

**CASE STUDY 2: MULTIPURPOSE FOREST MANAGEMENT FOR
BUSHMEAT PRODUCTION: A SUCCESS STORY FROM WEST AFRICA**

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1 INTRODUCTION

Okomu Forest Reserve is situated in the lowland tropical rainforest of Edo State, southwestern Nigeria. It contains some of the richest and relatively undisturbed high forest ecosystems in West Africa and is endowed with unique and rare biodiversity of international significance. It contains the relics of endangered wildlife species such as forest elephant (*Loxodonta africana cyclotis*), chimpanzee (*Pan troglodytes*), leopard (*Panthera pardus*) and Red-capped Mangabey (*Cercocebus torquatus*) whose conservation status are of local and global concern. One species of high forest monkeys, which is endemic to Nigeria, and is probably not found outside Okomu, is the white-throated monkey (*Cercopithecus erythrogaster*). At the same time, wildlife or “bushmeat” constitute a significant portion of the animal protein consumed by those living in the peripheral communities and is also sold commercially. Animal parts are used in traditional medicine as are a number of identified medicinal plants, which form an important component of the health care delivery programme in southern Nigeria.

In the past three decades intense human activities such as industrialization, farming, over-logging, and over hunting have led to a massive destruction of forest cover and the unique wildlife of Okomu Forest Reserve. Consequently, a non-governmental organization, the Nigerian Conservation Foundation (NCF), which is devoted to environmental protection, has worked in collaboration with the Edo State Government since 1987 for the sustainable development of Okomu Forest Reserve. The main objectives of the various management strategies are to develop the Reserve in partnership with the local communities and to create sustainable land use schemes, to include controlled hunting and logging, and to develop reforestation and farming schemes (including small-game and fish farming) which are compatible with forest conservation.

The management is an example of a success story of a partnership between the government, a non-governmental organization and the local communities. This phenomenon is new to natural resources conservation efforts in West Africa and has led to conflict resolution and increased productivity of the ecosystem.

1.1 Location, climate, vegetation and fauna

1.1.1 *Location*

Nigeria operates a Federal System in which there are three tiers of Government: Federal, State, and Local Governments. National Parks belong to the Federal Government while all Forest Reserves and Sanctuaries are the responsibilities of the respective State Governments. There are 36 such State Governments of which Edo State in southwestern Nigeria is one.

Okomu Forest Reserve is located in Edo State of Nigeria about 75km west of Benin City, the State capital. The Forest Reserve has an area of 1 082 km² and is situated between the rivers Osse and Siluko to the east and west respectively and between longitude 5°E and 5°30'E and latitude 6°N and 6°N. (Refer to Map 1.) It is the largest and the least degraded forest reserve in Edo State.

1.1.2 *Climate*

The climate of Okomu is tropical, with well-marked rainy and dry seasons. The mean annual rainfall is 2 100mm falling mainly between March and October with the highest rainfall occurring in June, July and September. The relative humidity is high, not less than 65 percent during the afternoons in any month of the year. The mean monthly temperature is 30.2°C. The dry season is preceded by two months of Harmattan in December and January, when the northeasterly winds from the Sahara desert prevail across the entire country.

Map 1. Location of Okomu Forest Reserve, Nigeria

1.1.3 Vegetation

The Okomu Forest Reserve consists of semi-deciduous, humid, lowland rainforest and is representative of this rapidly disappearing ecosystem of southwestern Nigeria. Freshwater swamp forests are found along the rivers. The African mahogany family (Meliaceae) is well represented including: *Khaya ivorensis*, *Entandrophragma angolense*, *Entandrophragma cylindricum*, *Guarea cedrata*, *Guarea thompsonii* and *Lovoa trichilioides*. Other economically important species include *Milicia excelsa*, *Gossweilerodendron balsamiferum*, *Terminalia ivorensis*, *Terminalia superba* and *Triplochiton scleroxylon*.

The forest is a mosaic of the following physiognomic forms:

- “High forest” with well stocked middle and lower storeys and numerous emergent trees.
- “Broken High Forest” with small gaps interrupting the canopy at 6-12m (“tall closed shrub”) or 3-6m (“low closed shrub”) and a few emergent trees.
- “Open shrub” as above but interrupted by many open glades containing light demanding herbs.

The extent of the shrub has greatly expanded due to gaps created by exploitation and by wind throws.

1.1.4 Fauna

The Reserve contains a high degree of biodiversity in terms of fauna, and it provides habitat to the endemic white-throated monkey (*Cercopithecus erythrogaster*) and several other animals on the Nigeria endangered species decree No. 11 of 1985 (e.g. the forest elephant (*Loxodonta africana cyclotis*), leopard (*Panthera pardus*), forest buffalo (*Synceros caffer*), yellow backed duiker (*Cephalophus sylvicultor*), chimpanzee (*Pan troglodytes*), red-capped mangabey (*Cercocebus torquatus*) and the African dwarf crocodile (*Osteolaemus tetraspis*)). Other animals include Mona Monkey (*Cercopithecus mona*) and the putty-nosed guenon (*Cercopithecus nictitans*). Galago (*Galago demidovii*) and potto (*Perodicticus potto*) are very common and there is a healthy population of Red river hog (*Potamochoerus porcus*). There is also an impressive variety of bird life in the reserve.

1.2 History of land use

Okomu was legally constituted a Forest Reserve in 1912 by Government order 397. In 1950, it was re-constituted a Native Administration Forest under the Benin District Council. Before 1950, Okomu was a relatively undisturbed forest. There was little farming and the ecosystem represented one of the richest in West Africa in terms of biodiversity. At this point, the reserve was divided into two areas BC 9 and BC 10 for management purposes.

In 1970, the reserve came under the management of the State Government, to be managed on behalf of the local community. Despite the fact that the land was constituted community land, the State Government granted a 99 year lease of 1 500 ha from area BC 9 to a palm oil company and another 2 000 ha from area BC 10 to a rubber company for development of oil palm and rubber tree plantations. Although both of these areas were termed as a “de-reservation” there was no evidence that the lease was ever legally gazetted. It is therefore not known how much this has affected the statutory rights of the occupancy.

In 1982, Oates and Anadu carried out a survey of the conservation status of forest reserves in Ondo, Ogun, and Bendel States (part of Bendel State in 1982 is now part of Edo State). Because of the high rate of exploitations within the Reserve and human settlements on its periphery they recommended *inter alia* that a Wildlife Sanctuary be set up in the core of Okomu Forest Reserve to protect the unique flora and fauna of the tropical forest ecosystem. In particular it was thought that the creation of the Sanctuary was the last hope for the protection of endemic and endangered species of wildlife including the endemic white-throated guenon monkey, (*Cercopithecus erythrogaster*), of which there is an estimated population of about 3 000. The creation of the Sanctuary was gazetted in June 1988.

(Refer to Map 2) In 1999, the Okomu Forest Reserve was declared a National Park (Decree 46 of 1999).

Map 2. Okomu Forest Reserve and the Sanctuary

2 A MANAGEMENT STRATEGY FOR THE OKUMU FOREST RESERVE

The rapid loss of the unique tropical forest biodiversity attracted the attention and participation of the Nigerian Conservation Foundation (NCF) an environmental non-governmental organization (NGO) in the management of Okomu Forest Reserve. Registered in 1982 as a charitable trust, the activities of NCF encompasses conservation education, support for wildlife research, and protection of endangered species. The Foundation is affiliated to the World Wide Fund for Nature (WWF), one of the largest private conservation organisations in the world.

The main objectives of the management of Okomu Forest Reserve, as stated in the Memorandum of Understanding between the Edo State Government and the Nigerian Conservation Foundation, are as follows:

- To protect the Okomu Wildlife Sanctuary as an inviolate refuge for threatened plants and animals of the rainforest of southwestern Nigeria;
- To develop, in partnership with the government and the communities living in the project area, sustainable land use schemes, including controlled hunting and logging; reforestation; fish, small game and crocodile farming; and agricultural practices that are compatible with forest conservation;
- To inventory and monitor on a long-term basis the resources of the Sanctuary and surrounding areas;
- To generate support for wildlife conservation through promotion of conservation education among communities in the project area.

Management inputs from the Nigerian Conservation Foundation (NCF):

- Nominate, subject to the approval of the Edo State Government, a project manager who shall have overall responsibility for ensuring that the project objectives are achieved. The project manager shall act as a link between the government and the Nigerian Conservation Foundation;
- Seek financial and material support from local and international sources for the project;
- Recruit technical/scientific staff to execute the project;
- Disseminate information on the project through publications, seminars, workshops etc.;
- Train local personnel in the techniques of wildlife investigation and conservation education;
- Produce a management plan for the sustainable use of the resources of Okomu forest reserve.

Management inputs from Edo State Government

- Provide guidance and support for the Okomu Forest project;
- Nominate a local staff who shall assist the Project Manager in the execution of the project and be responsible for law enforcement in the project area;
- Appoint a conservation education officer who shall be attached to the project;
- Assign other cadre of staff as may be required for the effective protection of the project area;
- Continue to pay the full salaries and allowances of all officially assigned personnel. (The Nigerian Conservation Foundation will provide necessary logistical support for assigned personnel to perform their duties effectively);
- Ensure the fullest possible liaison between the project and the Government;
- Implement rural development activities recommended by the Project Consultants, in collaboration with the Nigerian Conservation Foundation.

Participation by local communities

- Management staff for law enforcement and labour within the reserve are recruited from the local communities;
- The benefits of controlled hunting, agro-forestry farming, and other benefits from the utilization of community farmlands and swamp fringe forests accrue directly to the rural communities;
- The programme of land leases for farming activities is undertaken with the participation of the local communities.

2.1 Multi-purpose land use classification

The Nigerian Conservation Foundation carried out a complete ecological and socio-economic survey of the area and produced a Master Plan for the Management of Okomu Forest Reserve in 1995. The Master Plan contained six main land use zones as follows:

- An inner conservation core-denoted a wildlife sanctuary;
- A forest/wildlife production buffer zone, contiguous to the sanctuary;
- Other high forests under long term (99-years) community leases;
- A zone of plantations mostly for oil palm and rubber trees;
- Peripheral community farm lands with a practice of agro-forestry;
- The swamp forest fringes.

Details of land use practices and management prescriptions for the different zones are presented in Table 1 below. Refer also to Map 3. The land use planning encourages interactions between different zones. Therefore, zones are not mutually exclusive. For example, tree crops occur in community farmlands, and farms occur within the plantations.

The land use zonation was done as a management strategy to:

- Function as a conflict resolution strategy among the major land users in the Forest Reserve.
- Ensure total protection of the Wildlife Sanctuary
- Ensure optimum utilization of the Forest Reserve by the rural communities and for revenue generation for Edo State Government Forestry Department.
- Ensure protection of biodiversity in perpetuity using the strategy of multipurpose use and forest regeneration.
- Ensure rational exploitation of wildlife for bushmeat and by-products and optimal utilization of other non-wood forest products, such as fuelwood, leaves and medicinal plants.

2.2 Strategies for enhancing the carrying capacity of the wildlife habitat

The strategies for enhancing the carrying capacity of the wildlife habitat include carefully controlled logging activities to avoid destruction of the environment for wildlife. The Management Policy requires that forests plants be planted to maintain forest integrity (plant and habitat diversity). For multipurpose land use practice, nurseries are established to cater for plant requirements, including those species that animals eat and those that provide vital niches for various animal communities in all land use schemes.

Table 1. Multi-purpose Land Use of Okomu Forest Reserve

Land Use Classification		Land Use Practice	Area (Km ²)	% of total Reserve
a.	The Wildlife Sanctuary	An inner reservation core. Conservation of wildlife strictly for scientific, and educational purposes as the primary form of land use. Tourism is allowed on a limited scale, but there is total ban on hunting.	112	8.4
b.	Forest Production Buffer Zone	A zone of high forest around the sanctuary. There is also a ban on hunting. Controlled timber extraction is allowed under licence.	235	17.5
c.	Other Production Forest	This is an area where controlled hunting and logging activities are allowed. However, as part of forest management practices, each logging contractor is required to plant five forest trees for every tree that is cut. In more peripheral forest compartments, adjacent village communities are given long-term (99 years) leases, with a condition to protect and keep the complete integrity of the forest cover at all times. The area of each lease is limited to one acre per member of the community.	180	13.4
d.	Plantations and other tree crops	Oil Palm (<i>Elaeis guineensis</i>) and rubber tree plantations occur within the Reserve. The primary aim is to boost small-holder tree crop production, to encourage small-holder development and provision of rural infrastructures. At the same time, the land use practice is geared towards forest regeneration and maintenance of a rain forest mosaic.	202	15.1
e.	Peripheral community farms with agro forestry	Human population community enclaves occur mainly on the periphery of the Forest Reserve. The land use plan stipulates land allocation of 1 ha/person in each community, and therefore community land is commensurate to population size. Communities that require more than this allocation pay a certain "lease cost". Revenue that is so generated is ploughed back to the communities by the management for rural development. Communities are encouraged to undertake small-scale livestock production-based on goat keeping, snail cultivation, crocodile farming and bee-keeping for revenue generation and poverty alleviation. Farmers practice agro-forestry in consonance with the forest regeneration and forest conservation policy.	164	12.2
f.	The Swamp Forest Fringes	The extensive swamp forests and river fringes are the main areas where raffia palms have been planted for the production of palm wine and local gin. These swamp forests are important for fish and wildlife diversity. Logging activities are therefore carefully controlled to avoid destruction of the environments for fish, wildlife, and humans. The management policy requires that swamp forests remain so by planting more raffia palms and swamp forest trees. Logging is scattered throughout the swamp forests on a 25-year cycle. There is an annual inspection of the swamp forests by an independent, neutral agency. Penalties for not adhering to strict conservation and environmental protection guidelines include an upward review of lease costs to reduce the profit margins of the village communities.	297	22.2
Total			1 340	100

Map 3. Land use classification of the Okomu Reserve

3 WILDLIFE ASSESSMENT AND PRODUCTION OF BUSHMEAT

3.1 Assessment of wildlife resources

Officials of the Nigerian Conservation Foundation, some international staff and staff of Edo State Government Forestry Department initiated an inventory and monitoring activities of the wildlife resources of the Reserve in 1987.

In wildlife management, the most accurate method for wildlife undertaking a census is total count. This can be done either by air or on the ground and aims to provide a complete record of all the animals of all species within a Forest or Game Reserve. However, because of the very dense tropical rain forest vegetation, direct total counts by aerial means were not feasible. Time and cost implications made total counts of wildlife by ground census impracticable as the Forest Reserve has an area of over 1 000 km².

Therefore, all population counts were done by indirect assessments whereby sample counts are made, and the results extrapolated to other areas of similar vegetation type within the Forest Reserve. Two indirect methods were used: the standard King's Strip Census (KSC) and the Time Species Counts (TSC) method. Refer to Box 1 below for details of these methods.

Kings Strip Census (KSC)

This method involves making systematic or random transects within the sample area. The observer makes left and right observations, up to a sighting distance of about 100 metres, in the dense tropical rain forest. Records are kept for each tract as follows:

- Length of Transect
- Number of animals seen for a particular species
- Average sighting distance, perpendicular to the transect line
- Total area covered by the observer's efforts.

The formula for calculating the population of each species of animals for the area covered is as follows:

$$P = \frac{A \sum Z_i}{\sum 2X_i Y_i} \quad \text{where}$$

- P = Total population of a particular species of animal
- X_i = Average sighting distance of animals perpendicular to transect line i
- Y_i = Length of transect line i
- Z_i = Number of animals seen along transect line i
- A = Total area
- 2X_iY_i = Total area sampled for transect line i

The calculation is then repeated for all species of animals.

Time Specific Count (TSC)

This is a total count of all the animals found by a team of observers within a particular compartment, usually with homogenous vegetation. The dimensions of the compartment can range between 50 x 50 m to 1 km². The observers, with each observing a particular stratum of the forest ecosystem, make a record of all animal species found. The total effort of the observers within a compartment of 1 km² is limited to one hour. The results of the total count are then extrapolated to areas with similar vegetation within the sample area.

The accuracy of the two methods depends on the sampling intensity but can be as low as ±10 percent.

Box 1. Sampling methods

One kilometre transects were taken at random locations at right angle to the major roads, and observations were made on animals and their activities, including droppings and defecations, calls and animal tracks.

Population at compartment level was considered to be the average between high population and low population compartments. The results were then extrapolated for other compartments within each zone.

Not surprisingly, the zone with the highest wildlife population was the Wildlife Sanctuary. Conversely, the zone with the lowest wildlife population was the community farmland with a significant portion of forest and wildlife populations exploited.

The “Other Forest Production Zone”, where the wildlife survey was intensively conducted, represented a “medium” between the two extreme potentials. The figures presented in Table 2 were derived by extrapolating the results from this zone for the entire Forest Reserve. Although extrapolating the results for the entire Reserve is not without flaws, it was nevertheless the best available means of assessing the wildlife population for the Reserve. Given that the sampling intensity was very low (around 0.06 percent), the results in Table 2 are only indicative and should be treated with extreme caution. However, they could be valuable as a base line for monitoring changes over time.

3.2 Sustainable offtake for bushmeat production

Following the wildlife survey, the project management team proceeded to make calculations of the sustainable offtake of wildlife for bushmeat production, based on the intrinsic rate of increase of each species of wildlife, which depends on its total population in a particular area, the sex ratio, rate of recruitment, and natural mortality pattern.

An offtake of about 10 percent of wildlife populations (other than endangered species) was considered reasonable in Okomu Forest Reserve, assuming that the sanctuary, and the buffer zone are well-protected from hunting, and that these zones provide a core breeding zone to replenish the rest of the Forest Reserve.

Although the estimates for wildlife population and their offtake is for the entire Reserve, it must be emphasized that hunting for bushmeat only occurs in four out of the six land use areas, These are community farm lands, plantations, swamp fringe forests, and other production forests, accounting for 84 percent of the total Forest Reserve. This means that, in theory, only about 84 percent of the above estimated offtake is available to licensed hunters and local communities.

Due to variations in wildlife population densities according to vegetation types and land use schemes, a more comprehensive wildlife census is needed for the Forest Reserve to provide more detailed and reliable information on the wildlife potential in individual zones. The offtake will then be specified for each zone, vegetation type and compartment.

3.3 Hunting practices for bushmeat production

3.3.1 Hunting permits and regulations

The prospective hunter in the Forest Reserve who wishes to hunt for bushmeat has to apply to the police for permission to possess firearms, and to purchase ammunition. Hunting permits cost about \$6.0 per year and the applicant has to undergo some physical and general tests. There will also be an enquiry to see if the applicant has any criminal record. The physical fitness of the prospective hunter (including eye sight) and his courage to face wild animals in the bush, his tolerance in dealing with

Table 2: Estimates of wildlife populations in Okomu Forest Reserve

SPECIES	Estimated population
Duiker (3 species: Yellow-backed: <i>Cephalophus silvicultor</i> , Black duiker: <i>Cephalophus niger</i> Grey duiker: <i>Cephalophus maxwelli</i>)	57 960
Forest buffalo: <i>Synceros cafer</i>	6 440
Civet cats: <i>Viverra civetta</i>	167 440
Genet: <i>Genetta pardina</i>	57 960
Leopard: <i>Panthera pardus</i>	1 610
White throated monkey: <i>Cercopithecus erythrogaster</i>	128 800
Mona monkey: <i>Cercopithecus mona</i>	193 200
Putty nose guenon: <i>Cercopithecus nictitans</i>	2 382 800
Elephant: <i>Lonodonta africana cyclotis</i>	0
Bushbuck: <i>Tragelaphus scriptus</i>	80 500
Cane rat: <i>Thryonomys swinderianus</i>	644 000
Porcupine: <i>Atherurus sp.</i>	193 200
Giant rat: <i>Cricetomys emini</i>	225 400
Pangolin: <i>Manis tricuspis</i>	96 600
Ground squirrel: <i>Epixerus sp.</i>	644 000
Flying squirrel: <i>Anomalurus sp.</i>	38 640
Potto: <i>Perodicticus potto</i>	64 400
Redcap: <i>Cercocebus galeritus</i>	80 500
Mongoose: <i>Herpestes naso</i>	579 600
Chimpanzee: <i>Pan troglodytes</i>	8 050
Crocodiles: Long-nosed: <i>Crocodylus niloticus</i> Short-nosed: <i>Osteolaemus tetraspis</i>	48 300
Galago (dwarf): <i>Galagoides demodori</i>	64 400
Red River hog: <i>Potamochoerus porcus</i>	161 000
Monitor lizard: <i>Varanus niloticus</i>	225 400
Tree hyrax: <i>Dendrohyra sp.</i>	64 400
Climbing squirrel: <i>Xerus sp.</i>	96 600
Tortoise: <i>Kinixys erosa</i>	38 640
Terrapin: <i>Pelaneadusa subruffa</i>	32 200
Royal python: <i>Python requinus</i>	25 760
Rock Python: <i>Python sebae</i>	64 400
Green mamba: <i>Dendrospis viridis</i>	128 800
Snail: <i>Archachatina marginata</i>	966 000
Guinea fowl - Two species: <i>Guttera edourdi</i> , <i>Numida meleagris</i>	193 200
Grey plantain eater: <i>Crinifer piscator</i>	64 400
Horn bill (8 species): <i>Lophoceros nasutus</i>	161 000
African Grey Parrot: <i>Psittacus erithacus</i>	64 400
Red billed Wood dove: <i>Turtur after</i>	144 900
Woodpecker: <i>Mesopicus goertae</i>	128 800
Eagle: <i>Falconidae</i>	64 400
Owl: <i>Ptilopsis sp.</i>	25 760
Senegal coucal: <i>Centropus Senegalensis</i>	128 800
Yellow wagtail: <i>Budytes flavus</i>	193 200
Whitethroated bee eater: <i>Aerops albicollis</i>	193 200
Francoline: <i>Francolinus bicalcaratus</i>	80 500

other hunters, and his control under provocation, are all aspects of the applicant's behaviour and conduct with which the authorities must be satisfied before a permit is issued.

In addition to the rigorous examinations, which the prospective hunter must pass before he is issued a licence, he must also observe the following rules:

- Guns must not be loaded at home or anywhere other than at the hunting ground;
- No hunter may lend his gun to anyone else;
- A hunter must not fire at an unidentified object or animal;
- In daytime, firing must be angled up or down, not straight ahead (at the height of other possible humans in the area).

Regulations also exist on the species and number of animals which a licensed hunter is allowed to hunt on an annual basis and on the cartridge calibres which may be used for different groups of animals.

3.4 Pattern of bush meat production and promotion of economic returns

3.4.1 Hunting tools

Both primitive and modern hunting tools are currently employed in Okomu Forest Reserve Forest. In addition to the use of guns, mammals are still hunted by simple tools such as snares traps, spears, bows and arrows, poisoned baits and nets. Dogs are also used in traditional group hunting. The following are the hunting techniques identified in the reserve and its environs.

3.4.2 Hunting techniques

- (a) **Trapping and snaring by farming communities.** This is used for mammals (small, medium and big game). They consist of trap-fence line and gin traps. Snares and traps may be baited depending on the type of animals hunted. They are usually set for animals, which have definite and well-defined tracks. Refer to Figures 1 and 2.
- (b) **Individual professional hunting by dane guns and shot guns.** The kill is usually eaten by the hunter's family and when a big animal is killed, it is either sold fresh to a local consumer who eats the kill or to a local collector who smoke-dries it for sale to a retailer. Night hunting is also practised. The hunter who bears the arm carries a head lamp which blinds the animal, and it is the reflection from the animal's eyes that betrays it. Using this method a hunter may kill one or two medium sized animals (of the size of bush-buck (*Tragelaphus scriptus*)) or bigger ones such as buffalo (*Synceros caffer*). Any hunter who kills a buffalo is usually exalted among the hierarchy of hunters in his rural community because of the risks involved in killing such an aggressive animal.
- (c) **Community hunting by urban dwellers.** This is the category of licensed full-time professional or part time hunters who are bound by law to hunt certain categorised and numbers of wildlife depending on their relative abundance. Professional hunters derive their livelihood from bushmeat and animal by-products. They may therefore, spend several weeks in the bush during which they hunt day and night. The women in their families are usually used as intermediaries, supplying them with fresh ammunition and food at set rendezvous in the bush. They in turn carry carcasses of animals shot for processing and for sale in surrounding towns and villages.

3.5 Marketing of bushmeat

The production, distribution and marketing of bushmeat in Okomu Forest Reserve and its environs is similar to any other tropical rain forest area of southern Nigeria. The starting point of the distribution channel is the producer - in this case the hunter. Most producers reside mainly within the enclaves and the periphery of the Forest Reserve. He either sells his fresh product locally for consumption in rural

areas or gives it to his wife first for processing and preservation and subsequently to a village collector. The wife generally has two methods of preservation: soft smoking or dry smoking before she sells directly to village collector. The producer can also sell directly to the village collector who will carry out the smoking process himself. The producer's wife can also sell fresh carcasses to roadside sellers who carry out the smoking exercise and selling 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 roadside seller.

Dry smoking is usually carried out either in a mud-built smoking chamber or drum. Bushmeat which is dry smoked can last 2 - 4 weeks depending on how dry it is. Since the demand for it is high, most of the commodity is sold before decomposition.

The way and manner in which bushmeat is being smoked in some parts of Nigeria leaves much to be desired. First is the question of hygiene. Smoking may not necessarily meet with the highest standard of sanitation. To ensure a maximum economic return, it is desirable that dry smoking is done by retaining the meat in a smoking chamber for as long as is practicable in order to reduce the moisture content to the barest minimum so it does not decompose quickly.

However, at present, there is probably no alternative preservation method that can be suggested for bushmeat in Nigeria. First, the tropical forest region is so humid that sun drying meat for biltong could easily lead to decomposition. Secondly, salt is such an expensive commodity that salting as a method of preservation could make bushmeat too expensive to be out of reach of many people.

4 THE ECONOMIC AND CULTURAL SIGNIFICANCE OF FOREST WILDLIFE IN OKOMU

As part of the survey of economic importance of wildlife in Okomu Forest Reserve, their cultural significance among the local communities was also studied.

Apart from the well-documented roles of wildlife in local and international tourism and as a source of bushmeat, local communities in Nigeria, and indeed along the west coast of Africa, depend heavily on wildlife by-products for ornamentals and traditional medicines. For example, by-products such as tusks, hooves, horns, beads, feathers, skins and teeth are used in producing highly priced ornaments. Traditional chiefs and warriors wear leopard skins in ceremonies as a symbol of prowess and supremacy. Python skins are very important dressing components for masquerades in annual celebrations, while elephant tusks are important to the installation of traditional rulers.

The use of wildlife by-products in traditional medicine is however one of the most significant uses of wildlife among the local communities in high forest areas.

Table 3 shows the results of a recent survey of various tropical high forest wildlife by-products that are used in traditional medicine. These uses range from direct application of by-products for curing certain ailments, to uses for invoking spirits to perform certain functions. Furthermore, recent surveys showed that both medicinal and spiritual uses of wildlife by-products are very popular among local communities. Therefore, it is not a question of whether one believes in these rather obscure uses to which wildlife by-products are put but it demonstrates clearly how the culture of local communities in tropical high forests is interwoven with their environment and the non-wood forest products.

Figure 1. Grass Cutter Snare

Figure 2. Rope trap

Figure 3. Rodent trap

Table 3. Medicinal uses of wildlife in some villages around Okomu Forest Reserve

Animal	Part used	Medical uses
Elephant	Head	Used to prepare medicine such “Magun and Oda”. This is a Yoruba medicine used on women who flirt about. Also used for witchcraft by elders.
	Faeces	Features in various important traditional medicines.
	Bone	Used as “Ajako” and for traditional medicine known as “egbe”. This is used in time of danger for easy disappearance. In preparing traditional medicine and witchcraft, a piece of meat is attached to the bone and mixed with traditional black soap, which is used for bathing. This is believed to bring wealth. Commonly used by businessmen and women.
	Skin	Used for protection and prepared in form of talisman that is thought to bring good luck. Used by hunters for protection against dangerous animals like lions and leopards. Also used in witchcraft in form of “padlock”. The case becomes severe if this padlock is thrown into a river or a pit lavatory. A string made from elephant skin is used to hold together a white horse tail, which is waived to the audience during the masquerades.
	Footprints	Soils defined by elephant footprints are useful to secure justice in law courts.
Leopard	Skin	Prepared medicinally with black soap and other ingredients, this may then be used by local boxers and wrestlers to provide them with extra strength. Also used by businessmen and women when bathing and is believed to provide wealth and riches. Can also be used in “padlocking” enemies. Used to prepare talisman for protection against witchcraft. Hunters cover their knife cases with leopard skin and it is believed it enhances deep and poisonous cuts. Also used for witchcraft by politicians, civil servants and chiefs to command respect and to win popularity among staff.
	Urine	The urine is used to prepare a traditional medicine, which is used by night watchmen/guards. This is thought to tie down thieves and make them unconscious when they cross the gate leading to the areas being guarded.
Lion	Heart	Used by warriors for poisoning spears and arrows during war or for hunting purposes. Used to prepare a concoction for children to drink for immunity against diseases.
Buffalo	Bone	The bone is burnt and mixed with other ingredients to prepare concoctions for prevention against witchcraft.
Bushbuck	Bone	Used to prepare concoction for children between 3 months and 3 years of age for the development of strong bones and rigid body. Village wrestlers also use this. The bones are burnt and mixed with other ingredients, which are applied to the legs to make the bones strong. Also used by pregnant women who find it difficult to walk.
	Horn	Mixed with alligator pepper and other ingredients and used for witchcraft to inflict bad luck on enemies. Also used for witchcraft in commanding and directing people to do specified duties.
Maxwell duiker	Skin	Used by blacksmiths and goldsmiths for attracting customers.
	Horn	Special medicines prepared by hunters are believed to be more potent when kept in the horns.
Red-flanked duiker	Skin	Used by blacksmiths and goldsmiths for attracting customers. The skin is also used to cover knife dashes, purses and rings by hunters to protect them from dangerous wild animals.
Gorilla	Skin	Used to prepare medicine and witchcraft for initiating madness against enemies.
Chimpanzee	Skin	This is used in traditional medicine by pregnant women to prevent miscarriage.
Green monkey	Skull	Used to prepare a concoction for children between 6 months and one year old to prevent and cure stomach ailments.
Red river hog	Bone	The bone is burnt, mixed with shear-butter oil and applied to the body to prevent boils and other skin diseases. Also used to in a concoction to cure teething problems in young children.
Aardvark	Paws	This is used to prepare concoctions to cure early infection in fingernails.
	Tail	Used by elders to command respect among their subordinates.
Flying squirrels	Tail	Wrestlers use this against opponents to make it impossible to floor them or put them to submission. It is used to prepare medicine with other ingredients to avert miscarriage in pregnant women.
Cane rat	Skin	A mixture of the skin, intestine and black soap are prepared and used to bathe young children for general immunity against all diseases.
Python	Teeth	Burnt teeth ashes are mixed with orange lemon and coconut oil and used to prepare a concoction for children to cure stomach troubles. It is also used to prevent snakebites.
	Liver	Used to prepare medicine to cure convulsion in children.
Guinea fowl	Various parts	A mixture of liver, intestines, feathers and skull together with alligator pepper is used to cure dizziness.

5 MANAGEMENT AND RESEARCH PRIORITIES

Increased population pressure is among the most important indirect causes of loss of wildlife, and biodiversity in tropical rain forest (Egwali, 1996). If there is no alternative income generating sources, and where there is open access to land with little restriction to land leases, there is bound to be intense hunting, indiscriminate logging, fuelwood gathering, and shifting cultivation.

This, in turn, leads to deforestation, habitat loss, wildlife scarcity, loss of biodiversity and erosion. These problems still occur at Okomu due to a high human population density in southwestern Nigeria, which is mostly depending on the rural agrarian economy revolving around forest products. There is thus an urgent need to evolve a management and legal strategy that will limit settlements in and around the Forest Reserve.

Furthermore, the involvement of local communities in this tripartite management system of Okomu Forest Reserve has to be further developed. The management must evolve an institutional and legal framework for community participation in the decision-making process concerning management principles and practices that will enhance forest conservation and resource utilization. Their actual involvement in the day to day running of the Forest Reserve, and in sharing the benefits of forest conservation, must be clearly defined.

Community participation must be developed sustainably e.g. along the guiding principles of the Communal Area Management Programme for Indigenous Resources (CAMPFIRE) in Zimbabwe, the Administrative Management by Design (ADMADe) in Zambia, and the Luangwa Integrated Resource Development Programme (LIRDp) in Zambia. What these programmes have in common is a culturally viable, realistic administrative design for the involvement of local communities in the integrated utilization of their natural resources.

It is also important to discourage any pressure from the government to de-reserve more of the forest reserve for monoculture of oil palm and rubber tree plantations. Furthermore there is a need to develop a sustainable silvicultural programme to restock and replenish the Forest Reserve, which has been depleted of some of its rare woody plants through illegal and indiscriminate logging. Agro-forestry farming system should also be encouraged among the peripheral communities, as this system will enhance soil fertility and maintain the tropical rain forest mosaic.

A thorough inventory of the wildlife of the Forest Reserve must be carried out. Wildlife management must be based on detailed knowledge of varieties of species, their total populations, sex ratio and other population characteristics upon which viable and sustainable game cropping depends. It is important also that game cropping be systematic and organized for optimum sustainable yield of bushmeat. There must be strict hunting laws and a massive campaign in the environs of the Forest Reserve to increase public awareness of the importance of wildlife and forest conservation. There must also be a programme of research into management practices for sustainable economic benefits to Edo State Government and the rural communities.

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