

CHAPTER 6

THE ROLE OF WILDLIFE FOR FOOD SECURITY IN CENTRAL AFRICA: A THREAT TO BIODIVERSITY?

*Nathalie van Vliet, **Robert Nasi, ***Katharine Abernethy, †Christian Fargeot, ††Noëlle F. Kümpel, †††Anne-Marie Ndong Obiang, *Stéphane Ringuet

*University of Copenhagen, **CIFOR, ***University of Stirling, †CIRAD, ††ZSL, †††ANPN, *TRAFFIC

Introduction

Meat from wild terrestrial or semi-terrestrial animals, termed “bushmeat”, is a significant source of animal protein in Central African countries, and a crucial component of food security and livelihoods in rural areas. Estimates of bushmeat consumption across the Congo Basin range between 1 million tons (Wilkie & Carpenter, 1999) and 5 million tons (Fa *et al.*, 2003), and harvest rates are estimated to range from 23 to 897 kg/km²/year (Nasi *et al.*, 2008). Starkey (2004) estimated that a total of 161 tons of bushmeat was sold per year in five markets in Gabon. Similarly, Fa *et al.* (1995) suggested that the volume of bushmeat traded annually in Equatorial Guinea’s two main markets is of the order of 178 tons. An inventory in 1995-96 of the four main markets in the Cameroon capital, Yaoundé, estimated sales between 840 and 1,080 tons of bushmeat per year (Bahuchet & Ioveva, 1999). In Yaoundé, Edderaï & Dame (2006) identified 15 markets and 145 restaurants and cafeterias selling bushmeat and providing jobs for 249 people. Fargeot & Dieval (2000) estimate consumption in Bangui, the Central African Republic (CAR) capital, to be of the order of 9,500 tons per year. van Vliet *et al.* (in press) report annual sales equivalent to 271 tons in Kisangani, Democratic Republic of Congo (DRC).

Many sustainability assessments focusing on tropical forest wildlife in the region have warned about the increasing unsustainability of hunting and associated ecological impacts (Bennett & Robinson, 2000). Although humans have been hunting in the forests of Central Africa for millennia, there are several reasons why hunting is not sustainable in every place and for all species: (i) increasing consumer demand, from growing human populations and a lack of acceptable alternative sources of protein, (ii) greater efficiency of



© Grégoire Dubois

hunting and trade, due to easier access to wildlife source areas and markets and more efficient gear types and (iii) increasing hunter supply, resulting from rural poverty and a lack of alternative rural livelihoods (Kümpel, 2006). In addition, civil conflict or insecurity, poor governance, lack of respect for government law and order, and inadequate law enforcement are all contributing factors. The growth of extractive industries such as logging and mining, particularly where operating without proper management or impact mitigation plans, has multiple impacts on wildlife hunting and trade. In the course of unregulated activities, companies directly destroy critical habitat, disturb movement patterns and alter behavior of wildlife, and indirectly facilitate hunting in remote areas, often not governed by village traditions, by building roads and camps, thus providing or facilitating transportation for hunters and market trade as well as increasing local demand (Thibault & Blaney, 2003; Poulsen *et al.*, 2009). The loss of both traditional hunting territories and methods (e.g., hunting zone rotations) allows open access to the resource and concentration of hunting, with negative implications for hunting sustainability (Kümpel *et al.*, 2010a).

Photo 6.1: A red river hog (*Potamochoerus porcus*) taken by surprise while feeding

Overhunting for bushmeat in tropical forests is an issue of concern for three main reasons:

- **Food security and livelihoods:** the depletion of wildlife is intimately linked to the food and livelihood security of numerous inhabitants of the Congo Basin, as many forest-dwelling or forest-dependent people have few alternative sources of protein and income. These dependent people would be affected if the resource comes to total depletion as well as suffer from a total ban in hunting or trade, if no alternatives are provided.
- **Ecological impacts:** there is strong evidence illustrating that the scale of hunting poses a real threat to many Central African forest species. Local extirpations of hunted species are widespread, with West and Central Africa being particularly hard hit. The loss of keystone species through hunting reduces the resilience of the forest as a whole by disrupting ecological and evolutionary processes.
- **Health and infectious diseases:** bushmeat is a known reservoir of infectious pathogens, including HIV (which originated from SIV or Simian Immunodeficiency Virus), Ebola and monkey pox virus, but we still understand relatively little about the transfer dynamics of such infections. Parasitic and bacterial infection risks from wild meat consumption are also likely to be significant due to the inappropriate sanitary conditions under which transportation and storage occurs.

Despite the increasing international attention to the bushmeat issue, the available information on bushmeat harvest and trade is still fragmented and understanding of the complex interactions between the ecological, socio-economic and cultural dimensions is limited. Field studies are usually site or country-specific without follow-up or coordination among sites and disseminated either in unpublished reports or peer-reviewed articles that are not easily accessible to certain audiences. As a result, governments and other stakeholders do not have objective data generated at national and regional levels to support their management decisions. A number of international and regional framework agreements and policy forums now call for action. Since the 11th Conference of the Parties (COP-11) from the CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) in 2000, three Central African countries have developed or drafted National CITES Bushmeat Action Plans, namely Cameroon, Gabon and the Republic of Congo. From 2001 to 2005, FAO (Food and Agriculture Organization), supported the development of national bushmeat strategies. The Decision IX/5 at COP-9 from the CBD (Convention on Biological Diversity) in 2008 on Forest Biodiversity, urged Parties to address as a matter of priority major human-induced threats to forest biodiversity, including unregulated and unsustainable use of wildlife. Since 2008, the Observatory for the Forests of Central Africa (OFAC), with technical



Photo 6.2: The Douengui camp serves as the technical center for the Compagnie des Bois du Gabon logging concession and as an anti-poaching barrier

© Frédéric Spaulchne

support from TRAFFIC³⁶, is working to include wildlife and bushmeat issues more explicitly in their database through the development of a Central African Bushmeat Monitoring System (*Système de suivi de la filière Viande de Brousse en Afrique centrale* (SYVBAC) – box 6.1). The current edition of the State of the Forest is the first to include a chapter specifically on bushmeat. As an introduction to the bushmeat issue, this chapter aims at synthesizing the most relevant information available for the Congo Basin since the early 1980s. We will start by describing the species commonly hunted and traded as bushmeat. Second, we will focus on the role of bushmeat for food and income. Third, we will analyze the reasons behind bushmeat hunting, trade and consumption, especially in urban areas where other sources of protein are available. Finally, we will describe the impacts of hunting on wildlife populations and the broader forest ecosystem.



Photo 6.3: African rivers often abound with fish

Box 6.1: The development of a Bushmeat Monitoring System for Central Africa (SYVBAC): a multi-stakeholder participatory process coordinated by TRAFFIC

Nathalie van Vliet, Stéphane Ringuet
University of Copenhagen, TRAFFIC

Since 2008, TRAFFIC has been supporting a participatory process with key stakeholders for the development of a Central African Bushmeat Monitoring System (SYVBAC - *Système de suivi de la filière Viande de Brousse en Afrique centrale*). This system will provide a regular overview of the trends in bushmeat harvest and trade at the regional level through indirect indicators. To ensure the sustainability of SYVBAC over the long term, the monitoring system will function under OFAC, with the technical support from TRAFFIC for the development phase. TRAFFIC organized two technical workshops in Douala (Cameroon), in December 2008 and February 2010. In addition, a three day technical expert workshop was held in Libreville (Gabon) in June 2010 to facilitate the involvement of the private sector in the development and functioning of SYVBAC. Stakeholders involved in the development of SYVBAC represent the working expertise from six Central African countries in the region (Cameroon, Central African Republic, Congo, Democratic Republic of Congo, Equatorial Guinea and Gabon). The general objective of SYVBAC is to generate the information needed to support the development of policies and strategies that aim to bring the bushmeat trade down to sustainable levels. The specific objectives are to monitor: (i) the levels and the evolution of bushmeat use and trade in the region; (ii) the factors that influence bushmeat use and trade; (iii) the impacts of bushmeat trade on endemic/rare/protected species; (iv) the importance of bushmeat trade in national economies, poverty alleviation, nutrition and health of human populations. For indicators collected at the national level, SYVBAC will build partnerships with national bushmeat focal points. At the site level (villages, towns, community hunting zones, sports hunting areas, logging/mining concessions, protected areas and buffer zones), SYVBAC will build partnerships with NGOs, the private sector, local wildlife committees and universities or other scientific and technical institutes.

³⁶TRAFFIC: The wildlife trade monitoring network (<http://www.traffic.org>).

Species commonly hunted and traded

In Gabon alone, 114 recognized species have been recorded in hunter catches, household consumption and markets. This figure is very high compared to West African markets, where wildlife is already dramatically impacted. Mammals make up the majority of the harvest (about 90 % of species recorded) in comparison to birds (3 %) and reptiles (6 %).

Different mammal species are not hunted equally frequently. Rodents and ungulates usually represent more than two thirds of the carcasses

sold in urban markets or recorded from hunter catches in Central Africa (table 6.1). The most frequently hunted species are those between 2 and 22 kg, with brush-tailed porcupine (*Atherurus africanus*), blue duiker (*Cephalophus monticola*) and red duikers (other *Cephalophus* spp.) forming the majority of the catch in most forest areas. Blue duiker alone can account for about a third of the catch (Kümpel, 2006; van Vliet, 2008). The presence of other species depends on local circumstances as well as hunting techniques.

Table 6.1: Percentage of carcasses from ungulates, primates, rodents and other species in different hunting sites of Central Africa

Country	Site	Source	Ungulates (%)	Primates (%)	Rodents (%)	Other species (%)
DRC	Ituri forest	Hart, 2000	60 - 95	5 - 40	1	1
Gabon	Makokou	Lahm, 1994	58	19	14	9
	Dibouka, Baniati	Starkey, 2004	51.3	10.6	31	
	Dibouka, Kouagna	Coad, 2007	27	8.3	48.7	
	Ntsiete	van Vliet, 2008	65	23.5	9	
Congo	Diba	Delvingt <i>et al.</i> , 2001	70	17	9	4
	Oleme	Gally & Jeanmart, 1996	62	38		
	Ndoki and Ngatongo	Auzel & Wilkie, 2000	81 - 87	11 - 16	2 - 3	
CAR	Dzanga-Sangha	Noss, 1995	77 - 86	0	11 - 12	2 - 12
Equatorial Guinea	Bioko and Rio Muni	Fa <i>et al.</i> , 1995	36 - 43	23 - 25	31 - 37	2 - 4
	Sendje	Fa & Yuste, 2001	30	18	32	
	Sendje	Kümpel, 2006	35	16	43	
Cameroon	Dja	Dethier, 1995	88	3	5	4
	Ekim	Delvingt <i>et al.</i> , 2001	85	4	6	5
	Ekom	Ngnegueu & Fotso, 1996	87	1	6	6

Most mammal species (70 %) hunted for bushmeat in the Congo Basin are not listed as threatened on the IUCN Red List of Threatened Species (see box 3.2). Average extraction rates calculated for African forest mammals within each Red List category indicate that unthreatened species have the highest extraction rates. In Gabon, 23 of the partially protected species and 24 of the totally protected species were found to be used as bushmeat. However, rare and vulnerable species (e.g., great apes, elephants, okapis) usually represent a small proportion (often less than 5 %) of the total catch (Abernethy & Ndong Obiang, 2010; van Vliet *et al.*, 2010).

The nature of the offtake also varies depending on hunting technique, distance from the village and vegetation type. In north-east Gabon, secondary forests provide the greatest diversity of species (15 regularly hunted species, mainly blue duiker, rodents and small monkeys) compared to

other vegetation types (van Vliet & Nasi, 2008). Rivers and riverine forests provide prey like reptiles and ungulates (mainly water chevrotain (*Hyemoschus aquaticus*) and sitatunga (*Tragelaphus spekei*). Mature forests provide mainly medium sized ungulates such as red duikers and red river hogs, as well as small monkeys. Rodents and small ungulates (mainly blue duiker) predominate in agricultural areas and small carnivores and birds around roads. Differing hunting methods target different species, with guns being used for larger animals and arboreal species (Kümpel, 2006; Coad, 2007; van Vliet, 2008), and snares for relatively smaller and terrestrial prey, often used to protect farming plots. Strong positive relationships have been found between the distance from a village and both prey species body size (Coad, 2007; van Vliet, 2008) and catch per hunting effort (Kümpel *et al.*, 2010a), suggesting impacts of hunting on wildlife around settlements.

The role of bushmeat in the diet and incomes of people in the Congo Basin

In many rural areas of Central Africa, bushmeat is the main source of animal protein available (although fish is usually also available), and is cheaper than any source of domesticated meat. Even where it is more expensive than alternatives, bushmeat is essentially a “free” source of protein as it can be captured rather than purchased (Kümpel, 2006). As such, bushmeat plays an essential role in people’s diet. In rural commu-

nities, wildlife provides significant calories, as well as essential protein and fat. Even where bushmeat is used to satisfy basic subsistence requirements, many families also use hunting to supplement short term cash needs (table 6.2). For hunters, the distinction between subsistence and commercial use is often blurred given that meat from the forest supplements both diet and incomes (Kümpel *et al.*, 2010b).

Table 6.2: Bushmeat use in various communities

Country	Locally consumed (%)	Sold (%)	Source
DRC	10	90	de Merode <i>et al.</i> , 2003
CAR	27	73	Noss, 1995
	65	35	Delvingt <i>et al.</i> , 2001
Equatorial Guinea	57	34	Fa & Yuste, 2001
	10	90	Kümpel, 2006
Gabon	41	59	Starkey, 2004
	60	40	van Vliet, 2008
	56	44	Carpaneto <i>et al.</i> , 2007
Cameroon	36	64	Wright & Priston, 2010
	44	56	Solly, 2004
	34	40	Delvingt <i>et al.</i> , 2001
	63	15	Takforyan, 2001
	59	28	Takforyan, 2001
	68	14	Dounias, 1999
Congo	28	68	Delvingt <i>et al.</i> , 2001
	42	54	Delvingt <i>et al.</i> , 2001
	45	35	Delvingt <i>et al.</i> , 2001

Note: Total can be less than 100 % as there is a percentage of “loss” and “undetermined” use. Moreover, data come from different villages resulting in disparity between local consumption and sale in the same country and for the same source of data.



Photo 6.4: A moustached guenon (*Cercopithecus cephus*) hunted in CAR



Photo 6.5: A hunter returns from the forest

It is important to understand to what extent rural people depend on bushmeat, rather than simply use it, and would therefore suffer if the resource diminished (box 6.2). Many people depend on wildlife resources as a buffer to see them through times of hardship (e.g., unemployment, illness of relatives, crop failure), or to gain additional income for special needs (e.g., school fees, festivals, funerals) (Fa & Brown, 2009), and this “safety net” is often more important for the more vulnerable members of a community (Allebone-Webb, 2008; de Merode *et al.*, 2004). Barriers to access to hunting tools (guns, wires, ammunition) mean that in some cases it is the wealthier households in a community that benefit most from hunting (it is the case in DRC for example (de Merode *et al.*, 2004)). However, how bushmeat income is spent is important in judging its potential for poverty alleviation. Studies in Gabon, Equatorial Guinea and Cameroon have found that hunting incomes tend not to be reinvested back into the household but spent on non-necessities (Coad *et al.*, 2010; Kümpel *et al.*, 2010b; Solly, 2004).

By choosing a specific hunting technique and a specific hunting area, hunters target particular species with a view to whether they will be consumed or sold (Coad *et al.*, 2010; van Vliet & Nasi, 2008). They often choose to sell larger species (Abernethy & Ndong Obiang, 2010; Coad, 2007; Okouyi, 2006; Fa & Brown, 2009) or those preferred for their taste (van Vliet, 2008), and consume those carcasses that have little commercial value, including those which are rotten or taboo (Kümpel, 2006), leading to potentially significant biases in the characteristics of the market compared to local offtakes. Fishing, where possible, is also an important source of protein and income. Fishing often has higher investment costs than hunting, where nets or a boat may be required, but can replace hunting as a primary activity in coastal or riverine areas (Blaney, 2008; Abernethy & Ndong Obiang, 2010).

Box 6.2: The role of bushmeat in the livelihoods and food security of rural people in Equatorial Guinea

Noelle F. Kümpel

ZSL

Bushmeat is an important resource for rural people in the Congo Basin, as either a regular source of protein or income, or a safety net in times of hardship. However, it is important to understand the extent to which rural communities depend on bushmeat, and would therefore suffer with its demise. An evaluation of wildlife use and dependence within the context of other available livelihoods and foods was carried out in continental Equatorial Guinea, a country currently undergoing a dramatic economic boom. Household surveys and hunter interviews over 12 months in three villages with differing combinations of market and forest access enabled comparisons between communities, households and individuals.

At community-level, bushmeat was an important source of income (with nearly 90 % of men hunting), while wild plants were more important for consumption, particularly where limited market access increased prices of imported alternatives. Within a village, the poorest and most vulnerable households gained a significantly greater proportion of income and production from bushmeat, largely because of a lack of other livelihoods, and this increased in the lean season. Poorer households were least food secure (having higher “food insecurity” scores) and least livelihood secure (having fewer sources of income). At individual-level, hunting income benefited men more, and was less likely to flow back to the household. Median monthly income from hunting was however less than half that of preferred paid employment.

Bushmeat contributed significant value and income to all communities studied, suggesting it is an important component of the rural economy across the country. Forest and particularly market access were important factors in determining livelihood strategies. Critically, bushmeat was important for the poorest households, particularly as a safety net at vulnerable times. To ensure the sustainability of bushmeat hunting, policy needs to account for the true value of forests to the livelihoods of forest people, control commercial trade, manage forest access and offtakes, and also promote alternative livelihoods for potential commercial hunters.

Hunting for the commercial trade is probably the primary driver of the increasing levels of bushmeat offtake in Central Africa (Davies, 2002). In some of the highly urbanised nations such as Gabon, aggregate urban bushmeat consumption can be higher than aggregate rural consumption due to the higher population density of urban areas (Starkey, 2004), although *per capita* rural consumption across the region is on average 2 to 13 times greater than that of urban individuals (Wilkie *et al.*, 2005). A precise

evaluation of the quantity of wild meat consumed *per capita* is not easy to compare between sites from the published information for various practical and methodological reasons. It is clear, however, that consumption depends on the type, wealth and residence of consumers, with hunter-gatherers eating 50 to 216 g of meat daily, while general rural (e.g., farmers or logging company employees) and urban populations consume 40 to 260 g, and 3 to 120 g, respectively (table 6.3).

Table 6.3: Average daily bushmeat consumption in various communities (g/day)

Country	Site	Hunter-gatherers	Rural populations	Urban populations	Source
DRC	Ituri	160			Bailey & Peacock, 1988
	Ituri		120		Aunger, 1992
	Kiliwa		40		de Merode <i>et al.</i> , 2004
CAR	Mossapoula	50			Noss, 1995
	Ngotto		90		Delvingt <i>et al.</i> , 2001
	Bangui			39	Fargeot & Diéval, 2000
Cameroon	Campo	216	185		Bahuchet & Ioveva, 1999
	Campo	201	18 - 164		Koppert <i>et al.</i> , 1996
	Dja		75 - 164		Delvingt <i>et al.</i> , 2001
	Dja		171		Bahuchet & Ioveva, 1999
	Mbanjock			5	Bahuchet & Ioveva, 1999
Congo	Odzala		116 - 164		Delvingt <i>et al.</i> , 2001
Gabon	Libreville			3	Thibault & Blaney, 2003
	Libreville		50 - 260	20 - 120	Wilkie <i>et al.</i> , 2005
	Port-Gentil			8	Thibault & Blaney, 2003
	Oyem			24	Thibault & Blaney, 2003
	Makokou			39	Thibault & Blaney, 2003
	Gamba			94	Thibault & Blaney, 2003

Source: Modified from Nasi *et al.*, 2008



© Grégoire Dubois

Photo 6.6: An African python coiled on a log in Loango National Park, Gabon

Bushmeat consumption in urban areas

Urban consumers usually have the choice of several sources of protein but opt for bushmeat for a variety of reasons (e.g., cost or taste) that vary between regions. In Kisangani (DRC) and Bangui (CAR – box 6.3), consumers typically buy bushmeat as it is the cheapest or most available form of meat although not necessarily the most preferred (van Vliet *et al.*, 2010; Fargeot, 2010). In CAR, the poorest urban families often buy smoked bushmeat as the most available and cheapest source of protein, often from the less expensive species, and consume it in very small quantities per day (Fargeot, 2010). In other Central African towns, bushmeat is among the most expensive sources of protein. For the wealthiest families in Libreville or Yaoundé, the incentives for bushmeat consumption do not only depend on availability and prices. In urban Gabonese towns, the wealthiest households consume less bushmeat per person per day than poorer house-

holds, but are less sensitive to prices and often choose fresh wild meat (rather than smoked) and the more expensive species (porcupine, red river hog (*Potamochoerus porcus*) or python) (Knights, 2008). Schenk *et al.* (2006) analyzed taste choices in Gabon, reporting that consumers differentiate amongst bushmeat species and that wildlife cannot be treated as a generic food source. In urban Equatorial Guinea, the most preferred foods are all fresh fish or bushmeat species, red snapper (*Lutjanus campechanus*), porcupine and blue ducker, whereas the top three most consumed foods are frozen mackerel, frozen chicken and frozen pork due to their lower cost (Kümpel, 2006). The price of bushmeat in comparison to other sources of protein affects bushmeat consumption. Wilkie *et al.* (2005) showed that changes in the price of fish affect bushmeat consumption where fish and bushmeat are substitutes.

Box 6.3: Analysis of bushmeat consumption in Bangui

Christian Fargeot
CIRAD

A study of the determining factors for bushmeat consumption in Central African urban areas and the economic importance of this sector was carried out in March 2008. Findings were based on a survey of 1,000 households in Bangui, the capital of the Central African Republic (CAR).

An analysis of households' purchases of protein revealed the importance of beef (40 % of purchases), followed by fish (24 %) and then bushmeat (22 %); smoked meat (17 %) being much more consumed than fresh bushmeat (5 %).

From a religious perspective, only Muslims, for whom it is strictly forbidden (and, to a lesser degree, Jehovah's Witnesses), do not eat bushmeat. From an ethnic perspective, the Foulbés, who are largely Islamist, also do not eat bushmeat. All other religious and/or ethnic groups in CAR are large consumers of bushmeat.

The purchasing power of households determines consumption. The rich buy more bushmeat than the poor. However, relatively, bushmeat is a higher percentage of the protein purchases of the poor for whom bushmeat, especially when smoked, forms an essential part of the food rations. This can be explained by the relative cost of various proteins, expressed in terms of fresh biomass weight: smoked products (caterpillars, fish and bushmeat) are much cheaper than fresh products.

Based on data from this survey the annual total consumption of bushmeat in Bangui is estimated at 8,000 tons of fresh biomass, with an average of 10 kg of biomass consumed per person per year. The total value of bushmeat consumed per year in Bangui is estimated at CFA 8.3 billion (\$ 16 million), which amounts to 1.2 % of the GDP of CAR.

Besides the economic factors that drive demand for bushmeat, cultural factors also explain bushmeat consumption patterns. East *et al.* (2005) used a study of consumption and preferences in Bata, Equatorial Guinea, to indicate that besides income, ethnicity and nationality are key determinants of bushmeat consumption. In Bata (Equatorial Guinea) and in Bangui (CAR), purchasers of fresh domestic meat are more likely to be Muslims originating from neighboring countries whereas bushmeat consumers are most likely to be from local ethnic groups (East *et al.*, 2005; Fargeot, 2010). The Equatoguinean consumers preferred fresh meat or fish (not just bushmeat) over frozen meat and fish types, often citing health reasons. Some authors have also shown that a cultural preference for bushmeat encourages consumers to pay high prices for bushmeat (Bahuchet & Ioveva, 1999; Trefon & de Maret, 1999). For example, King (1994) suggests that in urban areas of western Cameroon the rate of consumption seems predominantly dictated by preference or taste rather than a lack of alternatives. Chicken, beef, pork and fish are commonly available in urban restaurants and from street corner “chop stalls” at cheaper prices than bushmeat. In Gabon, familiarity with the taste of bushmeat

due to childhood experience is clearly a major factor in determining preference (Starkey, 2004). In Gabon again, bushmeat is associated with the village, with rituals and with ceremonies, such as men’s circumcision ceremonies (Angoué *et al.*, 2000; van Vliet & Nasi, 2008). The traditional role of bushmeat has also been shown in Equatorial Guinea, where some species are considered to have magical or medicinal properties that increase their value and others are taboo (Kümpel, 2006). Taboos on certain foods are widespread in parts of Central Africa (Okouyi, 2006; van Vliet & Mbazza, 2011). Taboos can be specific to a tribe, clan, family or individual, and can relate to hunting as well as consumption. Taboos do not necessarily reduce the level of hunting of a species (especially when non-specific hunting methods are used) but do reduce their trade value. For example, yellow-backed duikers (*Cephalophus sylvicultor*) can be accidentally hunted in villages near Makokou, but the meat is never consumed by the young people in the village and never sold in the bushmeat market of Makokou (Okouyi, 2006; van Vliet, 2008). However, local taboos can break down where trade to other regions or to other tribes is possible (e.g., the trade in apes in Equatorial Guinea (Kümpel, 2006)).



Photo 6.7: Hunters often spend several days in basic shelters in the heart of the forest

Long term ecological impacts of hunting

Impacts on wildlife populations

Data from African sites indicate significant drops in mammal densities between un hunted and hunted sites: 13 to 42 % reduction in DRC (Hart, 2000), 44 % in CAR (Noss, 2000) and 43 to 100 % in Gabon (Lahm, 1994; van Vliet, 2008). As hunting pressure becomes heavier, primate numbers may drop almost tenfold (Oates *et al.*, 2000) and carnivores are significantly affected (Henschel *et al.*, 2009). Hunting is also a major cause of a reported 50 % decline in apes in Gabon within two decades (Walsh *et al.*, 2003). Interpretation of these data is however difficult since information on the influence of habitat type and past hunting pressures is not often available.

Thus, major drops in mammal densities are more likely to occur in previously un hunted areas than in areas that have gone through a long history of hunting pressure. The rapid decline of fauna after intensive periods of hunting has also been suggested by market studies in Bioko, Equatorial Guinea (Fa *et al.*, 2005). Overall numbers of carcasses decreased by 23 % between 1991 and 2005, while revenue increased by 35 % and the proportion of carcasses of smaller species, such as rodents and the blue duiker, also increased (Fa *et al.*, 2005). This suggests a dramatic reduction in presence of the larger species: Ogilby’s duiker (*Cephalophus ogilbyi*) and diurnal primates.

Species are impacted by hunting pressure to different extents. Indeed, some appear very vulnerable while others appear relatively unaffected. Larger-bodied, longer-lived species with low intrinsic rates of population increase, such as large primates, large carnivores, elephant (*Loxodonta africana*) and yellow-backed duiker are less resilient to hunting than species with high intrinsic rates of population increase such as rodents and small to medium-sized duikers. The black colobus (*Colobus satanas*) was found to be more vulnerable to over-hunting in Equatorial Guinea (Kümpel *et al.*, 2008), perhaps because it is an easy target owing to its relative inactivity and large body size (Brugiere, 1998). In areas where larger species have been significantly depressed, abundance of small and medium-sized species can remain unaffected or even increase. For example, the small-sized blue duiker is significantly less abundant in remote forests inside the Ivindo National Park than in hunted areas close to Makokou with similar vegetation cover, while the larger red duikers such as Peter's duiker (*Cephalophus callipygus*) and bay duiker (*Cephalophus dorsalis*) are less abundant or even depleted in those same hunted areas (van Vliet, 2008; van Vliet *et al.*, 2007). The explanation may be that abundance of resilient species may rise if their competitors are harvested, known as “density compensation”

(or under-compensation) (Peres & Dolman, 2000). Suggestions of density compensation have been made in Korup forest monkey communities, in Cameroon, with relation to increases in putty-nosed guenons (*Cercopithecus nictitans*) in heavily hunted sites (Linder, 2008).

Population age structures and demographics of hunted *vs* non-hunted sites are rarely available but studies in Gabon in the late 1980s (Dubost, 1980) concluded that hunting and trapping most severely affect young adult chevrotains and duikers, the age class with the greatest reproductive potential. Hart (2000) found that duiker dispersal rates in DRC were higher in a hunted than unhunted area, and concluded that dispersal was potentially important in maintaining small ungulate populations under exploitation; as expected under “source-sink” theory, the dispersal capacity of species may also explain the high and localised hunting offtakes over the long term observed in a rotational hunting system in Equatorial Guinea (Kümpel *et al.*, 2010a). Recent results from the Republic of Congo, however, showed that animals' dispersal rates do not appear to be greatly increased by hunting pressure (Mockrin, 2009). Building a fuller understanding of animal population demography under hunting, including dispersal, is essential for management efforts.



Photo 6.8: Great blue touracos (*Corythaeola cristata*) are actively hunted for meat and feathers

Long term impacts of hunting on ecosystems

The loss of animals from forest ecosystems results in the disruption of ecological and evolutionary processes, as a result of changes in species composition and probable reduction in biological diversity (Emmons, 1989; Redford, 1992). Most of the evidence for this comes from case studies in the Neotropics³⁷, with a paucity of relevant studies conducted in the Congo Basin. Predicting the long-term influences of hunting on the ecosystem remains a tremendous challenge, but the Neotropical studies already show that reduced mammal densities can result in severe ecosystem changes and cascading effects on the entire food web. Although every organism contributes to ecosystem processes, the nature and magnitude of individual species' contribution varies considerably. Most ecosystem processes are driven by the combined activities of many species. Plant regeneration (affected by the loss of pollinators, seed dispersers and seed predators), food webs (affected by the loss of top predators or of their prey), and plant diversity (affected by a change in herbivores patterns or an increase in pests) are amongst the various processes dependent upon the presence of fauna. Therefore activities such as hunting have the potential to impact not only targeted species but the ecosystem more broadly.

“Keystone species”, “ecosystem engineers”, or organisms with high community importance value are species or groups whose loss is expected to have a disproportionate impact on the ecosystem compared to the loss of other species. As hunters preferentially select large animals, which are often keystone species, the local extinction of these animals results in dramatic changes to eco-

systems. Top predators (e.g., large cats, raptors, crocodiles) impact biodiversity by facilitating the access to resources that would otherwise be scarcely available to other species (e.g., carrion, safe breeding sites) or by initiating a trophic cascade (Terborgh & Estes, 2010). Local extinction of these predators can trigger large changes in prey populations, which in turn dramatically alters browsing or grazing to the point where large regime shifts or ecosystem collapse happen. Elephants and other mega-herbivores can play a major role in modifying vegetation structure and composition through their feeding habits (including differential herbivorous behavior and seed dispersal) and movements in the forest (killing a large number of small trees). Their impact has in some cases appeared to be positive (Goheen *et al.*, 2004), in others negative (Guldmond & Van Aarde, 2008), but they do have a strong impact on vegetation dynamics. Ungulates such as wild pigs and duikers are among the most active seed dispersers or predators; thus a significant change in their population densities will have a major effect on seedling survival and forest regeneration.

Human extractive activities in tropical forests (including but not restricted to hunting) are therefore disruptive processes and can trigger numerous effects, not yet fully understood, which will in turn alter, in a more or less significant way, the overall function, structure and composition of the ecosystem. As forest resilience is dependent upon all these processes and functions, it is very likely to be impacted by the loss of biodiversity linked to the direct and indirect impacts of defaunation (Thomson *et al.*, 2009).

³⁷Neotropics (or Neotropical zone) include South and Central America, the Mexican lowlands, the Caribbean islands, and southern Florida.



Photo 6.9: African rivers are a source for freshwater shellfish

Conclusions

Increased hunting pressure has tangible effects on wildlife and is likely to have long term impacts on forest ecosystems. As it is expected in hunted areas, the abundance and composition of mammal assemblages differ from unhunted areas. However, the abundance of several hunted species can decline without necessarily indicating unsustainability. The most resilient species are often able to adapt to hunting pressure, either by modifying their biological parameters and their ecology or by taking the niche left empty by the most vulnerable species. Despite long and continuous sustained heavy harvesting, some bushmeat species continue to thrive in natural and modified habitats. Multiple studies suggest that the brush-tailed porcupine and the blue duiker are highly resilient

to hunting. Thus, high harvesting pressure should not always be equated with local extinction. On the other hand, many vulnerable species such as elephants and great apes, although not representing high percentages in the hunter's catch, have declined or become locally depleted due to hunting. In addition, very little is still known for the majority of other Central African hunted species that are partially or totally protected. The effects of hunting on those species need further investigation, with a particular focus on the impacts of hunting at varying spatial and temporal scales and under different hunting techniques, to provide objective information for sustainable wildlife management.

Photo 6.10: Fishermen on the edge of Lake Maiï Ndombe in the DRC



Bushmeat plays a crucial role in the diets and livelihoods of rural and urban people in Central Africa. Bushmeat serves multiple roles at the hunter level and remains a major source of protein and income in most rural areas. The distinction between subsistence and commercial hunting is blurred, particularly where rural areas are well integrated in the cash economy, but also because often bushmeat is the most valuable tradable commodity for remote communities. However, there remains a lack of detailed empirical evidence concerning the role of bushmeat within the rural household economy, and in maintaining the food and livelihood security of different forest-dependent communities. Such an understanding is needed to formulate an appropriate policy response to the bushmeat issue for the benefit of both local livelihoods and forest ecosystems.

The increasing trade from rural to urban areas is the main driver of unsustainable levels of bushmeat hunting in Central Africa. Even where urban consumers have access to domesticated sources of meat, bushmeat remains an important item of their diet. Indeed, bushmeat serves multiple functions over and above the purely consumptive. There are cultural, spiritual and taste preferences that override predictions and patterns of behavior captured in economic models. Moreover, in some urban towns, bushmeat remains the cheapest source of protein. As such, with Central African nations becoming increasingly urbanised, there is no guarantee that demand for bushmeat will decline. However, preferences are relatively elastic, and there is generally no particular demand for protected and vulnerable species, with the more common species (such

as brush-tailed porcupine or giant pouched rat) often being the most highly valued for their taste or their cultural value. There is thus hope for the sustainability of the trade if it can be restricted to the more resilient species, supplemented by the production and marketing of acceptable alternatives (such as fresh meat and fish) at an appropriate scale.

The reasons behind bushmeat consumption are complex and integrate factors that should not be disregarded in efforts to promote the sustainable levels of bushmeat hunting. More particularly, a clear understanding of consumer preferences for both wildlife and alternatives is needed before any efforts to develop alternative protein sources are started. As demand from the increasing urban population in Central Africa increases, the target for awareness-raising campaigns should shift from rural to urban settings with innovative

messages and approaches that take into account Central African perceptions of wildlife. The Convention on Biological Diversity (CBD) and the report of its Liaison Group on Bushmeat recognizes that existing policies and legal frameworks related to hunting are unpractical or unfeasible, provide unrealistic approaches for enforcement, and ignore the economic and nutritional value of bushmeat (Nasi *et al.*, 2008). As such, multidisciplinary approaches are needed to combine a better knowledge of the use and trade of bushmeat, the strengthening of legal frameworks, the provision of food and livelihood alternatives and the sustainable use of wildlife. None of these alone appear to be able to solve the so-called “bushmeat crisis”, but combined and incorporated into solid national and regional bushmeat strategies, there is potential to achieve a more sustainable use of wildlife for food in Central Africa.