no longer sufficiently abundant to be harvested on a regular basis. Although other factors may indirectly be responsible for the reduction in these populations, over-hunting might however, be the main cause of the decline in the populations of wildlife at the Banyang-Mbo Wildlife Sanctuary.

Based on the results from this study, all the predictions made are consistent with the initial hypotheses. All are functional at different levels, directly or indirectly, in causing wildlife biodiversity loss. The principle cause is the complex of activities that constitute development, either at the individual level or at the level of the state. The patterns of ecological degradation and biodiversity loss resulting from monoculture plantations, unsustainable exploitation of the natural resource base and establishment of trade links and development of markets for the natural resources of Cameroon were an early development. The growth and expansion of these trade links continues to the present day. The cultural, legal and economic context inherited from the colonial past is also a powerful factor defining patterns of activity both in terms of trade and in terms of development. Biodiversity depletion can be seen either in terms of numbers of individuals of a particular species (fewer Elephants, Gorillas, Chimpanzees, Giant Pangolins and Leopards etc) or the loss of entire species (e.g. Rhinos), the degradation of ecosystems (lowland forest) or the loss of whole ecosystems (montane forest).

These powerful causes of wildlife biodiversity loss in Cameroon are to a large extent located outside the boundaries of the country. The causes of this loss can be both direct and indirect: Biodiversity is exported directly (Timber, Parrots, Ivory, Chameleons, Chimpanzees and Gorillas) or lost indirectly through expansion of commercial plantations (Coffee, Cocoa, Rubber, Bananas).

In an economy with 93 percent of its exports natural resources and agricultural products, the causes of biodiversity loss are very clear. Some international treaties such as CITES are not particularly effective but could be made much stronger with more commitment to the detection and enforcement of its functions outside the producer countries. Going back to a purely subsistence existence is no longer possible. Cameroon gets her living from the natural resource base, which is increasingly being exploited in an unsustainable way. The only way to slow the process is to provide economic alternatives such as the development of a secondary sector of the economy. This would require substantial external investment, which would in turn require reform of the labour laws and establishment of a transparent and non-corrupt judiciary. The further up the causal chain one gets the more complex the solutions to the problem become. Solutions at one level cannot be made without reference to higher levels. The local situation cannot be corrected without reference to the national context. The national context cannot be corrected without reference to the international context. The scale and costs involved at each level are much higher than would be the case if correction were possible at the lower level.

One major cause of wildlife biodiversity loss is that there is no awareness of biodiversity and therefore no constituency for it within Cameroon. The environment is similarly perceived both by people in the villages and by the government as an economic or nutritional resource and not in terms of biological value. Such perceptions only come with education and with liberation from economic needs. The potential for appreciating the beauty of nature is only possible when one has a full stomach. The pidgin word for “all animals na beef” which clearly show peoples’ relationship to their natural fauna. At this point, the loss of wildlife biodiversity in Cameroon and Sub-Saharan Africa as a whole is essentially a concern of the developed world.

8.1 RECOMMENDATIONS

8.1.1 Further research

This study has come out with some visible trends of hunting at the Banyang-Mbo Wildlife Sanctuary over time. It would seem premature to draw conclusions on the sustainability of hunting at the BMWS at this juncture. Although there is a downward trend in bushmeat off-take and biomass, the data from this study was collected and compared only for six months hence I recommend that a longer- term study which can yield a better picture of the bushmeat harvest rates be conducted again in this area in order to draw logical scientific conclusions on the impact of hunting on wildlife biodiversity loss in the area. Also a systematic biological research on population density and relative abundance of animals at the Banyang-Mbo Wildlife Sanctuary should be conducted. Such data can be used in conjunction with this study to determine the sustainability of hunting; this could also be used to design off-take limits.

Market channels for bushmeat in the area must be surveyed in order to establish the final destination of bushmeat. If the final destinations are small towns close to the area, then the authorities in charge may take action to stop the commercial bushmeat trade. If the final destinations are larger towns like Kumba, Dschang, Bamenda, Douala and Yaoundé then a different approach will be needed to stop the trade.

8.1.2 Proposed Action Plan for the Ministry of Wildlife and Forestry

Under the current situation, the only readily available and cheap source of animal protein for both tribes is bushmeat. Therefore, any conservation campaign wishing to reduce bushmeat consumption must be able to provide a cheaper and sustainable alternative animal protein source and change local bushmeat consumer behavior through social marketing and education campaigns. Additionally, hunters from both societies derive income from the sale of bushmeat. For a hunter to change his occupation there must be more profitable employment options available to make the shift possible.

The Ministry of Forestry and Wildlife should use all legal means within its jurisdiction to stop all illegal forms of hunting such as killing of protected species, commercial hunting, hunting at night, hunting with unregistered guns and other illegal weapons including poison and wire snares in and around the Banyang-Mbo Wildlife Sanctuary. The Ministry of Forestry and Wildlife through the Provincial Delegation of Forestry and Wildlife for the Southwest should develop hunting management committees in selected target villages which will then be developed into a model that extends to all the communities in and around the sanctuary.

8.1.3 Proposed Hunting Systems for Banyang-Mbo Wildlife Sanctuary

Most natural resources such as wildlife natural parks and reserves the world over are regulated using closed seasons and closed areas. It may be beneficial if the Ministry of Wildlife and Forestry consults with the communities concern if they desire hunting seasons and or closed areas to conserve their bushmeat resources. If that is the case then their ideas should be consolidated with the results of this study. Many protected areas use a core “no hunt” zone that serves as a supply to hunted zones (Novaro et al. 2000). However, the fact that the Banyang-Mbo Wildlife Sanctuary is small with a high human population density this approach may not be very feasible or realistic. Hunting limits based on species may be an option for this area however; this cannot be set without relevant biological data.

It is further recommended that:

- The local communities establish mechanisms to prevent hunting of especially vulnerable species. This might involve invoking traditional taboos, restricting use of certain hunting technologies and promoting local agreements.
- Hunters’ unions should be initiated to curb down the influx of outside interest. This will ensure that only registered hunters will be eligible to hunt under supervision.
- The government of Cameroon should implement extension programmes that are crucial to provide locally appropriate production of alternative sources of protein (domestic livestock and fish farming).

- The government should also promote traditional income generating activities like cottage industries and the self-help initiatives of local population should be identified and supported in accordance with gender-specific resource management principle.
- The government of Cameroon should also subsidize agricultural activities and make importation of agricultural appliances duty free.

One very important recommendation to the government of Cameroon is that it should encourage the creation of technical schools and rural artesian centres in Cameroon to train young Cameroonians to be self-employed hence divert their attention from natural resources.

Above all, the government should create employment opportunities to Cameroonians and also cut down the high taxes levied on private businesses in this way more people will be self-employed and the pressure on natural resources will reduce. International non-governmental organizations (NGOs) and academic institutions should double their efforts to create awareness on the identification of animal species by the local people and the consequences of destroying wildlife through over-harvesting and initiate behavioural change.

They should promote and conduct research on ecological and social topics relevant to hunting such as the biology and ecology of hunted species, effects of different types, intensities and locations of hunting on wildlife species, nutritional, cultural and social needs of local hunting communities. Promote and conduct long-term monitoring of targeted wildlife populations and their habitats so that management can be adaptive. Lastly Government and international NGOs should encourage the creation of the primary industry that can process and package NTFPs in this area.

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APPENDICES

Appendix 1: Standard questions posted to 187 hunters during interviews at BMWS

- 1) Age?
 - a) 0-15 b) 16-30 c) 31-45 d) 46-60 e) 60 and above
- 2) Marital Status?
 - a) Single b) married c) divorce d) widowed
- 3) Number of children?
 - a) 1-2 b) 3-5 c) 6 and above
- 4) Level of Education?
 - a) Primary b) secondary c) university d) No formal education
- 5) Main occupation?
 - a) Hunting b) farming c) others
- 6) Which animals do you kill most in the forest?
 - a) b) c) d)
- 7) Which animals do you eat most?
 - a) b) c) d)
- 8) Which animals do you sell most?
 - a) b) c) d)
- 9) Which animals do you think are frequently seen in the forest today?
 - a) b) c) d)
- 10) Which animals were most abundant in the forest 10-20 years ago?
 - a) b) c) d)
- 11) Which animals are least present in the forest today?
 - a) b) c) d)
- 12) Which animals do you prefer to eat most?
 - a) b) c)
- 13) Which animals sell at premium prices?
 - a) b) c) d)

14) Do you understand the meaning of protected animals?

a) Yes b) No

15) Which animals are protected in your forest region?

a) Elephant b) Chimpanzees c) Monkeys d) I don't know

16) Are there any Religious, Social, Cultural or traditional values attached to killing of certain animals?

a) Yes b) No

17) If yes which animals?

a) Leopard b) elephant c) monkeys d) I don't know

18) Does politics influence the harvest of animals from the forest?

a) Yes b) No c) I don't know

19) If yes how?

.....

20) If all these animals were in one place in the forest and you had a short gun with only one cartridge, which one would you, shoot?

a) Elephant b).....c).....d).....

21) Do you have any hunter's association in your village?

a) Yes b) No

22) Who should be responsible for managing hunting in the village?

a) Government b) Village council c) Hunters d) No body

23) What is the role of the Ministry of Wildlife and Forest in managing hunting in this area?

a) Regulate hunting b) Educate hunters on hunting methods c) I don't know

24) How many times have you been confronted by a wildlife officer for killing carrying a certain species of animal?

a) One b) two to four times c) several times d) Never

25) Does the presence of the Ministry of Wildlife and Forestry in your village have any impact on your hunting activities?

a) Yes b) No

26) Why do you actually hunt?

- a) Just for the pleasure of it
- b) I am unemployed and hunting is the only way to carter for my family’s livelihood
- c) Hunting is less expensive to carry out
- d) None of the above
- e) b and c above

Appendix 2: Data collection sheet for study

Date	E.Name of animal	B/M name	Sex	Weight (kg)	Age (m/y)	Origin of animal	Destination	Quantity	Physical condition	Price (cfa)

Name of Assistant.....
 Name of village.....

Appendix 3: List of species known to live in the Banyang-Mbo Wildlife Sanctuary

List of species known to live in the Banyang-Mbo Wildlife Sanctuary.

Common name	Scientific name	Legal status	Keyang name	Mbo name	Pidgin name
Primates	Primates		Nstik	Nkem	Monkey
Greater white nose monkey	<i>Cercopithecus nictitan</i>		Ekai	seeh	White nose
White -collared mangabey	<i>Cercocebus torquatus</i>		Ekasso	Nkakum	Gendarme
Crown red guenon	<i>Cercopithecus pogonia</i>			Souboum	
Mona monkey	<i>Cercopithecus mona</i>		Ngai	Pouing	
Red-eared monkey	<i>Cercopithecus erythrotis</i>		Nchwei	Sunkw uon	
Drill	<i>Papio leucophaeus</i>	Protected	Nsongnya	Sunkwuon	Sumbu
Chimpanzee	<i>Pan troglodytes</i>	Protected	Ekirikak	Mebange	Chimpanzee
Golden potto	<i>Arctocebus catabarensis</i>		Ebow	Medubambe	Bush baby
Allen's galago	<i>Galago alleni</i>		Ebow	Oboah	Bush baby
Artiodactyla	Artiodactyla				Deer
Blue duiker	<i>Cephalophus monticola</i>		Reteh	Mehsen	
Bay duiker	<i>Cephalophus dorsalis</i>		Ngukenow	Dembin	Frotambo
Yellow-black duiker	<i>Cephalophus sylvicultor</i>		Nkongho	Nzii	Sleeping deer
Ogilby's duiker	<i>Cephalophus ogilby</i>		Nso	Mbin	Bush deer
Red river hog (Bush pig)	<i>Potamoschus porcus</i>	Protected	Njiwi	Ngwuon	Bush swine
Water chevrotain	<i>Hyemoschus aquaticus</i>	Protected	Seku	Sukum	Water beef
Bush buck	<i>Tragelaphus scriptus</i>		Mfon	Nya'a	Antelope
Forest buffalo	<i>Syncerus caffer nanus</i>	Protected			
Pholidota	Pholidota				Catah beef
Tree pangolin	<i>Manis tricuspis</i>		Njie	Saih	Catah beef
Long -tailed pangolin	<i>Manis tetradactyla</i>		Njie	Saih	Catah beef
Giant pangolin	<i>Manis gigantean</i>	Protected	Njie Nsok	Saih nzo	
Rodentia	Rodentia				Tchuku- Tchuku beef
Brush- tailed porcupine	<i>Atherurus africana</i>		Nnyok	Gwuon	Tchuku- Tchuku beef
Cane rat	<i>Thryonomis swinderianus</i>		Njuinok	Nzibi	Cutting grass
Giant rat	<i>Cricetomys gambianus</i>		Ngumbok	Kwenyam	Grumbeef
Brown rat	<i>Crechetomys spp.</i>			Pou'oh	Brown rat
African giant squirrel	<i>Protexerus stangeri</i>		Mbarichkat	Mbouyam	Squirrel
Red footed squirrel	<i>Funisciurus pyrropus</i>			Mekwa'a	Squirrel
Fying squirrel	<i>Anomalurus derbianus</i>			ngwing	Fying squirrel
Carnivore	Carnivore				
African palm Civet	<i>Nandinia binotata</i>		Mbay	Mbpeh	Bush preussi
African civet	<i>Viverra civetta</i>		Resem	Eswuah	Bush dog
Forest genet	<i>Genetta spp.</i>			Meshing	Bush pussi
Dark mongoose	<i>Crossarchus obscurus</i>		Sebioh	Mezuing	20 in line

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Marsh mongoose	<i>Atilax paludinosus</i>		Mbak	Ebubuh	
Black-legged mongoose	<i>Bdeogale nigripes</i>		Mbak	mbunyam	
Otter sp.				Ebohlong	
Leopard	<i>Panthera pardus</i>	Protected	Nkwoh	Ngwo'o	
Hyracoidea	Hyracoidae				
Tree hyrax				kehnyam	
Reptiles					
Gabon viper	<i>Bitis gabonica</i>			Ejung	Viper
Cobra	<i>Naja spp.</i>		Meri	Ehubi	Black snake
Green mamba	<i>Dendroaspis jamensoni</i>		Mbam	Nkonwe'eh	Green snake
African rock python	<i>Python sebae</i>		Ngem	Ngem	Python
Nile monitor lizard	<i>Varanus niloticus</i>		Remak	Nguanweh	Ngombe
Nile crocodile	<i>Crocodylus spp.</i>	Protected	Nyong	Ngan	Crocodile
African dwarf crocodile	<i>Osteolaemus tetraspis</i>	Protected	Ebu	Nkwbrin	Alligator
Tortoise sp.			Rewen	Kubah	Trokey
Birds					
Palm -nut Vulture	<i>Gypohierax angolensis</i>			Jung	Eagle
Guinea fowl	<i>Gutera plumifera</i>		Ehang	Kehngweh	Bush fowl
Black casqued hornbill	<i>Ceratogymna atrata</i>		Ngond	Nkwon	Hornbill
Parrots	<i>Parrots erythacus</i>		Euneng	Quing	parrot
Red king fisher				Ugne'eh	king fisher
Francolin	Francolin				
Green turaco	<i>Turaco persa</i>				
Chiroptera	Chiroptera				
Bats sp.	Bats		Waku	Njame	Blind bat
Proboscidea	Proboscidae				
Elephant	<i>Loxodonta africana cyclotis</i>	Protected	Nsok	Nzo	Elephant
Hyracoidea	Hyracoidae				
Tree hyrax	<i>Dendrohyrax dorsalis</i>			Kehnyam	Stone beef
Rock hyrax	<i>Procavia capensis</i>				

Adapted from WCS, 1999/ 2000

Appendix 4: Animals harvested by taxonomic groups

Taxonomic units	
Groups	Common name
Primates	Crowned Guenon monkey
	Golden potto
	Greater white-nosed monkey
	Mona monkey
	Red eared monkey
Rodents	Brush tailed porcupine
	Cane rat
	Giant forest squirrel
	Giant rat
	Squirrel
Duikers	Blue duiker
	Bay duiker
	Ogilby's duiker
Bush pig	Red River forest hog
Protected	Drill
	Dwarf crocodile
	Python
	Water chevrotain
Pangolin	Tree pangolin
	Long- tailed pangolin

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Carnivore	African Civet
	African palm Civet
	Dark Mongoose
	Forest Genet
	Mongoose sp.
Others	Cobra sp.
	Gabon viper
	Green mamba
	Guinea fowl
	Hornbill
	Monitor lizard

Appendix 5: Animals recorded less than 5

Animal name	Grand total
Allen's Galago	4
Otter	1
Yellow backed duiker	3
Chimpanzee	1
Bat sp.	2
Brown rat	4
Tree hyrax	1
Elephant	0
Leopard	0
Palm-nut Vulture	3
Dove	4
African grey parrot	3
Giant Pangolin	0
Buffalo	0

Appendix 6: Pictures of animals commonly hunted and hunting huts at BMWS



Plate 1: Hunter & researcher with a Gabon viper



Plate 2: Bushmeat on sale at Tinto Market



Plate 3: A hunter just arriving his hunting hut



Plate 4: A duiker shot with a short gun at Barah



Plate 5: Bushmeat sales at Elumba market



Plate 6: A hunting hut at Akriba village



Plate 7: Pieces of Bushmeat sold in a village



Plate 8: Wire snare set along a fence in the forest



Plate 9: Wire snare for ground dwelling animals



Plate 10: A hunter setting wire snare in forest



Plate 11: A hunter setting foot trap on animal path

Appendix 7. Results of respondents for hunters' interview

Quest 1	Hunters ages	% count	Freq count	Quest. 6	Animals groups killed	% count	Freq count
	0-15	0	0		Duikers	38	64
	16-30	33.7	63		Rodents	46	87
	31-45	43	81		Primate	16	36
	45-59	15	28		Small carnivore	0	0
	60 and above	8.3	15				
	Total	100	187			100	

Quest 2	Marital status	% count	Freq count	Quest. 7	Animals eaten most	% count	Freq count
	Single	15.6	30		Rodents	63.6	119
	Married	78	145		Primates	28.3	53
	Divorced	1.6	3		Duikers	5.9	11
	Widowed	4.8	9		Others	2.2	4
	Total	100	187			100	187

Quest. 3	No. of children	% count	Freq count	Quest. 8	Animals sold most	% count	Freq. count
	1-2	31	58		Rodents	51.9	97
	3-5	48	90		Duikers	42.2	79
	6 and above	21	39		Primates	3.2	6
	Total	100	187		Others	2.7	5

Quest. 4	Level of education	% count	Freq count	Quest. 9	Animals frequently seen in forest today	% count	Freq. count
	No formal	13.4	25		Rodents	57.8	108
	primary	35.8	67		Duikers	24.6	46
	secondary	50.3	94		Primates	16	30
	University	0.5	1		Others	1.6	3
	Total	100	187			100	187

Quest. 5	Main occupation	% count	Freq count	Quest. 10	Animals most abundant 10-20 yrs ago	% count	Freq. count
	Hunting	81.3		152	Duikers	33.7	63
	Farming	16	30		Primates	35.8	67
	Others	2.7	5		Rodents	30.5	57
	Total	100	187			100	187

Quest. 11	Animals least present in forest today	% count	Freq count	Quest. 12	Animals preferred to eat most	% count	Freq. count
	Leopards	31	58		Domesticated	86	161
	Elephant	22.9	43		Rodents	10.7	20
	Chimpanzees	21.6	40		Pangolin	1.2	2
	Drills & other monkeys	24.5	46		Moneys	2.1	4
	Total	100	187			100	187

Quest. 13	Which animals sell at premium prices?	% count	Freq count	Quest. 14	Understanding of term protected Spp.	% count	Freq. count
	Pangolin	50.8	95		Yes	53	99
	Brush-tailed Porcupine	46	87		No	47	88
	Water beef	2.6	4				
	Elephant	0.60	1				
	Total	100	187			100	187

Quest. 15	Which animals are protected in region?	% count	Freq count	Quest. 16	Any religious, ritual values attached to killing wildlife?	% count	Freq. count
	Elephant	38	71		Yes	100	187
	Chimpanzees	20.3	38		No	0	0
	Monkeys	5.3	10				
	I don't know	36.4	68				
	Total	100	187			100	187

Quest. 17	If yes which animals?	% count	Freq count	Quest. 18	Does politics influence harvest of animals?	% count	Freq. count
	Leopard	34	63		Yes	89.9	185
	Elephants	27	51		No	1.1	2
	Primates	20.3	38		I don't know	0	0
	I don't know	18.7	35				
	Total	100	187			100	187

Quest. 19	Do you have a hunters' union	% count	Freq count	Quest. 20	Who should regulate hunting in village?	% count	Freq. count
	Yes	0	0		Gov't	0	0
	No	100	187		Village councils	15	28
					Hunters	76	142
					No body	20	37
	Total	100	187			100	187

Quest. 21	Role of Ministry of Wildlife and Forestry on hunting in village	% count	Freq count	Quest. 22	How many times have you been confronted for killing wildlife?	% count	Freq. count
	Regulate hunting	21	40		One time	33.7	63
	Educate hunters	31	58		two to four times	35.8	67
	I don't know	32	60		several times	6.9	13
	No role	16	29		Never	23.6	44
	Total	100	187			100	187

Quest. 23	Does ministry presence impact hunting activities in region?	% count	Freq count	Quest. 24	Level of collaboration between wildlife agents and hunters	% count	Freq. count
	Yes	0	0		Good	8	16
	No	33.6	63		V. good	0	0
	I don't know	66.4	124		Poor	38	71
					V. poor	47	87
					I don't know	7	13
	Total	100	187			100	187

Quest. 25	Level of collaboration between Wildlife agents and communities	% count	Freq count	Quest. 26	Why do you hunt?	% count	Freq count
	Good	21	41		Just for hunting pleasure	0	0
	V. good	1.6	3		I am unemployed	0	0
	Poor	34	63		Hunting investment is less	0	0
	V. poor	27	50		None of the above	0	0
	I don't know	16	30		b and c above	100	187
	I don't know	100	187			100	187

Appendix 8 Extrapolation of annual off-take and biomass of animals harvested by hunters (n = 429) in the whole of Banyang-Mbo Wildlife Sanctuary.

Common name	Scientific name	Extrapolation of annual off-take for the whole BMWS area (n=429) hunters	Extrapolation of Annual Biomass for the whole BMWS area (n=429) hunters
Water Chervrotain	<i>Hyemoschus aquaticus</i>	4290	45427,42
Dark Mongoose	<i>Crossarchus obscurus</i>	6925	12203,82
Forest Genet	<i>Genetta spp.</i>	1348	3572,96
Giant Forest Squirrel	<i>Protexerus stangeri</i>	1041	1066,4
African Civet	<i>Viverra civetta</i>	1716	12747,43
African Palm Civet	<i>Nandinia binotata</i>	5822	20837,14
Cane Rat	<i>Thryonomis swinderianus</i>	6741	43635,43
Drill	<i>Papio leucophaeus</i>	1470	19182,43
Brush-Tail Porcupine	<i>Atherurus africana</i>	26414	118833
Bay Duiker	<i>Cephalophus dorsalis</i>	5270	87638,57
Blue Duiker	<i>Cephalophus monticola</i>	44248	226328,14
Bush Pig	<i>Potamoschus porcus</i>	4412	293803,71
Cobra species	<i>Naja species</i>	306	919,3
Giant Rat	<i>Cricetomys gambianus</i>	11031	17343,86
Red-Eared Monkey	<i>Cercopithecus erythrotis</i>	3003	10986,08
Pangolin species	-	11828	33314,91
Squirrel species	-	2880	1628,97
Ogilby's Duiker	<i>Cephalophus ogilby's</i>	20530	229576,89
Green Mamba	<i>Dendroaspis jamensoni</i>	1716	4700,61
Golden Potto	<i>Arctocebus catabarensis</i>	735	1164,43
Bush Fowl	<i>Guttera plumifera</i>	1287	2046,94
Mongoose species	-	4290	16001,09
Hornbill	<i>Ceratogymna atrata</i>	551	1055,34
Tortoise species	-	1287	2879,2
Python	-	429	6006
Monitor Lizard	<i>Varanus niloticus</i>	858	4290
Greater White-Nosed	<i>Cercopithecus nictitan</i>	8151	59998,71
Gabon Viper	<i>Bitis gabonica</i>	796	2990,74
Dwarf Crocodile	<i>Osteolaemus tetraspis</i>	2574	20166,1
Crowned Guenon Monkey	<i>Cercopithecus pogonia</i>	735	3240,2
Mona Monkey	<i>Cercopithecus mona</i>	11276	56860,89
Red Capped Mangabey	<i>Cercopithecus torquatus</i>	306	1961,14
Bush Buck	<i>Tragelaphus scriptus</i>	367	10418,57
Grand Total		194633	1372826,42