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UTILIZATION OF FOREST WILDLIFE IN WEST AFRICA

by

S.S. Ajayi
Consultant
University of Ibadan

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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FOREWORD

This document presents the results of the first of a series of studies that will be undertaken on the utilization of forest wildlife. The ultimate objective will be to produce a comprehensive manual on this subject from a number of regional analyses.

We are grateful to Dr. Ajayi for the thorough way in which he has dealt with the formidable task of assembling and compiling data for West Africa. Because the finalization of the overall work may take a considerable time, it was considered appropriate to publish Dr. Ajayi's findings in the present document in order to make them immediately available to persons interested in and working in this subject area.

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1. INTRODUCTION

Although wildlife is generally acknowledged in Africa as a valuable source of protein and revenue, there are as yet very few hard facts in the form of comprehensive published information on its pattern of utilization and its nutritive and economic importance. Moreover the forest wildlife in Africa, which has from time immemorial provided man with a significant portion of his animal protein intake, has received very little attention from scientists, administrators, development planners and financiers of development programmes. In West Africa, where the tropical forest occupies a large proportion of the total vegetation cover, the role of wildlife as a source of food is probably more important than elsewhere, because of the prevalence of tsetse flies (Glossina species) which make large-scale production of livestock very difficult. As far as is known, there has not been a comprehensive compilation of quantitative information on the forest wildlife of West Africa as a source of food and by-products, an evaluation of traditional methods of production, harvesting and marketing and the contribution of forest wildlife to local communities in socio-economic terms.

1.1 OBJECTIVES OF THE PRESENT STUDY

This study, therefore, has as its objectives, to collate recent information and results of research projects into the utilization of forest wildlife in West Africa for food and animal products. It is designed to evaluate traditional methods of utilization of wildlife, with particular reference to mammals. It also includes an assessment of traditional processing methods for meat and animal products, bushmeat and by-products in rural economies and of the nutritive value of forest species which are significant food items. Items of investigation also include an examination of the wildlife management practices in several West African countries, with a view to exploring possibilities for integrated use of wildlife and food crops in the broad concept of traditional and modern farming with wildlife and forestry, in line with the current practices of agro-forestry.

While recognizing the role of wildlife as a source of meat, are there ways of managing these resources together with food crops so that the former can be exploited on a rational basis, in order that their existence and food habits on farms and in forests would not cause "economic damage? The present study attempts to answer this question and to compile various on-going research projects in the areas stated above and to identify gaps in our knowledge of the status, biology, and methods of management. This will facilitate the drawing-up of research priorities directed at more efficient utilization of forest wildlife.

1.2 SCOPE OF THE STUDY

The study was carried out in six West African countries which possess extensive tropical forests and where wildlife is recognized as an asset, in terms of food and animal products. In order to have a balanced view of the various subject areas mentioned above, it was recognized that wildlife utilization and management practices in West Africa are to some extent influenced by colonial background. On this basis three Francophone countries (Cameroon, Benin and Ivory Coast) and three Anglophone countries (Nigeria, Ghana and Liberia) were visited and on-the-spot assessments of the various aspects of wildlife utilization made.

The study was confined to tropical forest areas only, and limited to the utilization of terrestial mammals. A generalized questionnaire (Appendix 1) was used as a guide for collating information from the six countries visited.

While this document is meant primarily to serve as a guide for wildlife extension workers, and rural people who are most affected by the status of this resource, it could also assist Administrators and planners to focus their attention on wildlife, because of its values, especially in rural economies. In competing for government funds, development planners in West Africa, as in many other parts of the world, frequently rely on the "Cost/Benefit" ratios of projects. Traditionally, wildlife management and nature protection has been part of Forestry Departments in most West African countries visited; Forestry Departments are in turn amalgamated with Agriculture and Fisheries under the umbrella of the Ministry of Agriculture and Natural Resources. Most divisions of the Ministry are often well aware of the economic importance of their various resources and, therefore, convince the financial authorities to approve their projects more easily. Wildlife managers in some West African countries have suffered from lack of data on this subject, partly due to neglect and partly due to the fact that the results of conservation are often long term and cannot be quantified in monetary terms easily. It is hoped that this study would serve the purpose of drawing the attention of administrators to the socio-economic and conservation benefits of wildlife.

2. IMPORTANT FOREST MAMMALS UTILIZED FOR FOOD AND ANIMAL PRODUCTS

2.1 SPECIES UTILIZED FOR FOOD AND ANIMAL PRODUCTS

Asibey (1974) stated that protein deficiency and malnutrition is prevalent in Africa, south of the Sahara, partly because wildlife which used to be man's main source of animal protein is now in short supply. Over-hunting has depleted wildlife in most parts of West Africa, and therefore man cannot afford to be as selective as say 50 years ago, as to which species of animal he eats and which taboo forbids him from eating. In southern parts of Nigeria and Ghana, maggots, various insects and agama lizards are eaten (Asibey 1974). In short, people eat whatever is available. In the tropical forest region, where, because of environmental hazards, domestic livestock cannot thrive as in the savanna regions, wildlife is and will continue to be of paramount importance because with the naturally low protein diets of the inhabitants, every gram of animal protein counts. It is therefore pertinent to state here that practically all forest mammals are eaten in West Africa - ranging from bats, squirrels, galagos, monkeys to antelopes and elephant. Appendix II gives a list of important species in terms of animal protein sources, and the value of their by-products.

2.2 USES OF ANIMAL PRODUCTS

Animal products are here understood to cover any part of the animal body, including its droppings that are used by people other than for food. There are many ways in which animal products are utilized:

- the use of ivory, teeth of the hippopotamus and the skins of big cats for ornamental purposes is one of the most popular,

- skins of antelopes such as yellow-backed duiker, bush buck, bongo and colobus monkeys are used for decorations, and other valuable household materials e.g. ladies handbags, purses etc.,

- in West Africa, especially in southern Nigeria (Ajayi 1978) and in southern Cameroon (Akum, unpublished M.S.) any part of an animal may be used for traditional medicine. In some cases a whole rodent is used as one ingredient of some medicinal preparations or witchcraft. In others, only the faeces are used, while skins, bones and meat are widely used (Appendix III).

- Forest mammals are also widely used in scientific research. Primates are widely used in bio-chemical, physiological and medical research because of their close resemblance to man. In fact the "rheusus factor" in blood types and blood clotting was first discovered in monkeys, and the findings utilized for man. Primates and other mammals are also used to test new drugs, because their physiological processes are close to humans'. Other mammalian species are also used in studying life cycles of pathogens, parasites etc.

3. PATTERNS OF BUSHMEAT PRODUCTION, PRESERVATION AND MARKETING

3.1 HUNTING TOOLS

Asitey (1978) observed that hunting tools have evolved in West Africa from simple traps, through spears, bows and arrows to guns, rifles and even automatic weapons.

In most West African countries, forest mammals are still hunted with snares, traps, spears, bows and arrows, poisoned baits and nets. Dogs are also used in community traditional group hunting which will be discussed later. The introduction of dane guns 1/, shot guns and rifles as a result of man's urbanization matched a corresponding higher demand for wild animal protein. However, it is interesting to note that both the primitive and modern hunting tools are still employed in West Africa today. The following are amongst hunting techniques identified in this part of Africa.

3.2 HUNTING TECHNIQUES

(a) Trapping and snaring (often associated with subsistence farming).

Mainly used for mammals, small medium and big game. They consist of trap-fence line (for small game), gin traps (for small game), snares and pit-falls (for both small and medium sized game). Snares and traps may be baited, depending on the type of animals desired to be killed. They are usually set for animals which have regular routes especially where well defined tracks exist.

This hunting technique is practised in Nigeria, Ghana and Liberia.

(b) Individual professional hunting with dane guns and shot guns

This type of hunting involves a professional hunter going out with a dane gun to hunt, frequently with an assistant to carry his kill. The kill is usually eaten by the hunter's family and when a big animal is killed, it is either sold fresh to local consumers or to a local collector who smoke-dries it for sale to a retailer.

Night hunting is also practised in a similar way. The hunter who bears the arm carries a head lamp with which he dazzles the animal, and it is the reflection from the animal's eyes that betrays it. Using this method a hunter may kill animals the size of bushbuck (*Tragelaphus scriptus*) or bigger, such as buffalo (*Synceros cafer*). In most parts of West Africa any hunter who kills a buffalo is usually elevated among the hierarchy of hunters in his rural community, because of the risks involved in using such a semi-primitive weapon for a rather aggressive animal.

1/ Muzzle loading guns.

(c) Community hunting

(i) Community hunting for commercial purposes

Traditional hunting tribes may have little to do after the farm harvests at the early part of the dry season. They set out in groups ranging from 3 to 10 and may be up to 20 in number, including their youngsters. They may travel long distances and invade anywhere that game is relatively abundant, including the rain forests. In Nigeria, the Kemberi, Zuru and Dankari kari tribes of the north western region are noted for this type of hunting while in Liberia it is the Sapo and Kran. Such a hunting spree may last several weeks, during which their kills are smoke-dried and sold to retailers who in turn sell to the markets. This type of hunting is most wasteful as animals are indiscriminately killed for their cash value.

(ii) Annual festival community hunting

Another type of community hunting in West Africa is of a festive nature. It is often an annual event where villagers go out during the dry season (the rainy season is regarded as a closed season) to hunt on a particular area of land, which is the property of that particular village. A particular village cannot hunt on the property of another either in Nigeria (Olawoye and Ajayi, 1975) or Ghana (Asibey, 1978). When hunters reach the hunting ground, they space themselves out a few yards from each other, and dogs are signalled to comb the bush and drive the animals out. The participants make a lot of noise as they cut their way through the bush. When they see an animal, there is a chase and the animal is run down and killed.

The kill is usually shared among the participants, but some animals are reserved for the village head as his traditional right.

This method of hunting with definite closed season whereby local people respect the tradition not to hunt during the rainy season, has some conservation value as wildlife is not depleted by it.

(iii) Community hunting by urban dwellers

This is the category of licenced full-time professional or part-time hunters, who are bound by law to hunt certain categories and numbers of wildlife depending on their relative abundance. Most urban professional hunters hunt with rifles or single or double barre shot guns. Licenses to hunt are issued by the game divisions of forestry departments in Cameroon, Nigeria, and Liberia and by the Department of Game and Wildlife in Ghana. Permits are not granted to hunt species which are prohibited or fully protected (denoted first schedule). Occasionally permission may be given to hunt animals which are partially protected (second schedule). Lists of these species are contained in the proposed Nigeria "Wildlife Conservation Decree", the Liberia "Wildlife Conservation, Regulation", and the Ghana "Game Laws" (Appendix V).

3.3 MARKET STRUCTURE OF BUSHMEAT TRADE

Market structure is here taken to include such diverse economic phenomena as marketing channels, and preservation methods.

Structure is the organizational characteristics which determine the relationships between sellers in the market and the buyers. They are in fact the organizational characteristics which influence the nature of competition and prices of commodities within the market.

The production, distribution and marketing of bushmeat in West Africa is not as complex as for some agricultural products. In most cases there seems to be the following general simple pattern in this part of Africa: the starting point of the distribution channel is the producer, in this case the hunter. Most producers reside mainly in rural areas and the producer either sells his fresh product locally for consumption in rural areas or gives it to his wife first for preservation and subsequently to a village collector. The wife generally has two methods of preservation: soft smoking or smoke drying before she sells directly to village collectors. The producer can also sell directly to a village collector who will carry out the smoking process himself. Alternatively, the producer's wife may sell fresh carcasses to roadside sellers who carry out the smoking exercise and sell by the roadside simultaneously. Otherwise, the roadside seller may have to buy from the village collector. The urban retailer can only buy from the village collector (often in smoke dry condition) or from roadside sellers. The ultimate consumer buys mostly from the urban retailer in markets. Occasionally an ultimate consumer buys from a roadside seller.

Another aspect of the market structure is posed by traditional hunting tribes who may travel several kilometres and organize communal hunting for several weeks and eventually smoke dry their products which are sold direct to village collectors and to urban retailers who eventually sell to ultimate consumers. They may also sell fresh carcasses directly to ultimate consumers in urban areas. The following chart (Fig. 1) shows a generalized production, preservation and marketing structure for bushmeat in West Africa.

3.4 PRESERVATION OF BUSHMEAT

Throughout West Africa, the only method used to preserve bushmeat is by smoking. Two types of smoking were identified: soft smoking and dry smoking. Smoking is usually carried out either in a mud-built smoking chamber or drum (Hartog & de Vos, 1973). Salting or biltong sun-drying is not common. Bushmeat which is dry-smoked can last 2 - 4 weeks, depending on how dry it is and since the demand for it is so high, most of the commodity is sold before decomposition.

At present, there is probably no technologically similar alternative preservation method that could be suggested for bushmeat in West Africa. First, the tropical forest region is so humid that attempts at sun-drying meat for biltong leads to decomposition. Secondly, salt is such an expensive commodity that salting as a method of preservation could make bushmeat too expensive and out of reach of common people. In fact, most people would prefer to utilize salt in a more economical way than to preserve bushmeat.

However, the way in which bushmeat is smoked in parts of West Africa leaves much to be desired. First there is the question of hygiene. Smoking should be done in a manner that meets with the highest standards of sanitation. It is also desirable that dry smoking is effected by retaining the meat in a smoking chamber for as long as is practicable, in order to reduce the moisture content to the bearest minimum to ensure that it does not decompose quickly. Determination of minimum moisture content that would meet this requirement is, however, a field for further investigation.

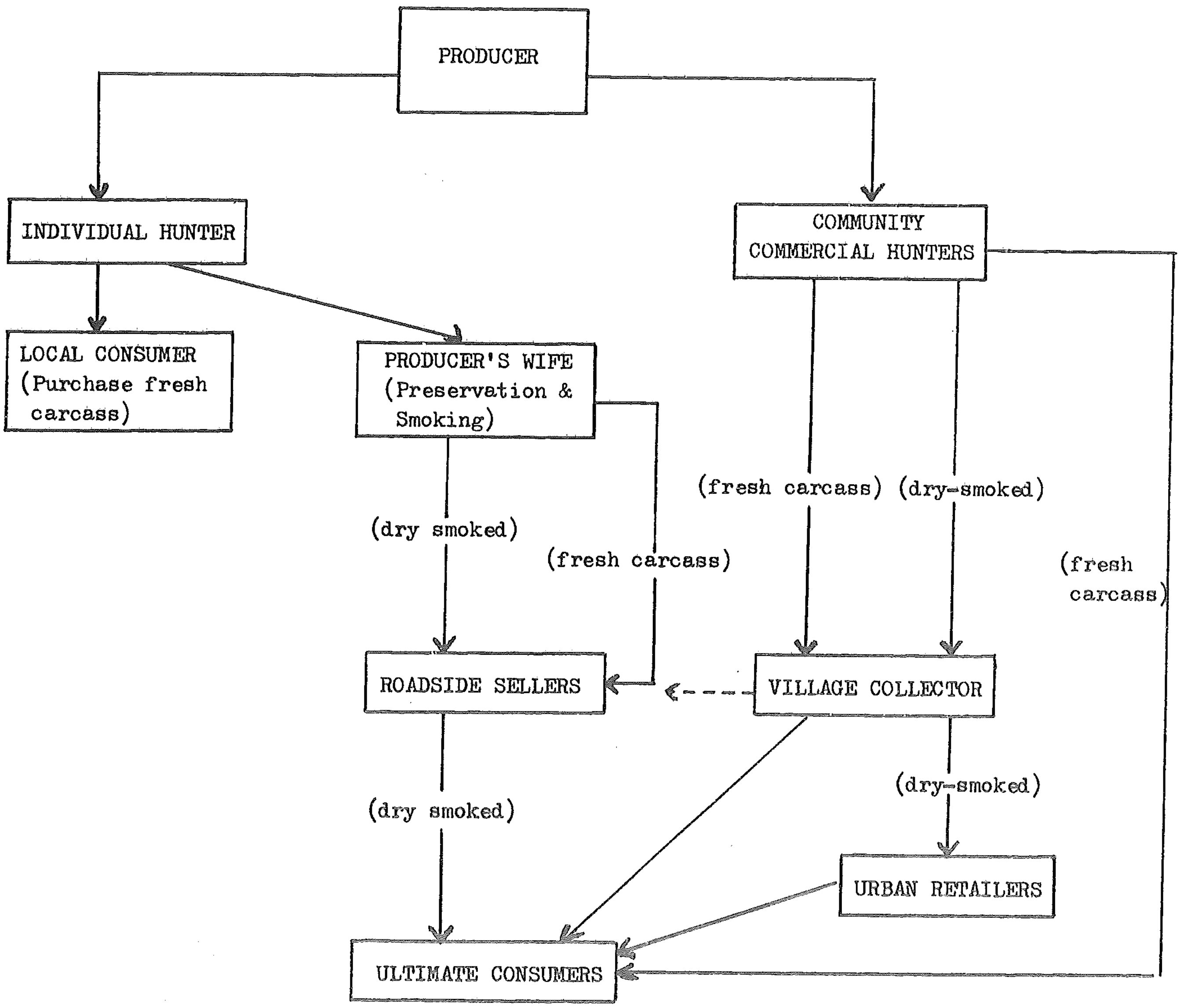


Fig. 1 MARKET STRUCTURE FOR BUSH MEAT IN WEST AFRICA

4. ECONOMIC IMPORTANCE OF FOREST WILDLIFE AND ITS PRODUCTS IN WEST AFRICA

West Africa has the highest human population density compared with other parts of the continent, south of the Sahara (Milligan and Ajayi, 1978). The human population continues to grow rapidly and so are the natural accompaniments of their demands, most especially animal protein. Ajayi (1970) observed that it is because of the rapid population growth and because the tsetse infested tropical forests make the development of livestock almost impossible, that biologists and policy makers have been looking at wildlife as possible alternative sources of animal protein. However, available information on the value of wildlife as a source of meat to date, especially in West Africa, has been almost entirely qualitative. The need, therefore, arises to collate existing information, scattered as it might be, in order to quantify the significance of this resource in the tropical forest regions of West Africa, where it is difficult to substitute wildlife with domestic animals, in large enough quantities to meet the demands of the present population growth.

During the course of this study, it was found that work had been carried out on the importance of bushmeat in some parts of Ghana and Nigeria. However, nowhere had any comprehensive country-wide survey been conducted with regard to the economic importance of bushmeat and animal products in either rural or national economies. In Ghana, Asibey (1970, 1974a, 1974b, 1976 and 1978) has carried out market surveys in some selected urban and village markets to determine the economic importance of bush meat, particularly the grass cutter (Thryonomys swinderianus) in the economic development in Ghana. In Nigeria, Charter (1970) has reported on the importance of wildlife in rural economies in the thickly populated south. The Federal Department of Forestry, Lagos (1977) has also reported export figures of forest animals and by-products from southern Nigeria; while FAO (1967) published reports on the value of some selected by-products exported from Sierra Leone and Ghana in 1962 and 1965 respectively. Apart from these references, there is no published data available on the importance of wildlife in national and rural economies in Africa.

4.1 BUSH MEAT IN THE NATIONAL ECONOMY

In the absence of published information on the type of comprehensive, country-wide surveys referred to above, efforts have been made to extract data from these references on the importance of forest mammals in national economies (Table 1).

However, some of the figures referred to in Table 1 below are inevitably based on the personal judgement of authorities that are directly concerned with wildlife utilization. Table 1 also relates the percentage mean annual consumption of animal protein to human population in five countries. In all cases, it is evident that wildlife, and particularly forest mammals, account for 20-90% of total animal protein consumed. Liberia lies entirely in the tropical rain forest belt of West Africa, with an annual rainfall of above 80 inches over most of the country. The forest region is unsuitable for large-scale production of livestock and hence, most of the Liberian population depends on wildlife for meat (Jeffrey, 1977). Liberia has no national parks or game reserves although efforts are now being made by the Forestry Development Authority to create some wildlife refuges. In the counties of Grand Gedeh and Grand Bassa, wildlife is the only source of meat known to the people and here, as in most parts of Liberia, wildlife is merely referred to as "meat" as there is no other substitute for it as a source of animal protein, except for a few domestic animals which are slaughtered to welcome important visitors.

In Ghana, out of the 15.22 grams of protein consumed by an average person per day, 1.75 grams come from bushmeat, mostly mammals, compared with 1.64 grams from domestic stock (Asibey, 1974). The remaining protein comes from plant sources and fish. This estimate did not state what proportion is accounted for by forest mammals, but from the list of wild animals eaten in Ghana today, rodents, bats, ant-eaters and primates form about 60% of the wild animal protein source, while the remaining 40% are birds and reptiles.

Data collected in Accra on a year-long basis revealed a minimum consumption rate of 98,160.44 kg of bush meat (mostly mammals), worth about US$ 15,514 (Asibey, 1978).

Asibey (1978) also reported that bush meat contributed 44% and 31% of the protein consumed in Wiawso and Asempaneye Districts of southern Ghana respectively. Fish contributed 35% and 31% respectively. Hence, domestic sources of meat in this part of Ghana contributed 10% and 9% respectively.

The value of wild animal meat consumed in southern Nigeria for the financial year 1965/66 was estimated at about US$ 20.4 million against US$ 34 million for domestic animals (Charter, 1970). Charter (1970) also stated that for locally produced animal food, 19% came from wild animals (mostly mammals), 60% from fish and 21% from domestic animals in southern Nigeria. He concluded, therefore, that Nigerians in the tropical forest belt are more dependent on protein from their natural environments than from agriculture.

Various estimates were also made by Petrides (1965) on the proportion of wild animal protein consumed in several localities of south-eastern Nigeria. These estimates range from 10 - 85% of the total meat consumed. Although it was not stated in which proportion forest mammals are utilized, information published by the Nigerian Federal Department of Forestry in 1977 gave an estimate of 18 - 60% for mammalian species (herbivores and carnivores), utilized for food and traditional medicines in that part of Nigeria.

The foregoing estimates show the degree of dependence of West Africans on forest mammals.

4.2 INTER-COMMODITY PRICE COMPARISON

One important index in assessing the economic importance of bush meat in the economies of West African countries is the price comparison of this food item with other sources of animal protein, i.e. domestic livestock. Market prices were abstracted either from published information or by direct market surveys. Countries for which data were available are Cameroon (Allo, personal comm.), Nigeria (Olawoye & Ajayi, 1975), Ghana (Asibey, 1970) Ivory Coast (N'Guessan, personal comm.), and Liberia (Ajayi, 1979). The comparative commodity prices are shown in tables 2 - 6.

There are some interesting facts which emerge from these tables. The first is that in almost all countries, bushmeat fetched higher prices than domestic animals. This can be attributed partly to production cost, i.e. cost of weapons, hunting outfits processing and, more importantly, to transportation resulting from retail sales which tend to increase prices by as much as 25 - 50% from the producer to ultimate consumer (O'Neil, personal comm.) (Fig. 1). The most important reason why bush meat is more expensive is the fact that the ever-rising demand for this rather diminishing resource, due to high population pressure, inevitably results in the increase of prices. It is important to appreciate that bush meat is highly favoured by West Africans, and the little that reaches the markets is regarded as a delicacy whose price cannot be compared on the basis of weight for weight with domestic animals, but rather on the connotation of a "rare commodity" which is consumed in urban centres by the privileged few. It is right to say, however, that in spite of the high prices, demand for bushmeat is very high.

The second observation that was made was that the species of forest mammals which were listed on Tables 2 - 6 are mostly small mammals, i.e. rodents, duikers and monkeys. Large herbivores such as buffalo, elephants etc. are completely absent from the list. From interviews with hunters and various authorities concerned with the management of wildlife in these countries, it was clear that the species listed below are the productive ones that survived the high hunting pressure of the last two decades or so. Large mammals have been virtually exterminated.

4.3 PRICE FLUCTUATIONS

Various fluctuations in prices of bush meat were identified during the survey. There were price fluctuations within the same market, inter-market price fluctuations and also, seasonal price fluctuations were reported in most places. With the exception of Liberia's "Rally-Time" and "General market at water front" there were neither grades nor standards for selling these products. Thus if ungraded products are traded, buyers often face considerable inconvenience and uncertainty. Although this aspect was identified as a deficiency in bushmeat trade, the prices quoted on Tables 2 - 6 were based on a method whereby an interviewer poses as a genuine buyer, in order to ensure good bargaining. The person who records his findings stands at a distance and it was found that after a compromise on the price of a piece of a given species was reached the piece was weighed. In this way it was thought that the errors and biases that might arise from the ungraded products were minimized.

Finally, it can be concluded from the various studies on the economic importance of bush meat in national economies, inter-commodity price comparisons of bushmeat and domestic animals, that man's dependence on wildlife, especially in West Africa's tropical forest areas, is higher than expected. Also it becomes clear from Tables 2 - 6 that because of the increasing demand for bush meat, the wildlife resource is diminishing and consequently becoming dearer. All these facts point to the need for policy makers and development planners to give priority to wildlife management in order to ensure higher productivity. Once the forest wildlife is exterminated, at least in the near future, there seems hardly any possibility of substituting it with domestic livestock because of the ecological and disease limitations that are inherent in the tropical forest ecosystem.

4.4 ANIMAL PRODUCTS

Except in Nigeria, Ghana and Sierra Leone there was no available information on the utilization of forest animal products and their economic importance. Two separate studies were made in Nigeria, first by the Federal Office of Statistics in 1965/66 Financial Year (reported by Charter 1970) (Table 1) and by the Federal Department of Forestry (1877). The two surveys were made in the tropical rain forest areas of southern Nigeria.

First it is worthy to note that the export figures in the two tables only represent a fraction of the country's total production since a significant portion is used locally and could not be included in the table. Secondly, the figures presented by Charter (1970) and the Federal Department of Forestry (1978) included birds and reptiles whose values were also significant in terms of national economy, but for the purpose of this study, only the figures for terrestial mammals are presented.

Table 1 shows that the products of forest mammals accounted for about ₦ 2.3 million (US$ 3.68 million) in 1965/66. This was during the period before the production of petroleum in Nigeria, and forest animal products alone must have contributed about 1% of the gross national product at that time.

Table 2 shows the result of a similar survey in 1977. Although the result represented a six-month survey, a conservative estimate of the revenue from annual products for the year 1977 could be put at about ₦ 28 256.00.

It is interesting to note that although the two surveys were carried out over the same area, Tables 7 and 8 show that there was a decline in revenue from animal products of about 82% in 11 years. Clearly, this decline cannot be attributed solely to any legislative measures against the export of animal products. In fact at the time of writing this report, there was no national wild animal law or faunal conservation decree operative in Nigeria. It is only reasonable to suggest, therefore, that this drop in revenue was due largely to the declining status of forest mammals.

The export figures of animal products from Ghana and Sierra Leone are shown on Table 9.

Although quantitative information on the monetary value of animal products in West Africa is scarce, the revenue of about US$26 000 and US$7 000 for Ghana and Sierra Leone cannot be regarded as significant to the economies of the countries concerned. In fact, the figures could be much higher than this but a lot of illegal exploitation takes place, and trophies are smuggled out of West Africa, rather than through international airports where they are taxed and recorded.

4.5 ANIMAL PRODUCTS IN TRADITIONAL MEDICINE

Wildlife is known to be an important aspect of the culture of West African tribes. Medicinal uses of a wide variety of forest animal products show the importance of this resource in the evolution of culture in this part of Africa. Although the general impression is that the inhabitants of the tropical forest zone are well advanced in medicinal uses of the flora and fauna of their environment for preventive and curative purposes, and that many species of forest animals are on the verge of extinction for this reason, little research has been conducted in this field.

The method employed by Ajayi (1978) in a study consisted of questionnaires on the uses of a wide variety of game animals in the tropical forests, including reptiles, birds and mammals. It was recognized that West Africans are rather secretive when it involves giving information on ingredients that are used to cure an illness or to perform certain feats in witchcraft (in most cases a native "doctor" will only release this information to the child he loves most within his family). Therefore, children of herbalists and native doctors were carefully selected to carry out the study.

Because of financial constraints, the investigation was restricted to the high forest area of south-western Nigeria in January - July 1978 and October - February 1979. The results on the uses of forest mammals for witchcraft and medicinal purposes are presented in Appendix III.

Table 1

ECONOMIC IMPORTANCE OF FOREST WILDLIFE IN
SOME WEST AFRICAN COUNTRIES

Countries	Cameroon	Nigeria	Benin	Ghana	Ivory Coast	Liberia
% mean annual consumption of wild animal protein	70–80 among rural people in the rain forest south	20 among rural people in the rain forest south	-	73 (for the whole country)	70% southern for the tropical rain forest before hunting was banned in 1974	80–90 for the entire country
Source of information	Allo (1979) personal comm.	Charter, (1970 Ajayi (1970)	-	Asibey (1978)	Asibey (1978)	Woods (1979) (personal comm.)
Human population	7.5 m (1978)	80 m (1973)	-	10.3 m (1974)	6 m (1978)	2 m (1978)

Table 2

Inter commodity comparison of bush meat and domestic animals Ibadan, Nigeria in 1975 (Summary for 4 markets)

Species		Price US$/kg
Hare - *Lepus* sp.	:	7.2
African giant rat - *Cricetomys gambianus*	:	5.0
Grass cutter - *Thryonomys swinderianus*	:	9.6
Tree hyrax - *Dendrohyrax arboreus*	:	6.4
Grey duiker - *Silvicapra grimmia*	:	6.8
Black duiker - *Cephalophus niger*	:	5.2
Bush buck - *Tragelaphus scriptus*	:	5.2
Domestic animals		
Beef	:	4.2
Pork	:	4.4
Mutton	:	2.8

Source: Olawoye & Ajayi, (1975)

Table 3

Inter-commodity price comparison of bushmeat and domestic animals in Sabouang, southern Cameroon, 1978

Species		Price US$/kg
Hare - *Lepus* spp.	:	3.75
Bush-tailed porcupine - *Atherurus africanus*	:	4.375
Duikers - *Cephalophus* spp.	:	2.50
Monkeys - *Cercopithecus* spp.	:	3.75
Baboons - *Papio anubis*	:	2.10
Civets - *Nandinia* spp.	:	1.875
Domestic animals		
Beef	:	2.50
Pork	:	2.00
Mutton	:	3.500

Source: Allo, (personal comm.)

Table 4

Inter-commodity price comparisons of bush meat and domestic animals in Accra, Ghana, in 1970

Species		Price US$/kg
African giant rat - *Cricetomys gambianus*	:	0.51
Grass cutter - *Thryonomys swinderianus*	:	1.06
Brush tailed porcupine - *Atherarus africanus*	:	1.06
Grey duiker - *Sylvicapra grimmia*	:	0.88
Bay duiker - *Cephalophus dorsalis*		0.86
Black duiker - *Cephalophus niger*	:	0.79
Bush buck - *Tragelaphus scriptus*	:	0.66
Green monkey - *Cercopithecus aeothiops*	:	0.79
Domestic animals:		
Beef (cheap cut)	:	0.30
(dearer cut)	:	0.45
Mutton	:	0.61

Sources: Asibey, 1070, 1974.

Table 5

Inter- commodity price comparisons of bushmeat with domestic animals in Abidjan, Ivory Coast, 1978

Species		Price US$/kg
Grass cutter - *Thryonomys swinderianus*	:	10.00
Domestic animals		
Beef	:	3.00
Pork	:	6.00
Mutton	:	3.50

Source : N'Guessan, (personal comm.)

Table 6

Inter- commodity price comparisons of bush meat and domestic animals in Monrovia, Liberia 1979

Species	Price US$/kg		
	Market 1 Rally-Time market	Market 2 General market at water front	Mean
Grass cutter			
Thryonomys swinderianus	—	1.0 (fresh sample)	1.0
Brush-tailed porcupine			
Atherurus africanus	—	2.5 " "	2.5
Grey duiker			
Sylvicapra grimmia	4.0 (dry smoked)	—	4.0
Red Colobus			
Colobus badius	3.0 (soft smoked)	—	3.0
Mangabeys			
Cercocebus spp.	3.0 (dry smoked)		
Spot nose monkey			
Cercopithecus ascenius	—	2.5 (fresh)	2.5
Domestic animals			
Beef			2.5
Pork			2.0
Mutton			4.0

Source : Ajayi (personal survey)

Table 7

Export of wild animal products from Nigeria in 1965/1966 Financial Year

Items	Quantity	Value US$
Live animals	3 005 head	609 084.00
Hides & skins	4 450 kg	3 533 194.00
Fur skins (of carnivores)	760 kg	86 850.00
Other products (horn, ivory etc.)	—	184 200.00
	Total	4 413 328.00

Source : Charter, 1970

Table 8

Export of forest animal by-products (Trophies) from southern Nigeria July - December 1977 (Federal Department of Forestry)

Species	Value US$
Bushbuck: *Tragelaphus scriptus* Duikers: *Cephalophus* spp.	1 814.00
PRIMATES	
Baboons: *Papio anubis*	312.00
PROBOSCIDAE	
Elephant: *Loxodonta africana cyclotis*	18 222.00
CARNIVORA	
Lion: *Panthera leo* Leopard: *Panthera pardus* African Civet: *Vivera civetta*	744.00
Total	21 090.00

Source: Federal Department of Forestry 1977

Table 9

Value of selected products exported from Sierra Leone and Ghana in 1962 and 1965 respectively

	Product	Main Destination	Value US$
Ghana	Zoo animals (including big cats)	Netherlands & U.K.	25 924
Sierra Leone	Monkeys	Netherlands, West Germany and U.S.A.	10 195
	Chimpanzee	U.S.A., Netherlands	7 105

Source: FAO (1967)

5. A COMPARISON OF CARCASS COMPOSITION AND NUTRITIVE VALUE OF WEST AFRICAN FOREST MAMMALS AND SOME DOMESTIC ANIMALS

5.1 CARCASS COMPOSITION

Although wildlife is widely utilized for food all over the world and Chapter 4 shows a considerable dependence of West Africans on wildlife, to date there is little statistical information on their carcass quality and nutritive value as is available for domestic sources of meat. Talbot et al. (1965) have, however, shown that for game meat (elephant, Coke's hartebeeste, wildebeest and zebra) in East Africa, the nutritive value of the protein was at least as high, and the vitamin content much higher than that of beef, mutton or pork from temperate zones. The authors also showed from some studies done on the body composition of wild and domestic ruminants that there are striking differences between wild and domesticated stock. The killing-out percentages were presented as follows: in zebra steers in East Africa 40-60%, wildebeest 50%, topi and Coke's hartebeest 53%, Thomson's gazelle 58%, impala 60%, Grant's gazelle 63%. It was further demonstrated that unlike domestic animals, the killing-out percentage of wild herbivores is relatively constant within each species. They also found that game meat has a lower fat content and relatively higher lean meat all the year round compared with domestic animals.

Apart from Asibey et al. (1975), Tewe & Ajayi (1977), Ajayi $ Tewe (1978), Tewe & Ajayi (1979) there is little published information on the nutritive quality of forest mammals in West Africa. Table 10 compares the percentage dressed carcass values of pig, sheep, cattle, domestic rabbit and some wild rodents (grass cutter and African giant rat). It shows that wild rodents compare favourably in carcass quality with rabbit and other domestic animals. However, it is important to note that this is amongst the only available information on this subject and, therefore, further research is necessary into the carcass composition of West African mammals, before further conclusions can be drawn.

5.2 NUTRITIVE VALUE

Appendix IV compares nutritive value (fat, protein and ash (carbohydrates)) of West African forest mammals with cattle, sheep and pig. In general, domestic animals are lower in protein and carbohydrates than their wild counterparts. For example, the range for carbohydrates is from 1.1% in red river hog to 6.0% in forest genet, whereas the range for domestic animals on similar environment is from 0.8% in pork and beef to 1.3% in mutton. Likewise, the range in protein is from 16.1% in tree hyrax to 55.4% in forest genet. For domestic animals the picture is that of lower values: 11.2% in pork to 19.6% in beef. It can, therefore, be concluded from available data on the proximate compositions of twelve forest mammal species and three domestic animals, that wildlife is superior in terms of protein and carbohydrates. In a separate study, Asibey (1978) also found that the protein content of twelve forest mammals (Table 2) ranged from 21.7 in porcupine to 24.9 in bushbuck and concluded that they compare favourably with domestic animals. However, it is important to note that very little work has so far been done on the mineral content of African forest mammals and virtually nothing on the amino-acid composition of the proteins.

Table 10

Live and carcass weights of some forest and domestic mammals

Animal species	Domestic Rabbit		Cattle	Pig	Sheep	Dwarf Forest Goat	Grass Cutter	African Giant Rat	
Average Live Weight (Kg)	1.569	1.851	643.6	93.9	27.1	15.67	5 872.1	1.033	0.919
Average Dressed Carcass (Kg)	0.792	0.948	249.4	70.2	13.9	7.94	3 746.4	0.534	0.474
Average Killing-out (%)	50.0	51.4	38.8	74.8	49.3	50.59	63.8	51.5	51.6

Table 11

Protein content of some forest mammals in Ghana (Asibey 1978)

Species	Protein content %
Brushtailed porcupine Atherurus africanus	21.7
Grass cutter Thryonomys swinderianus	22.7
African giant rat Cricetomys gambianus	22.45
Bay duiker Cephalophus dorsalis	24.1
Black duiker Cephalophus niger	23.9
Maxwell's duiker Cephalophus maxwelli	21.8
Bushbuck Tragelaphus scriptus	24.9
Palar civet Nandinia binotata	22.8
Civet cat Vivera civetta	23.2
Spot nosed monkey Cercoptheous petaurista	24.3
Mona monkey Cercopitheous mona	24.5
Colobus monkey Colobus polykomos	24.0

6. WILDLIFE AND FOREST ECOSYSTEMS: STATE OF KNOWLEDGE ON ABUNDANCE AND TRENDS

6.1 ABUNDANCE AND TREND OF FOREST MAMMALS

Although fragmented information exists for the various species utilized for food and animal products, and their economic importance, it was observed that in all the six countries visited, none has a record of status and trend of animal populations in tropical forest Game Reserves. Consequently, nobody knows what remains of forest mammals in West Africa. However, figure 2 shows forest National Parks and equivalent reserves in some West African countries.

It is thus impossible to state precisely here what the population trends are since there is no record of any census figures anywhere.

However, the following indices which arose from different aspects of this study give a strong indication of trend:

(a) Milligan and Ajayi (1978) have compared the population densities of 16 herbivores in 11 National Parks located in savanna regions in 7 West and Central African countries. The biomass densities indicate a considerable range from 214 kg/km^2 to 4 032 kg/km^2. Using rainfall data for these areas to estimate primary production and potential carrying capacity (Coe et al. 1976 and Leeuw 1977) indicates that the present biomass density levels of the West and Central African National Parks are well below the potential of their habitats. In most cases, present biomass densities are only 10% of the potential carrying capacities. The authors attributed the low biomass to over-hunting and lack of enforcement of game laws.

(b) The second indication used is the available export figures for forest mammals and by-products from southern Nigeria in 1965/1966 financial year and 1976/1977. There was a decline of about 80% in revenue (Table 7) which cannot be attributed to legislative control (because none exists) but to the rapid decline in the resource itself.

(c) The third indication is from the Wildlife and National Park Legislation of the countries visited. Animals were usually classified into three schedules according to the OAU Wildlife Algiers Convention of 1968. In accordance with the convention provision should be made under national legislations for lists of animals which are endangered and are, therefore, to be strictly protected (schedule I), and of animals which are partially protected (schedule II) i.e. animals which can only be hunted for exceptional reasons. Schedule III includes unprotected animals which can be hunted under licence.

Although some of the legislationscurrently used are old, it is important to note the rather staggering list of species which are endangered today and are not strictly protected by law at present. Because legislations are old, and since no surveys have been conducted to determine the status of listed species, it seems reasonable to combine schedules I and II for each country and treat this as a current list of endangered forest mammals in West Africa (Appendix V).

Even under the present classification, important species from the point of view of food and products are in danger of extinction. In Liberia, Ghana, and Nigeria, practically all primates are endangered. Likewise, forest antelopes such as the bushbuck and duikers, which are highly productive, are so intensively exploited that they are placed in schedule I of many countries. The big carnivores (leopard, and lion) whose skins are highly priced in the export market are also facing extinction in West Africa.

(d) Apart from the declining volume of trade in bushmeat in markets, recent market surveys in Nigeria (Olawoye and Ajayi, 1975, Ajayi, 1979) indicate that only species which are highly productive and are, therefore, difficult to hunt out - such as the rodents (giant rat Cricetomys gambianus and grass cutter Thryonomys swinderianus form the bulk of the bushmeat trade.

Except for Liberia, antelopes and monkeys are rarely sold because they are seriously depleted outside game reserves.

The foregoing account provides an indication of the decline in the status of forest mammals in West Africa. This decline could be attributed to over-hunting which is a direct result of higher demand for bushmeat - a phenomenon which is a natural accompaniment of the rising human population.

It is important, however, to point out certain anomalies in the wildlife legislations of the countries cited in Appendix V:

(i) First, in Cameroon, Ghana and Ivory Coast, the legislations are old and need to be updated. Ghana's legislation, for example, was the Wild Animal Preservation Act of 1961. However, discussions with the Chief Game and Wildlife Officer this years show that practically all forest primates are in danger of extinction in that country and that this should be reflected in the legislation. In Nigeria, no national legislation is yet operative.

The lists of animals given in Appendix V were derived from new draft legislations which are undergoing legal processing in both countries.

(ii) Certain categories of animals, notably, the large carnivores such as leopard and lion, and elephant are not adequately protected by law in certain countries. Indeed, Liberia and Ivory Coast made no provision for the protection of lion and leopard, species which are said to be in eminent danger of extinction in both countries. Although elephant is to be listed as a protected animal for Nigeria, the draft law only makes provision for the protection of immature animals. It is logical to protect the productive older age groups as well as immature elephants, if the objective is to save this species from extermination.

(iii) Thirdly, Ivory Coast has banned hunting since 20 February, 1974 and, therefore, theoretically, all forest species are under legal protection. However, it was understood that in practice this type of legislative measure could not be enforced as illegal hunting continues in most places.

However, these anomalies notwithstanding, Appendix I provides a clear indication of forest mammals that are in danger of extinction in West Africa; This list of animals would probably expand if the legislations on which it is based were updated, on the basis of status surveys.

6.2 UTILIZATION OF TROPICAL FORESTS AND THE FUTURE OF WILDLIFE

Wildlife is an important component of the forest ecosystem and is dependent on the vegetation in order to thrive. Hence, it would not be adequate to consider the status and trend of tropical forest mammals without giving some consideration to their habitats.

Until the beginning of this century, tropical forest wildlife was reasonably undisturbed and was considered to be in balance with traditional human activities, mainly shifting cultivation and hunting with primitive tools such as snares, traps and flint guns (Asibey, 1976). Towards the end of the last century, and more pronounced during the first decade of this century, plantation agriculture, particularly for cocoa, oil palm and rubber was introduced to West Africa. This marked the beginning of large-scale utilization and modification of tropical forest ecosystems. From that period onwards timber extraction for export market has gradually grown to a point that it constitutes a threat to the existence of tropical forests. It is pertinent to note here that the major factor which is responsible for the degradation of the tropical forest is economic, since rubber, cocoa and oil palm have been, and will continue to be important foreign exchange earners for many countries in West Africa. Unfortunately there was no early recognition of fauna conservation as a form of land use. When at some later stage steps were taken to set aside certain areas as game reserves, those early game reserves were not properly managed. Consequently, with the increasing population pressure and the high demand for meat, combined with drastic modification of the forest ecosystem, for agriculture, wildlife was greatly reduced.

The forest ecosystem is complex (Ajayi, 1978) thus making room for many niches and hence a much higher diversity of highly specialized animals than in savanna grassland. What this means is that the specialized nature of some forest animals does not enable them to survive once the primary forest is drastically modified or destroyed. For example, the gorilla, chimpanzee, and the bongo, to cite a few, can hardly survive in secondary forests. Asibey (1976) made a study of the food habits of Red Colobus monkey and found that 51 items of its diet come from economic trees of primary forests. He concluded that Red Colobus have been restricted to undisturbed forest areas for this reason. Once the remaining forest habitat is modified, the Red Colobus will be in danger of extinction in Ghana.

The following is an account of the status and trend of tropical rain forests in some West African countries. Table 12 gives a summary of estimates of the total area covered by tropical rain forests, and those set aside as forest reserves (Persson, 1974).

Starting from Cameroon, the whole southern part is covered by tropical rain forest, a total of 17.5 million hectares. Out of this, approximately 100 000 ha is mangrove forest. There was no information available on the area set aside as forest reserves.

Out of the estimated 31 million hectares of forest land in Nigeria, 7 million hectares is utilized for shifting agriculture and 1.9 - 3.9 million hectares are forest reserves. About 50% of the exploited commercial timber comes from unreserved forests, and another 50% from forest reserves, of course, with concession rights for exploitation.

At most, there are approximately 0.25 million hectares in the Republic of Benin, (2% of the country's total land area), but no information was available on the rate of exploitation.

Out of the 8 million hectares of tropical rain forest in Ghana, 1.8 million hectares have been legally constituted forest reserves. From the areas of unreserved tropical forests, about 50 000 ha disappears every year. About 50% of timber exploited comes from forests outside forest reserves. It is, however, interesting to note that out of 8 million hectares of Ghana's tropical forest, only 0.6% has been committed to wildlife conservation (Asibey, 1976).

In the Ivory Coast, about 16 million hectares of tropical forest land existed out of which 3 million heactares disappeared between 1956 and 1966. This degradation according to Persson (1974) continues unabated, and may lead to a serious depletion of high forests in a few years' time.

At present, 2.5 million hectares of closed high forests exist in Liberia out of which 1.6 is declared forest reserve, but up to date, no National Parks or Game Reserves exist.

The foregoing account of the extent and trend of West African tropical forests habitat forecasts a bleak future for the wildlife. Some urgent action is needed to arrest the rate of modification of the tropical forests; if not, it will have serious repercussions for primary forest wildlife species in this part of Africa.

Table 12

Areas of tropical rain forests in some West African countries

Country	Area of forest left (million hectares)	Forests classified reserved areas (million hectares)
Cameroon	17.5	-
Nigeria	31.0	1.9
Benin	2.1	-
Ghana	8.0	1.8
Ivory Coast	16.0	-
Liberia	2.5	1.6

7. SOME MANAGEMENT PROPOSALS

7.1 MANAGEMENT OF WILDLIFE ON FARMLANDS

The agricultural system of shifting cultivation, which has been practised for centuries in most of the tropics, (King, 1968) is still prevalent in West Africa. Under this system, the forest is cleared and food crops are planted.

The secondary re-growth, together with food crops, provide a good habitat for certain wildlife species such as rodents and game birds. These animals are often hunted by farmers and provide a steady source of animal protein. Even though the "small game" on farmlands have long been recognized as a source of food, apart from Hartog and de Vos (1973), who suggested a better harvesting technique for African rodents, they have hitherto often been regarded merely as "pests" that should be eliminated. There have been no suggestions as to how wildlife could be managed on farmlands to maximize production, while at the same time ensuring minimum of damage to crops.

During the study tour the impression gathered everywhere was that farmland animals provide a significant portion of animal protein for farmers and others in rural areas, and their active mangement may well provide a complementary element to the present management practices.

The suggestion to promote wildlife management on farmlands is a new concept to West Africa, which like Agro-Forestry, is a suggestion which could easily be discredited if it is not backed by intensive research findings, and careful but flexible planning.

Research proposals for this system are itemised in Chapter 8.

These and many other questions remain to be answered before such a management practice can be introduced extensively. However, this appears to be a vast, but potentially rewarding field of research, and could be attractive to researchers and planners alike.

The results of this practice may well revolutionize animal production in tropical forests.

7.2 POSSIBILITIES FOR INTRODUCTION AND RE-INTRODUCTION OF SPECIES

"Introduction" is here defined as an intentional movement of an animal or plant from its biogeographic zone to an area where an ecological niche exists for the species but where the species has never been known to thrive before. "Re-introduction", on the other hand, applies to movement of animals from one to a similar biogeographic zone, which formed part of their former range.

Since the foregoing account of the status and trend of forest mammals in Africa shows clearly that a large number of species are in danger of local extinction, it will not be out of place to consider here the ecological implication of extermination of these species, and the possibility of introducing and or re-introducing certain species.

Re-introduction

Extermination of certain species can and has led to undesirable ecological unbalance in some parts of the world, as follows:

First of all extermination means the complete loss of an animal species along with its existing or potential economic resource and cultural values.

A complete loss of a species may affect other species, thus disturbing the equilibrium of the ecosystem. Jungius (unpublished m.s.) cited an example of extermination of roe deer and red deer in their Abruzzo range in Italy which led the natural predators, wolves and bears to prey more heavily on domestic stock and Abruzzo chamois - which is now an endangered species.

It is therefore, desirable to re-introduce a species where it has been exterminated before, since its rehabilitation to its original habitat may not tend to re-establish the original composition of the ecosystem but to strengthen its stability. However, one ecological implication of re-introduction must be critically examined. Species extinct from certain areas may not be successfully established if re-introduced, because human activities might have modified the original habitat to such an extent that "new" niches have been created; an example is artificial afforestation using exotic tree species in many parts of West Africa. This is perhaps the crossroad between re-introduction and introduction. This is because the new niches created cannot be allowed to exist "vacant" indefinitely if the niches are similar to those in other habitats elsewhere. On this basis, the principle of introduction is considered in some quarters to be scientifically justifiable.

However, it must be remembered that there have been many introductions, especially early in the century and some have been successful while some were not.

The following are some ecological implications of introduction:

(a) Introduced species could cause ecological unbalance and displacement of native species whose requirements overlap with the newcomer. For example, red deer introduced into Chile and Argentina were reported to be competing with the hoemul and pudn for food and space, thus forcing native species to less attractive habitats (Jungius unpublished). Sika deer introduced from Japan to Germany are competing with red deer and fallow deer (Jungius unpublished).

(b) Introduction could lead to population explosion and habitat destruction, e.g. red deer introduced into New Zealand lacked natural control mechanisms and insufficient management resulted in population explosion and habitat damage.

(c) Child (1978) also stressed the veterinary implications of introducing new species since it is also possible to import their diseases with them. Diseases from introduced species might have a devastating effect on the native fauna since the latter have not been previously exposed to these diseases and, therefore, have not built up a natural immunity against them.

The above outlines general environmental implications of the conduct of re-introducing or introducing new species to West African tropical forests. However, since re-introduction is less controversial and appears to be feasible in West Africa, future consideration in this regard must take into account some practical pre-requisite to this exercise, according to Child (1978).

(a) A feasibility study:

(i) to collect data on the ecology and behaviour of the species

(ii) a determination of the reason for its extermination

(iii) a survey of the proposed re-introduction site to ensure that it would meet the ecological requirements of the species to be re-introduced

(iv) to be certain that the reasons for the species extermination have been removed.

(b) A provision of adequate protection and management for the re-introduction area. This should include veterinary supervision of the areas.

(c) Prior to release, animals must be held temporarily in the re-introduction areas in order that they might be acclimatized, and also to enable them to establish social groupings - in the case of gregarious species, that would enhance successful breeding when they are released.

(d) Since it is necessary to follow up the performance of the animals in the re-introduced area, it is important to mark them or fit individuals with radio-collars to enable them to be re-located.

(e) Stocks from overseas must be examined to ensure that they are clear of diseases.

In conclusion, the concept of introduction or re-introduction of species should not be rejected as a management tool for re-establishing the fauna of West African tropical forests.

It is important, however, to know the ecological implications of this concept, and to follow the general guidelines stated above in order to avoid ecological disasters which have rendered some similar programmes unsuccessful in the past.

8. STATE OF KNOWLEDGE ON TROPICAL FOREST MAMMALS, AND PRIORITIES FOR RESEARCH

8.1 RECENT AND ONGOING RESEARCH PROJECTS

In order to identify gaps in knowledge on the management and utilization of forest mammals a survey of past and ongoing research projects in this field were compiled for the six countries visited in West Africa (Appendix VI). Appendix VI also includes the aims and objectives of each project. Apart from the study of the biology of small mammals of economic importance such as the African giant rat, grass cutter, and bats, and some isolated surveys on bush meat marketing, other aspects of wildlife utilization seem to be neglected. On the basis of the current research projects gaps were identified and future research priorities and recommendations for the management and utilization of forest mammals were made.

8.2 PRIORITIES FOR RESEARCH

(a) Through the course of study on the utilization of forest wildlife for food and animal products, by literature surveys, in consultation with appropriate officers of the forestry departments and also reviewing recent research projects on this subject, it became evident that there was a conspicuous lack of quantitative information on the value of wildlife in the socio-economy of West African countries.

In the case of planning for the development, where wildlife has to compete with other sectors of the economy for funds, the importance of quantitative information on the economic importance of wildlife cannot be over-emphasized. Therefore, it is suggested that surveys be carried out, using the following guidelines in order to avoid biases and errors that may eventually render the final product worthless: the survey should be based on questionnaires which should have the following components (Appendix VII shows such a typical questionnaire):

(i) General information on the individuals: name, village, sex, age, income, size of family and whether or not hunting is a major occupation of the respondent.

(ii) Production and processing: pattern of hunting, etc.

(iii) Preservation and transportation.

(iv) Mode of processing.

(v) End use of the kill.

(vi) Marketing.

The following sampling techniques are considered appropriate both for rural and urban areas of the country to be surveyed. In order to have an appraisal of bush meat production and marketing, and to be able to trace bush meat from the producer to the ultimate consumer, such a survey should be conducted as follows:

Both rural and urban areas should be covered. There should also be a household survey and the sampling method should be "1 in K" type of sampling. By "1 in K" type of sampling, it is meant that the survey should be random in nature, with only one "household" to be interviewed out of every given number, say one out of every 10 or 20 or 50 depending on the size of village or town to be sampled. This method of course will have as a pre-requisite a knowledge of the lists of houses in a sample area.

The "1 in K" type of sampling method implies that if one out of every 10 households were to be sampled, the selection of the first house is critical to the rest, i.e. if you mix the addresses of the first 10 houses and choose one at random and that one happens to be number 1, the next must be number 11, 21, 31 and so on. If it is number 6, the others must be 16, 26, 36 and so on.

This will ensure random sampling and avoid bias.

It is again necessary to define the word "household" in a survey exercise such as this, because in African tradition there may be more than one family occupying the same house, and even in urban areas where many families occupy a block of flats which constitute a "house" the need for such a definition is more necessary. For convenience sake, therefore, the term "household" is taken to mean those eating from the same pot. The head of the "household" is usually the one to be interviewed. Such a survey would eliminate biases and errors as far as possible and the particular samples or respondents depending on the information sought, can be classified into different categories subject by subject or on the basis of the general information given.

(b) With the exception of Ivory Coast, there is no country in West Africa which has information on animal population and habitat monitoring.

It is suggested that these studies should be accorded priority since no effective development plan can take place without a knowledge of what remains of the wildlife, their trends and interactions.

(c) Everywhere in West Africa, wildlife are widely regarded as pests on farmlands to agricultural crops.

From available information these animals are the main sources of animal protein to the farmers in rural areas, and the main source of cash to hunters. Hunting farmland animals is also regarded as a means of sport in Ghana and Cameroon. The species concerned such as the grass cutters, bush fowl, giant rats, squirrels, fruit bats, etc. are prolific and are adaptable to the presently modified tropical forests. It is desirable to adopt a realistic approach to the management of farmland wildlife and examine how to harmonize the management of these animals and food crops in agriculture, rather than regard the wildlife purely as pests to be exterminated. It is important to study the methods of management of grass cutters, bush fowl, squirrels and giant rats, on cassava, rice, and maize farms so that man can begin to crop plants and animals on the same land, thus putting the forest lands on a more intensive use - a system which would be similar to the present practice of agro-forestry and should be integrated with it. It is even possible to crop, on a rational basis some other forest animals such as fruit bats, which are currently utilized for food but at present are regarded as a nuisance in forest areas. However, in order to embark on such a scheme, it would be necessary to have information on their productivity, behaviour and patterns of movement and migration, and their effects on forest trees.

In order to be able to harmonize the management of wildlife with agricultural crops, the following investigations should be made:

(i) The kind and extent of damage done by a wildlife species to a particular crop, and the period of the year this damage is done.

(ii) At what stage of development of that crop is this damage done?

(iii) At what stage can the damage by considered economically intolerable?

(iv) What is the reproductive cycle, and reproductive performance of the animal species concerned?

(v) Is there any correlation between population growth and reproductive cycle and intensity of damage?

(vi) From the knowledge of fecundity, mortality pattern, sex ratio and age structure of animals, what is the percentage of animals for each sex and per age group that can be cropped in order to reduce the population to a level in which the damage it does to crop is minimized to a level, in which the protein cropped from the farm can be regarded as a more profitable economic proposition and supplementation in land use?

(vii) What is the optimum rotational and seasonal cropping scheme that could be evolved for efficient wildlife cropping, that would ensure a sustained yield of animal protein?

(d) Modern legislation that would ensure efficient utilization of forest wildlife is mostly lacking in West Africa. Under the present exploitive practices in Liberia and Nigeria, where there is virtually no legislation restraint to the exploitation of wildlife, forest wildlife may well have little chance of survival.

Modern legislation for each country that would be based on the inventory of species and a sound knowledge of population trends, especially those of economic importance, their relative abundance, and population trends that would allow categorization of forest fauna into which species are threatened and should be prohibited in terms of exploitation, which are less rare and could be partially protected and exploited on exceptional grounds, and common species which could be hunted. Also, such legislation must prohibit export of animals from West Africa for zoos and trade in certain wildlife products such as ivory, hides and skins etc. In this regard the use of wildlife in forest national parks especially in Ivory Coast for tourism, whereby animals are specially protected for the sole enjoyment of tourists, again underlines the importance of the need to develop forest wildlife as a source of protein to the people also. The principle of "thou shall not touch" and "allow nature to regulate itself" as a policy for the management of parks and equivalent reserves is in many situations valid. In buffer zones and utilization areas requirements in terms of management for animal protein production are widely different. Secondly, it is well known that most species of animals can withstand a certain amount of "culling" per year, and advantage can be taken of this to "take off" this percentage, with modern management practices that are now available, to ensure a sustained yield. Hence it is possible that utilization of forest wildlife can be conducted simultaneously for game viewing and game cropping if a careful ecologically based management plan is made for appropriate game reserves. An obvious advantage of this practice, apart from providing valuable animal protein to rural people, is that it could reduce illegal hunting, since local hunters would participate in game cropping.

(e) The highly specialized and peculiar nature of some forest animals have made it impossible for them to survive outside their habitats, especially where tropical forests have been modified by man. Thus, a large number of primates, e.g. gorilla, colobus, artiodactyles such as the bongo and yellow backed duikers, are on the verge of extinction in West Africa. Rehabilitation of these and other species depends on detailed knowledge of their habitat requirements and the degree of their specialization, a knowledge of their general biology, food habits, reproductive performance etc.

(f) An area of wildlife utilization, which has hitherto not been recognized as of great importance to the inhabitants of the forest regions of West Africa and which has contributed in no small way to the declining trend of forest wildlife, is the use of forest animals and their products for medicinal purposes. This is an area where more information is required on authentic uses of wildlife in curative medicine and in which cases animals can be put to more efficient use and which areas of utilization of wildlife for medicinal purposes are merely destructive and should be discouraged.

(g) There is still a big gap in our knowledge of the nutrient quality of bush meat in West Africa. Apart from Asibey & Eyeson (1975) Tewe & Ajayi (1977) and Ajayi & Tewe (1978), there are virtually no publications on this topic. These articles merely give the live and carcass weight proximate compositions (crude, fibre, protein and fat) of some species of mammals. First, there are several forest species which are of importance as food items which the above studies did not cover. Secondly, more detailed studies are necessary into their mineral composition, the nature of their fatty acids, and the amino-acid composition of the proteins.

Already there are statements, based on hard facts, that East African wild ungulates contain more lean meat than their domestic counterparts. There are also claims that wildlife in general contains less saturated fatty acids than their domestic counterparts (saturated fatty acids are known to be inimical to good health). But these claims have not been well substantiated in West Africa. Detailed studies on the mineral components of the edible portion of forest wildlife are also desirable, since this would enhance a more comprehensive comparison with domestic animals - for which there is existing information on this subject.

(h) West Africa's wildlife populations are low, especially in high forest regions. Therefore, a wildlife policy solely based on tourism is unrealistic and weak. They live in dense vegetation where visibility is poor. Unadventurous tourists are discouraged by poor visibility and "modern" tourists who want comfortable pleasure do not want to spend extra efforts looking for animals in a dense tropical rain forest. Therefore, the multiple use of wildlife for meat and tourism could provide a dual advantage. A policy based on multiple use of forest wildlife for food and tourism would seem to be a more appropriate step.

9. SUMMARY AND RECOMMENDATIONS

The study on utilization of forest mammals and their by-products in West Africa has shown that practically all species are utilized for food, and a wide variety for ornamental, medicinal and scientific purposes. It also shows that forest mammals have contributed in no small way to the development of zoos all over the world. The present document reveals that both primitive and modern tools are employed side by side to exploit forest mammals. The various methods of exploitation which were examined show that commercial community hunting was indiscriminate in nature, most wasteful and should be discouraged. The method of preserving bush meat by dry-smoking, if done in an hygenic way, is perhaps the most practical and inexpensive method of getting bush meat from rural to urban areas and to the ultimate consumers. Salting as an alternative method is considered too expensive for the ordinary man to afford, and sun-drying to make biltong is not as effective as smoking because meat subjected to this method of preservation decomposes too quickly in the humid tropical environment.

Various studies on the economic importance of bush meat and animal products reveal rather impressive quantitative information that shows how heavily West African countries are dependent on wildlife. It shows that wildlife constitutes as much as 20 - 90% of the animal protein in the 6 countries visited, and a comparison of intercommodity prices shows that generally bush meat fetches higher prices than domestic animals. Thus, information contained in this document on this subject could help policy makers and planners to re-focus their attention on the management of this resource, since it is difficult to substitute domestic sources of animal protein with wildlife in a tropical forest environment, because of the various environmental hazards discussed.

At present, there is little information on the nutritive value of forest mammals that would allow for a comprehensive comparison with that of domestic animals. This is a field of research on which nutritionists and biochemists could usefully focus their attention, in order to provide the much needed information on protein quality, mineral and amino acid contents of bush meat, as this information is already available for pork, beef and mutton.

However, existing information so far shows that wild animals compare favourably with their domestic counterparts in meat quality, and are even superior in terms of protein and carbohydrate contents.

Although there is no on-going population monitoring programme for tropical forest mammals in this part of Africa, the indices of decrease in trade figures, ratio of animal biomass and the potential carrying capacity of wildlife habitats, and the long list of endangered species as contained in the wildlife legislations of several countries, give a strong indication of a rather sharp and accelerating downward trend of tropical forest wildlife from the beginning of this century. Likewise, recent information on the extent, mode and rate of modification of tropical forest vegetation shows that wildlife habitats are being drastically modified and degraded at such a rapid rate, that if nothing is done quickly to arrest the situation, tropical forest wildlife has very little chance of survival in West Africa.

An examination of West African fauna and agricultural practices shows that wildlife, notably rodents, could possibly be managed effectively with agricultural crops. West African rodents, such as grass cutters and the African giant rats which are highly productive and

and well favoured as sources of meat, have often hitherto been regarded as pests to various farm crops. However, they could probably be managed in such a way that wildlife and farm crops could be harvested economically from the same land. Also, the various forest plantations of both indigenous and exotic tree species could well provide valuable niches for re-introduced, or, in exceptional circumstances, possibly, introduced species of wildlife, and if both are managed together, could constitute a new approach to the conservation of forest wildlife and may thus lead to increased production of animal protein. These proposals are areas for future research. It must be pointed out, however, that apart from the research pre-requisites, the management of agriculture with rodents, like the taungya system, is a sensitive issue which could be easily discredited if not backed by careful and rather flexible planning and execution.

It was the view of the consultant that relatively little area of tropical forests in West Africa has been set aside for conservation of wildlife (Fig. 2) and that the forest zone,generally, does not receive much attention by the wildlife services. It is, therefore, suggested that greater emphasis be placed on the management and utilization of forest wildlife for food by West African governments.

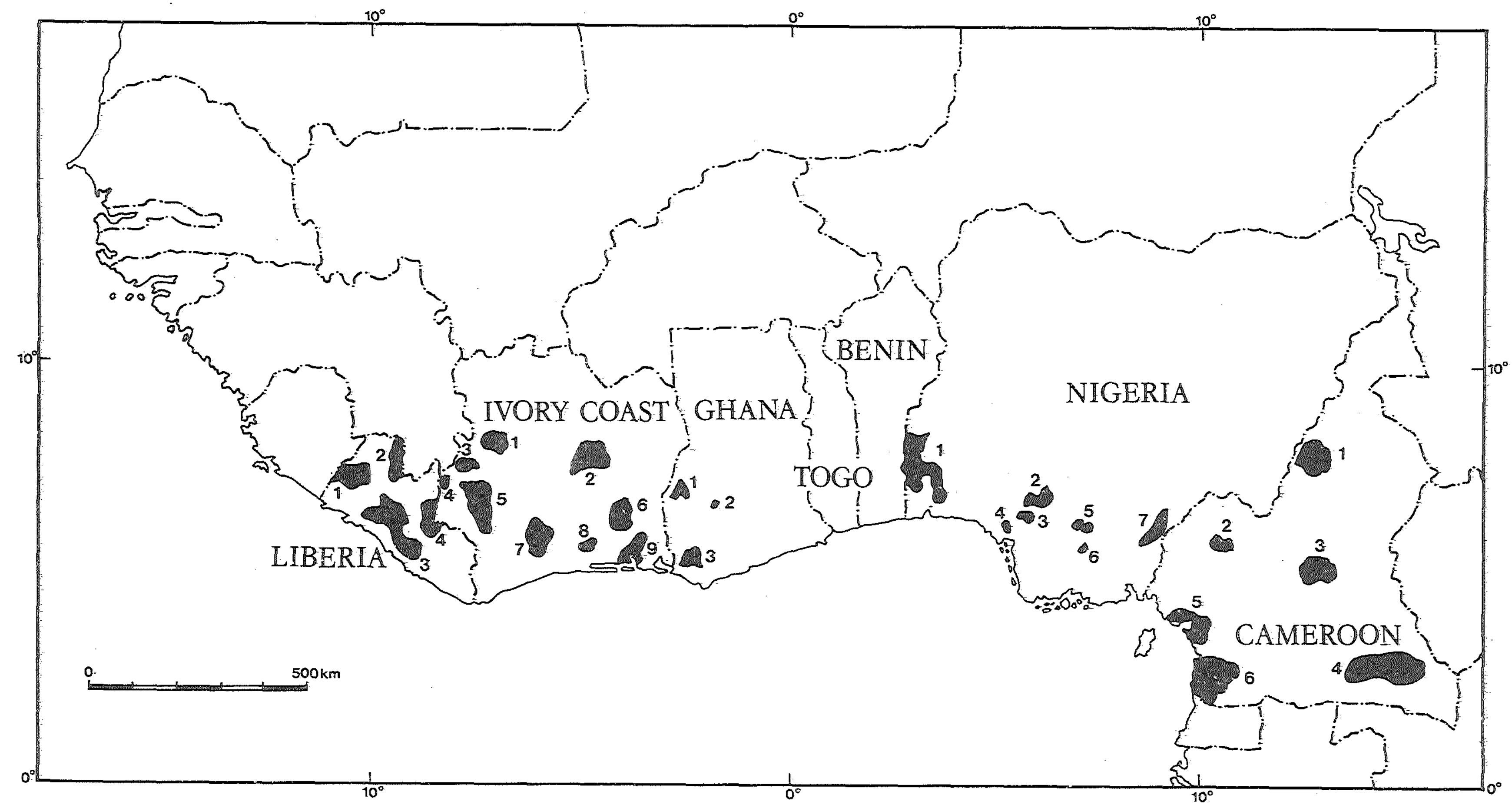
It also appeared that wildlife utilization is not sufficiently emphasized in the curricula of the Colleges of African Wildlife Management at Mweka (Tanzania) and Garoua (Cameroon),i.e. the two institutions which have so far produced the middle-level technical manpower for Africa. This is considered to be an important shortcoming and it is suggested that the concept of wildlife utilization in its widest sense, with emphasis on food and tourism, be introduced into the curricula of all institutions which deal with manpower development for wildlife management at all levels for the African region.

Wildlife legislation in several West African countries has many inadequacies. Most laws are very old and need revision. Some legislations, as pointed out in the text, contain several anomalies and do not give adequate protection to species of economic importance, which are now in danger of local extinction. In this connection, it is relevant to point out that the conservation method whereby the Government of Ivory Coast banned hunting since 20 February, 1974 is considered impractical and a negative approach to wildlife management.

A recent tour in Ivory Coast showed that illegal hunting continued unabated, especially in the tropical forest zone where wildlife is the main source of animal protein. A more positive approach would be to strengthen wildlife management services in terms of personnel, equipment, transport and other facilities and to give wildlife divisions a certain amount of autonomy, to enable them to cut through red tape - a phenomenon which has handicapped situations that require urgent attention. Education of citizens on the value of wildlife management is of course an essential tool in wildlife management, because no government project can succeed without the goodwill of the people. It is also important that local people,i.e. those that live closest to national parks and equivalent reserves,be involved actively in the running of these conservation areas.

This could provide employment opportunities especially for the unskilled section of the rural population. It must be remembered that most of the existing game reserves in West Africa were once traditional hunting grounds of the local inhabitants. If any government were to reserve such lands by law, it is only realistic to involve their participation and also give them part of the benefits that accrue from the utilization of wildlife resources.

Fig. 2 - TROPICAL FOREST NATIONAL PARKS AND EQUIVALENT RESERVES IN WEST AFRICA



LIBERIA

1. Gola, Kpelle and Belle Forests
2. G10, GB1 Forests
3. Khran - Bassa, Sapo Forests
4. Grebo Forest

IVORY COAST

1. Parc National du Sangbe
2. Parc National de Marahoue
3. Parc National de Mt. Peko
4. Parc National de Nimba
5. Parc National de Tai
6. Parc National de Diro
7. Parc National de Okromodou
8. Parc National de Sarama
9. Parc National Banco

GHANA

1. Bia Game Reserve
2. Kogye Game Reserve
3. Nini Suhien Game Reserve

NIGERIA

1. Opara/Upper Ogun Game Reserve
2. Ohosu
3. Okomu
4. Ologbo
5. Iri - Ada - Obi/Ologbolo - Emu - Urho Game Reserves
6. Orle River Game Reserve
7. Obudu Game Reserve

CAMEROON

1. Reserve du Faro
2. Kimbi River Reserve
3. Banga - Djerem Reserve
4. Reserve du Djo
5. Donala - Ehea Game Reserve
6. Reserve de Compo

Lastly, since wildlife is such an important source of food and since it is not easy to substitute it in the forest zone with domestic animals, at least in the foreseeable future, any wildlife policy of West African Governments that does not include <u>wildlife utilization for food</u> as its cardinal point is considered unrealistic and weak. The problem of shortage of meat is more acute in West than East Africa, and a policy of wildlife development for tourism should not be allowed to take priority over its management for food.

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APPENDIX I

GENERAL QUESTIONNAIRE FOR THE COUNTRIES VISITED

1. (a) What forest mammals are the main sources of animal protein ?

1. ________________ 5. ________________ 9. ________________
2. ________________ 6. ________________ 10. ________________
3. ________________ 7. ________________ 11. ________________
4. ________________ 8. ________________ 12. ________________

Utilized for by-products:

1. ________________ 6. ________________ 11. ________________
2. ________________ 7. ________________ 12. ________________
3. ________________ 8. ________________ 13. ________________
4. ________________ 9. ________________ 14. ________________
5. ________________ 10. ________________ 15. ________________

What are the by-products used for ?

1. ________________ 6. ________________ 11. ________________
2. ________________ 7. ________________ 12. ________________
3. ________________ 8. ________________ 13. ________________
4. ________________ 9. ________________ 14. ________________
5. ________________ 10. ________________ 15. ________________

2. What are the patterns of production of bushmeat in forest areas of your country?

(a) What are the production units:

i) On individual basis? Any variations in relation to tribes or ethnic groups?

ii) On family basis?

iii) On tribal basis?

3. Methods of exploitation

(a) By snares

For what species of animals?

(b) By Dane guns

For what species of animals?

(c) By modern weapons e.g. rifles

For what species of animals?

4. (a) Price range of bushmeat

Species	Price/kg (US$ equivalent)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

4. (b) Price range of typical forest domestic livestock mammals.

Species	Price/kg (US$ equivalent)
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

5. How is the bushmeat distributed from the production areas. (Rural areas)?

6. What is the value of bushmeat in the economies of rural forest communities?

7. What is the Gross Domestic Product of your country, and what proportion of this comes from utilization of forest mammals and their by-products?

8. (a) What are the Game Reserves/National Parks situated in forest areas in your country?

Game Reserve/National Park	Main wildlife species	Population
a.		
b.		
c.		
d.		
e.		
f.		
g.		
h.		
i.		

(b) What is the trend and status of the main forest species from the past decade or till present?

9. Is there any existing programme of integrated use of wildlife with forestry, wildlife with (agriculture) crop farming?

APPENDIX II

FOREST MAMMALS COMMONLY UTILIZED IN WEST AFRICA

ORDER	FAMILY	SPECIES	COUNTRIES IN WHICH THEY ARE UTILIZED					
			CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
Rodentia	Sciuridae	Tree Squirrels:						
		Protoxerus stangeri	x	x		x	x	x
		Epixerus ebii	x	x		x	x	x
		Funisciurus spp.	x	x		x	x	x
		Ground Squirrels:						
		Striped ground squirrel *Xerus erythropus*	x	x		x	x	x
		Xerus inauris	x	x		x	x	x
		Xerus brinceps	x	x		x	x	x
	Cricetidae	The African giant rat *Cricetomys gambianus*	x	x	x		x	x
	Thryonomidae	Grass cutter *Thryonomys swinderianus*	x	x	x	x	x	x
	Hystricidae	Porcupines *Hystrix* spp.	x	x	x	x	x	x
Pholidota	Manidae	Pangolins or scaly anteaters *Manis (Smutsia) gigantea*	x	x		x	x	x
Primates	Lorsidae	Bosman's potto *Perodictiticus potto*					x	x
		Golden potto *Arcotolebus calabarensis*						

ORDER	FAMILY	SPECIES	CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
			COUNTRIES IN WHICH THEY ARE UTILIZED					
		Allen's galago *Galago alleni*						
		Dwarf galago Galagoides demidovi						
	Cercopithecidae	Monkeys:						
		Papio mandrillus				x		x
		Forest baboons:						
		Mandrill Drill *Papio* (*Mandrillus*) *leucophaeus*	x					
		Mangabeys:						
		White collared mangabey *Cercocebus torquatus*	x				x	x
		Crested mangabey, black mangabey						
		Cercocebus galeritus						x
		Cercocebus aterrimus						x
		Guenous or Cercopithecid monkeys:						
		Allen Monkey *Allenopithecus nigroviridis*						
		Talapoin *Miopithecus talapoin*						
		Moustached monkey *Cercopithecus cephus*			x			
		Red bellied monkey *Cercopithecus erythrogaster*					x	

ORDER	FAMILY	SPECIES	COUNTRIES IN WHICH THEY ARE UTILIZED					
			CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
		Black-checked white-nosed monkey <u>Cercopithecus ascenius</u>			x			
		Lesser white-nosed monkey <u>Cercopithecus petaurista</u>			x		x	x
		Greater white-nosed monkey <u>Cercopithecus nictitans</u>			x		x	x
		Blue monkey <u>Carcopithecus mitis</u>	x		x		x	x
		Mona monkey <u>Cercopithecus mona</u>	x		x		x	x
		Diana monkey <u>Cercopithecus diana</u>			x		x	x
		Black & white colobus monkey <u>Colobus polykomos</u>	x		x		x	x
		Red colobus monkey <u>Colobus pennani</u>	x					
	Chiroptera	Bats:						
		Fruit bat <u>Eidolon helrum</u>	x	x	x	x		x
		Hammerheaded bat <u>Hypsignathus monstrosus</u>		x				
		Long-haired rousette <u>Lyssonycteris angolensis</u>		x				

ORDER	FAMILY	SPECIES	COUNTRIES IN WHICH THEY ARE UTILIZED					
			CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
		Gambian apaulet bat *Epomophorus gambianus*		x				
		Eastern apaulet bat *Epomophorus anyous*		x				
		Franquet bat *Epomops franwueti*		x				
		Lesser apaulet bat *Manonyeteris veldcampi*		x				
		Zenkers fruit bat *Scotonyoteris zenkeri*		x				
		Little coloured fruit bat *Monycteris foranata*		x				
		Long tongued fruit bat *Megaloglossus woermanni*						
Artiodactyla (Even-toed ungulated)	Cephalophinae	Duikers:						
		Bay duiker *Cephalophus doasalis*				x	x	x
		Jentink's duiker *Cephalophus jentinki*	x			x	x	x
		Yellow-backed duiker *Cephalophus sylvicultos*			x		x	x
		Black duiker *Cephalophus niger*		x	x	x	x	x

ORDER	FAMILY	SPECIES	COUNTRIES IN WHICH THEY ARE UTILIZED					
			CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
		Zebra duiker *Cephalophus zebra*					x	x
		Peter's duiker *Cephalophus callipygus*						
		Maxwell's duiker (Blue duiker) *Cephalophus monticola*	x	x		x	x	x
	Hippopotamidae	Hippopotamus *Hippopotamus amphibius*	x		x	x	x	
		Pigmy Hippopotamus *Choeropsis amphibius*					x	x
	Suidae	Bush pig (Red river hog) *Potamochoerus porcus*	x			x	x	x
		Giant forest hog *Hylochoerus meinertzhageni*	x			x	x	x
	Trangulidae	Water chevrotain *Hyenoschus aquaticus*	x				x	x
	Bovidae	Bongo *Boolercus envyceros*	x				x	x
		Sitatunga *Tragelaphus spekei*	x	x	x	x	x	x
		Bushbuck *Tragelaphus scriptus*	x	x	x	x	x	x
		Bushcow (Buffalo) *Synceros cafer*	x	x	x	x	x	x

ORDER	FAMILY	SPECIES	COUNTRIES IN WHICH THEY ARE UTILIZED					
			CAMEROON	NIGERIA	BENIN	GHANA	IVORY COAST	LIBERIA
	Mustelidae	Honey badger Mellivora capensis		x		x	x	x
		Congo clawless otter Anonyx (Paraonyx) congica						
	Viveridae	African civet Viverra civetta		x		x		x
		Two-spotted palm civet Genetta servalina				x		
		Forest genet Genetta pardina					x	x
		Giant genet Genetta victoriae						
		Black-legged mongoose Boleogale nigripes	x	x	x	x		
		Long-snouted mongoose Herpestes naso	x	x		x		
		Dark mongoose Crossarchus obscurus						
	Hyaenidae	Spotted hyaena Crocuta crocuta	x	x	x		x	x
		Golden cat Felix (Profelis) aurata	x	x	x	x	x	x
	Felidae	Lion Panthera leo			x		x	x
		Leopard Panthera pardus	x	x	x	x	x	x

APPENDIX III

Utilization of tropical forest mammals for traditional medicine and witchcraft

ORDER	SPECIES	PART OF BODY USED	MEDICINAL USES
Primates	Gorilla *Gorilla gorilla*	1. Bones	a) An important ingredient in preparation of concoction for young children to drink for protection against diseases and witchcraft
			b) Also used to prepare witchcraft to prolong pregnancy in women - an act of punishment for an enemy.
		2. Left hand	Commonly used to prepare concoction with herbs for children to drink for immunity against diseases, epidemics and witchcraft.
	Chimpanzee *Pan troglodytes*	1. Skin	Used in witchcraft prepared with other ingredients to a padlock. The user dictates his wishes against his enemy to the padlock and locks it. As long as the padlock remains in a locked position, so will his wishes affect the enemy.
		2. Bones and skull	An important ingredient in a concoction for children to give them immunity against diseases and witchcraft.
	Various monkeys	Skull	Used in combination with other ingredients to cure stomach ailments in children 6-12 months old.
Proboscidae	Elephant *Loxodonta africana cyclotis*	1. Meat	Used in preparation of medicines to be eaten by children for immunity against diseases.
		2. Bone with some meat attached	Used with black native soap for bathing for good luck.
Carnivora	African civet *Viverra civetta*	Anus	Used in traditional medicine for preventing convulsion in children.

ORDER	SPECIES	PART OF BODY USED	MEDICINAL USES
	Leopard <u>Panthera pardus</u>	1. Bones	Mainly used in witchcraft to effect protection against the wishes of enemies.
		2. Skin	a) In high demand for witchcraft to effect a respectful personality for an individual. b) Also used in witchcraft whereby any weapon made of iron cannot penetrate the skin of the user. Commonly used in time of intertribal wars.
	Leopard (<u>Panthera pardus</u>)	3. Faeces	An ingredient in witchcraft preparations to track down thieves.
	Lion <u>Panthera leo</u>	Heart	Used in witchcraft by warriors for courage.
Artiodactyl	Bushpig <u>Potamochoerus porcus</u>	1. Bone	Used in concoctions for children to prevent fever and associated illness when growing milk teeth.
		2. Head	Used in traditional medicines with black soap for bathing for good luck. Mainly used by traders and business men.
	Bushbuck <u>Tragelaphus scriptus</u>	1. Horn	Used in witchcraft for inflicting bad luck against an enemy.
		2. Bones	In preparation of concoctions with native black soap for bathing children 3 months - 3 years. This is supposed to impact immunity against "all diseases".
Insectivora	Hedgehog <u>Atelerix albiventris</u>	Whole body	Used in witchcraft for protection against witches.
	Elephant shrew: <u>Rycocyon</u> spp. and <u>Pentodromus</u>	Whole body	Used to prepare a concoction with palm kernel oil, and given to children in small doses to stop convulsion.
	Pangolin <u>Manis</u> (Smutsia) <u>gigantea</u>	Spine	Used to prepare medicines for pregnant women to effect delivery of their young.

ORDER	SPECIES	PART OF BODY USED	MEDICINAL USES
Rodentia	Bush tailed porcupine *Atherurus* spp.	Spine	Also used in concoction for pregnant women to effect easy delivery of their young.
	Crested porcupine *Hystrix* spp.	Spine	Used in concoction to prevent miscarriage in pregnant women.
	Flying squirrel *Anomalurops beecrofti*	Tail	Also an important ingredient in traditional medicine for pregnant women to prevent miscarriage, and to ensure that the child is eventually born healthy.
	Grass cutter *Thryonomys swinderianus*	Hair	Used in concoction for healing wounds.
		Skin and intestines	Mixed and ground with black soap to bathe children to impart immunity on them against diseases.
	Forest African giant rat *Cricetomys emini*	Head	Used in witchcraft to win the love of a woman.

APPENDIX IV

Proximate composition and mineral contents of
some forest mammals and domestic animals

FOREST MAMMALS	Moisture G.	Protein G.	Fat G.	Ash G.
Rodents				
African giant rat *Crycetomys gambianus*	65.99	18.99	11.0	3.9
Grass cutter *Thryonomys swinderianus*	65.8 # 77.4 + 69.7	20.7 # 26.2 + 18.8	0.7 # 7.4 + 8.9	0.5 # 1.0 + 1.2
Tree hyrax	78.7	16.1	2.9	1.9
Primates				
Green monkey *Cercopithecus aethiops*	80.3	17.6	1.3	1.1
Proboscidae				
Elephant (skin) *Loxodonta africana cyclotis*	49.4	29.2	19.7	1.7
Carnivora				
Long-snouted mongoose *Herpestes naso*	72.7	18.8	1.9	3.3
Forest Genet *Genetta pardina*	31.8	55.4	9.3	6.0
Suidae				
Red river hog *Potamochoerus aethiops*	70.1 # 72.4	23.8 # 27.2	1.6 # 2.7	1.1 # 1.1
Artiodactyl	45.1	40.6	10.7	3.3
Royal antelope *Nectragus pygmacus*	74.5	23.4	0.9	1.2
Grown duiker *Sylvicapra grimmia*	74.6	20.8	3.4	1.2
Grey duiker	59.5	33.4	2.0	4.0
Bushbuck *Tragelaphus scriptus*	47.6	50.9	12.2	3.7

FOREST MAMMALS	Moisture G.	Protein G.	Fat G.	Ash G.
Domestic animals				
Ox (beef)	73.8 + 54.7 *	19.6 + 16.5 *	12.0 + 28.0 *	1.0 + 0.8 *
Sheep (mutton)	78.5 + 62.5	17.2 + 16.8 *	2.9 + 19.4 *	1.0 + 1.3 *
Pig (pork)	64.8 + 41.1 *	19.4 + 11.2 *	13.4 + 49.0 *	0.8 + 0.6 *

Sources of Data:

* = Kramlich et al. 1973

+ = Tewe & Ajayi, 1978

= Ajayi & Tewe, 1979a, 1979b
Asibey, 1975.

Proximate values are expressed in terms of Grams/100 grams and minerals mg/100 grams of fresh edible tissue

APPENDIX V

A list of forest mammals classified under schedules I & II in the wildlife legislations of some West African countries

ORDER	SPECIES	Cameroon	Nigeria	Benin	Ghana	Ivory Coast	Liberia
Primates	Gorilla *Gorilla gorilla*	x	x	x			
	Chimpanzee *Pan troglodytes*	x	x		x	x	x
	Black & White colobus *Colobus polykomos*	x	x	x	x		x
	Olive colobus *Colobus verus*	x			x		
	Red colobus *Colobus badius*	x	x		x		
	Diana monkey *Cercopithecus badius*			x	x		
	Bosman's potto *Perodicticus potto*		x	x	x		x
	Golden potto *Arctocebus calabarensis*		x	x			
	Mandrill *Mandrillus* spp.		x				
	Mangabeys *Cercocebus* spp.		x				
Proboscidae	Elephant *Loxodonta africana cyclotis*	x	x	x	x	x	x
Artiodactyle	Hippopotamus *Hippopotamus amphibius*		x	x	x		x

ORDER	SPECIES	Cameroon	Nigeria	Benin	Ghana	Ivory Coast	Liberia
	Zebra duiker *Cephalophus zebra*						x
	Jentink's duiker *Cephalophus jentinki*						x
	Ogilby's duiker *Cephalophus ogilbyi*						x
	Royal antelope *Neotragus pygmaens*				x		x
Carnivora	Lion *Panthera leo*	x	x	x	x		
	Leopard *Panthera pardus*	x	x	x	x		x
	Caracal *Caracal caracal*	x		x			
	Spotted hyena *Crocuta crocuta*	x	x				
	Two spotted palm civet *Mandinia ginotata*		x				
	Honey badger *Mellivora capensis*				x		
	Clawless otter *Anonyx capensis*				x		
	Golden cat *Felis aurata*				x		x
	African civet *Viverra civetta*			x			x

ORDER	SPECIES	Cameroon	Nigeria	Benin	Ghana	Ivory Coast	Liberia
		COUNTRIES					
	Pigmy hippopotamus _Choeropsis liberieusis_				x		x
	Sitatunga _Tragelaphus spekei_		x		x		
	Water Chevrotain _Hyamaschus aquaticus_	x	x	x	x		
	Bongo _Boochercus enryceros_				x		x
	Red river hog _Potamochoerus porcus_		x	x	x		
	Giant forest hog _Hylochoerus meinertzhagenei_		x		x		
	Bushbuck _Tragelaphus scriptus_		x		x		
	Buffalo _Synceros cafer_		x	x	x		x
	Yellow backed duiker _Cephalophus sylvicultos_				x		
	Black duiker _Cephalophus niger_				x		
	Bay duiker _Cephalophus dorsali_				x		
	Red duiker _Cephalophus natalensis_				x		
	Maxwell's duiker _Cephalophus maxwelli_				x		
	Grey duiker _Sylvicapra grimmia_			x	x		

ORDER	SPECIES	COUNTRIES					
		Cameroon	Nigeria	Benin	Ghana	Ivory Coast	Liberia
Rodentia	Palm squirrel *Epixerus epii*		x		x		
	Brush tailed porcupine *Atherurus africanus*		x				
Pholidota	Giant pangolin *Manis gigantea*		x	x	x		
	Tree pangolin *Manis tricuspis*		x		x		
	Long tailed tree pangolin *Manis longuicaudata*		x		x		

APPENDIX VI

Research projects on tropical forest mammals and their utilization in West Africa

COUNTRY	RESEARCH PROJECT	AIMS AND OBJECTIVES	PROGRAMME CO-ORDINATORS
CAMEROON	-	-	-
NIGERIA			
1. Department of Forest Resources Management University of Ibadan.	1. Biology and Domestication of the African giant rat *Cricetomys gambianus* Waterhouse, Grass cutter *Thryonomys swinderianus* Temminck	About 71% of the rural population of Southern Nigeria would accept the giant rat and practically all Nigerians, both rural and urban would accept the grass cutter as an important source of animal protein. The populations of both rodents are depleted in Nigeria. The project which began in earnest in January, 1972 is aimed at examining the merits and demerits of these rodents as producers of meat, and the possibility of domesticating them for additional sources of food. The African giant rat is now fully domesticated and about 20 generations have been successfully bred in captivity. About 17 publications have emerged on its biology and performance in captivity. An extension booklet on the practical ways of raising the giant rat has also been published. (Ajayi, 1974, 1975).	Dr. S.S. Ajayi

COUNTRY	RESEARCH PROJECT	AIMS AND OBJECTIVES	PROGRAMME CO-ORDINATORS
NIGERIA			
2. Department of Forest Resources Management University of Ibadan	Patterns of bushmeat production, market structure of bushmeat in Southern Nigeria	The study was on investigating the problems associated with production, preservation and market patterns of bushmeat with the aim of recommending appropriate technology for wildlife production and preservation in Southern Nigeria (1975).	O.O. Olawoye S.S. Ajayi
3. Department of Forest Resources Management University of Ibadan	Nutritional value of commonly eaten wild animals of tropical forest zone, South Western Nigeria	The aim is to carry out protein analysis of the nutrient quality of wild animals in South Western Nigeria. Information from this study was compared with that of some common domestic animals	
4. Department of Forest Resources Management University of Ibadan	A survey on utilization of wildlife for traditional medicine in South Western Nigeria	To investigate the validity of claims of wild by-products in traditional medicines, how they can be effectively utilized and improved; and also to ascertain which forms of utilization are merely superstitious and destructive and how this aspect can be controlled.	
5. Department of Biology, University of Ife, Ile-Ife.	Management and utilization of the fruit bat (*Eidolon helvum*) for food in South-Western Nigeria	The fruit bat is widely eaten in forest areas of Southern Nigeria. The project examines the reproductive performance, its migration and roosting behaviour with the aim of controlled shooting for sustained yield of animal protein. The project which began in 1972 is highly successful and usefully utilized for teaching. A well illustrated dissection guide has been produced for the species. The fruit bat project at Ife University achieved the unique distinction of being the only research scheme in that University that was entirely financially self-supporting (Halstead, 1977)	Professor L.B. Halstead

COUNTRY	RESEARCH PROJECT	AIMS AND OBJECTIVES	PROGRAMME CO-ORDINATORS
NIGERIA			
6. Department of Zoology, University of Ibadan, Ibadan	Identification features of the 11 species of fruit bats of Western Nigeria 1. Straw coloured fruit bat <u>Eidolon</u> <u>helvum</u> Keir 2. Hammer-headed bat <u>Hypsignathus</u> <u>monstrosus</u> (H. Allen) 3. Long haired rousette <u>Lissonycteria</u> <u>angolensis</u> - Bocage 4. Gambian epaulet bat <u>Epomophorus</u> <u>gambianus</u> Ogilby 5. Eastern epaulet bat <u>Epomophorus</u> <u>anwrus</u> - Heuglin 6. Franquet's bat <u>Epomops</u> <u>franwueti</u> - Tomes 7. Lesser epaulet bat <u>Micropteropus</u> <u>pusillus</u> - Peters 8. Veldkamp's dwarf fruit bat <u>Manonycteris</u> <u>veldcampi</u> - Jentinks 9. Zenker's fruit bat <u>Scotonycteris</u> <u>zenkeri</u> <u>Matschie</u>	Includes ecology and a practical guide for identifying the fruit bat of Western Nigeria. The work was carried out in 1968 - 1976, (Happold, 1978(a), 1978(b), 1978(c)	Dr. D.C.D. Happold

COUNTRY	RESEARCH PROJECT	AIMS AND OBJECTIVES	PROGRAMME CO-ORDINATORS
NIGERIA			
	10. Little coloured fruit bat *Myonycteris forquata* - Dobson		
	11. Long - tongued fruit bat *Megaloglosus woermanni* Pagenstecher		
7. Adeyemi College of Education, Ondo	Domestication and breeding of Maxwell's duiker *Cephalophus maxwelli*	As this species of forest duiker is hunted daily, the population is depleted in most places. Hence the programme of examination of biology and breeding of this animal for food.	Cynthia and Patrick White
8. Department of Biology University of Benin, Nigeria	Bush meat market in Southern Nigeria	To find out the size of market and quality and variety of meat involved, and their monetary value in Bendel State of Nigeria. The study was preliminary in nature, aimed at providing justification for domestication of species which are highly favoured.	
BENIN	-	-	-
GHANA			
Department of Game and Wildlife, Ministry Post Office M239 Accra Ghana	1. The role of wildlife as a source of meat in Ghana, with particular reference to the Grass cutter *Thryonomys swinderianus* Temminck	A large project aimed at providing quantitative information for policy makers to justify investments into the development of wildlife especially for meat production.	

COUNTRY	RESEARCH PROJECT	AIMS AND OBJECTIVES	PROGRAMME CO-ORDINATORS
GHANA (cont'd)	2. Primate conservation in Ghana	In the light of economic and political problems that abound in Ghana, primate habitats have been altered in their natural geographical range. Timber exploitation and farming are largely responsible for these alterations. Hence the need for ecological surveys leading to a programme of conservation of primates.	
IVORY COAST			
1. Department of Biology and Physiology, National University of Ivory Coast, Abidjan, Ivory Coast 2. Institute of Tropical Ecology, Ivory Coast	Ecology, trapping technique and physiology of grass cutter *Thryonomys swinderianus*	Grass cutters are widely eaten in Ivory Coast. The study was therefore aimed at establishing the habitat requirements and physiology of the species that would provide a basis for domestication. Items of investigation also include: 1. Population dynamics 2. Reproductive patterns in nature and 3. Action of pituitary hormone on reproductive cycle.	Professor A.S. N'Diaye and Dr. Amany Konan
LIBERIA			
1. Forestry Development Authority, P.O. Box 3010 Monrovia	Ecological surveys of forest reserves for determining the status and relative abundance of wildlife species of economic importance in Liberia	Since there are no Game Reserves or National Parks in Liberia, the project, which is jointly financed by the Government of Liberia and the International Union for Conservation of Nature and Natural Resource (I.U.C.N.) is aimed at creating Game Reserves for the country.	

APPENDIX VII

A QUESTIONNAIRE ON WILDLIFE UTILIZATION

I. GENERAL INFORMATION

1. Country:

A [ ] D [ ]

B [ ] E [ ]

C [ ] F [ ]

2. Name of respondent:

3. Name of village of respondent:

4. What is your major occupation?

A [ ] Farming D [ ] Civil service

B [ ] Hunting E [ ] Self employed

C [ ] Teaching F [ ] Other (Specify)

5. Is hunting a major occupation?

A [ ] Yes B [ ] No

6. What is the size of your family?

A [ ] 1 member E [ ] 5 members

B [ ] 2 members F [ ] 6 members

C [ ] 3 members G [ ] 7 and above

D [ ] 4 members [ ]

7. How many of the members of the family do any hunting?

A [ ] 1 member [ ] Above 3

B [ ] 2 members

C [ ] 3 members

II. PRODUCTION AND PROCESSING

A. <u>Production</u>

1. How often do you hunt, on average?

A [ ] Every day C [ ] 3 times a week

B [ ] Twice a week D [ ] 4 times a week

2. Do you hunt in a group or individually?

A [ ] Group B [ ] Individually

3. Do you hunt in a specific area?

A [ ] yes B [ ] No

4. What is the average distance of your hunting area(s) from the village?

A [ ] less than 1 km C [ ] 4 to less 7 km

B [ ] 1 to 3 km D [ ] 8 to 10 km

E [ ] Above 11 km

5. What equipment do you use in hunting?

A [ ] Gun E [ ] Club

B [ ] Cutlass F [ ] Knife

C [ ] Spear G [ ] Trap

D [ ] Netting H [ ] Others (Specify)

6. How much money do you spend on average, per hunting trip, on material needed for hunting?

A [ ] Nothing

B [ ] \$ 1 - 5

C [ ] \$ 6 - 10

D [ ] \$ 11 - 20

E [ ] \$ 21 and above

7. How often do you have a successful hunting trip?

A [ ] Every time

B [ ] 3/4 of the time

C [ ] ½ of the time

D [ ] 1/4 of the time

8. What species do you usually kill?

A [ ]

B [ ]

C [ ]

D [ ]

E [ ]

F [ ]

9. Which are the larger species you have killed?

A [ ]

B [ ]

C [ ]

D [ ]

E [ ]

F [ ]

Animal (Name)	Number	Average weight if known
A. Grass cutters		
B. Giant rats		
C. Squirrels		
D. Porcupines		
E. Duikers		
F. Forest hog		
G. Bushbuck		
H. Monkeys		
I. Other spp.		

10. How do you usually convey your kill to the village?

A [ ] Head

B [ ] Bicycle

C [ ] Motorcycle

D [ ] Motor car

E [ ] Lorry/Truck

F [ ] Other (specify)

11. What periods of the year do you have the most successful hunting expeditions?

A [ ] Rainy season

B [ ] Dry season

C [ ] All year round

D [ ] Other (specify)

E [ ] Other (specify)

12. What periods of the year do you have least successful hunting expeditions?

A [ ] Rainy season

B [ ] Dry season

C [ ] All year round

D [ ] Other (specify)

B. <u>Processing</u>

1. Do you usually process your kill yourself?

A [ ] Yes

B [ ] No

2. Where do you usually do the processing?

A [ ] Near the spot of kill

B [ ] At the farm

C [ ] In the village

D [ ] Other (specify)

3. How much time do you spend, on average, to process each expedition's kill?

A [ ] Up to 6 hours

B [ ] 7 - 12 hours

C [ ] 13 - 24 hours

D [ ] 25 - 36 hours

E [ ] More than 36 hours

4. Do you do the processing alone or are you helped by others?

A [ ] Alone

B [ ] With others

5. What materials do you usually use for the processing?

A [ ]

B [ ]

C [ ]

D [ ]

E [ ]

6. What methods do you usually adopt for the processing?

A [ ]

B [ ]

C [ ]

D [ ]

E [ ]

7. How much do you spend on materials, on average, per expedition kill?

A ☐ Nothing

B ☐ $ 1 - 5

C ☐ $ 6 - 10

D ☐ $ 11 - 20

E ☐ $ 21 and above

III. END-USE OF YOUR KILL

A. Consumption

1. Approximately, what proportion, on average, of an expedition's kill do you consume in the household?

A ☐ None

B ☐ Some but less than 1/4

C ☐ Between 1/4 and ½

D ☐ Between ½ and 3/4

E ☐ Over 3/4 but not all

F ☐ All

2. Approximately, what proportion, on average, of an expedition's kill do you give out (free) to friends and relatives who do not live with you?

A ☐ None

B ☐ Some but less than 1/4

C ☐ Between 1/4 and ½

D ☐ Between ½ and 3/4

E ☐ Over 3/4 but not all

F ☐ All

3. If you were to buy the proportion of your kill that you consume or give away, what is your estimate of its value per month?

A [ ] Nothing

B [ ] $ 1 - 5

C [ ] $ 6 - 10

D [ ] $ 11 - 20

E [ ] $ 21 and above

4. How much do you spend, on average, buying meat of domestic animals per week?

A [ ] Nothing

B [ ] $1 - $5

C [ ] $6 - $10

D [ ] $11 - $20

E [ ] $20 and above

B. <u>Marketing</u>

1. What proportion of an expedition's kill, on average, do you sell?

A [ ] None

B [ ] Some but less than 1/4

C [ ] Between 1/4 and ½

D [ ] Between ½ and 3/4

E [ ] Above 3/4 but not all

F [ ] All

2. Where do you sell?

A ☐ In a market	D ☐ Other means
B ☐ Direct to customers in their houses	E ☐ Other means
C ☐ People come to buy from my house	F ☐ Other means

3. How do you sell?

A ☐ In bulk not weighed	D ☐ In bulk after weighing
B ☐ In pieces not weighed	E ☐ In pieces after weighing
C ☐ Other methods (specify)	

4. If you sell in pieces or in bulk by weight, how much do you charge per kilo?

Species	Price/Kilo

5. If you sell in bulk without weighing, what is the price you get, on average, for a small- and large-sized animal of a given species?

Species of animal	Price of small one	Average price of a large one
1.		
2.		
3.		
4.		
5.		
6.		

6. Are the prices of meat you sell affected by the season of the year?

A ☐ Yes B ☐ No

7. If answer to 6. is <u>yes</u>, when do you get highest prices and lowest prices?

Highest: ....

Lowest : ....

8. Do you incur any marketing cost?

A ☐ Yes B ☐ No

9. If answer to 8. is <u>yes</u>, give an estimate of such cost per expedition's kill

US$ ....

10. Are you always able to find buyers for all you want to sell?

A [ ] Yes B [ ] No

If answer to 10. is No, what do you do with the unsold portion?

A [ ] Consume at home C [ ] Throw away

B [ ] Give away D [ ] Other (specify)

E [ ] Other (specify)

IV. PROBLEMS

Under each of the following headings, state what problems you have.

PROBLEMS

Hunting	Transport	Processing	Marketing
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			