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Conserving and Eating Wildlife in Africa

Dr. David S. Wilkie
Dr. Michelle Wieland

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Cover photograph: Bushmeat transported on a logging company vehicle in the SFAC concession in Northern Republic of Congo.
John Sidle



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Executive summary

In Africa, there is growing interest amongst donors and governments to invest in efforts that attempt to both conserve and simultaneously eat wildlife. Except in a very few situations we do not believe that today and in the future wildlife can contribute a substantial and sustainable portion of animal protein in peoples' diets in sub-Saharan Africa.

Humans have been eating wildlife in Africa since before our lineage separated from other apes over 6 million years ago. Today, wildlife are hunted in both forested and savannah regions as a source of meat and income, to control agricultural crop pests, to reduce perceived threats to livestock and human safety, and as trophies. Where hunting pressure is high and unregulated, it is a far more immediate threat to wildlife populations than is habitat loss. Unsustainable hunting has now created huge areas of empty forests (Redford 1992; Wilkie et al. 2011) and savannas (Durant et al. 2013; Lindsey et al. 2013) and has caused the loss of the vital ecological roles wildlife play in the functioning of these ecosystems (Abernethy et al. 2013; Beaune 2015; Beaune et al. 2013; Durant et al. 2013; Effiom et al. 2014; Effiom et al. 2013; Galetti & Dirzo 2013; Nunez-Iturri & Howe 2007; Ripple et al. 2015). It also jeopardizes the dietary health, wellbeing and cultural identities of poor, isolated, and politically marginalized indigenous people like the Mbuti and Efe of the forests of DR Congo, and the Hadza of Tanzania.

Evidence shows that sustainable offtake of wildlife from tropical forests is approximately 150 kg/km²/year (Robinson & Bennett 2000). If we assume that 65% of live weight of harvested wildlife is edible (Hill & Hawkes 1983) then tropical forests can produce sustainably about 97kg of wildlife meat per square kilometer each year. If the average human adult needs approximately 0.25/kg/day of meat to remain healthy (91kg/person/year) then terrestrial tropical forest wildlife can meet human protein needs only when human population density is about 1 person per square kilometer (Robinson & Bennett 2000). Tropical savannas are only about an order of magnitude more productive

than tropical forests thus sustainable offtake rates for savanna wildlife could meet the dietary needs of a human population not much greater than 10 people per square kilometer (Robinson & Bennett 2000).

In 2014, human population density in the nations of sub-Saharan Africa averaged 90 people per square kilometer (UNDP 2014). No forested nation in sub-Saharan Africa has a current population density lower than 1 person per square kilometer, and only 4 (Botswana, Central Africa Republic, Gabon, and Namibia) have a population density below 10 people per square kilometer (www.indexmundi.com). That means that today only Botswana and Namibia may be able to provide a substantial portion of their human population with meat derived from wildlife, no other nations can do this.

Before the advent and spread of agriculture about 10,000 years ago, fewer than a hundred thousand humans lived in Africa (Schiffels & Durbin 2014) and they had little impact on the populations of wildlife they hunted and ate. By 1950, there were 150 million people in Africa. Today it is 1.186 billion, a seven fold increase in 65 years. Demographers project that the world's human population will grow from 7 billion to 9 billion by 2040 and possibly as high as 11 billion before stabilizing around 2050 (UN 2015). Present fertility rates indicate that the majority of these additional people will be born in sub-Saharan Africa. By 2050 1 in 4 people will be African.

Agricultural lands are currently expanding to feed Africa's rising human population a trend that will only accelerate in the coming decades. Intact habitat for wildlife will see a matching decrease. With more mouths to feed and likely continued declines in poverty, demand for dietary protein in Africa will sharply increase in the future. Given the shifts in demographics, protein demand, and wildlife habitat expected over the next 20-30 years, wildlife cannot be expected to play

anything but a minor and decreasing role in feeding people in Africa moving forward. Today where human population density is over 100 people/km² wildlife has almost completely vanished from the “menu.”

Wildlife today provides some urban consumers in Africa with the occasional dietary treat that offers a culturally valued connection to a rural past. Even this requires traders to “cast their nets” further and further afield to find sources of bushmeat –indicating that wildlife have been hunted out near to big cities. To prevent an ever increasing circle of wildlife depletion, urban consumption of animal protein will need to transition rapidly to domestic livestock and farmed fish produced in peri-urban areas. Even rural areas will need to rely far more on domestic livestock and farmed fish if they are to meet their dietary protein requirements and avoid driving wildlife to local extinction. Only where local human populations are very sparse and communities have formal legal rights to the exclusive use of wildlife on their lands and the capacity to enforce these rights, might people continue to feed themselves to some extent by eating wildlife (e.g., Namibia’s community conservancies).

It is true that there are still some places in sub-Saharan Africa where wildlife are an important source of food and a valuable source of income. Then again so were Passenger Pigeons in the eastern United States in the 1860s and 1870s. But in both cases these benefits were the fleeting result of harvest rates that were profitable but ecologically unsustainable and thus short-lived. The last Passenger Pigeon seen in the wild was on March 22, 1900. Current rates of hunting of wildlife for food in sub-Saharan Africa are roughly 30 times higher than is sustainable. When demand and supply are so out of balance, hunting and eating wildlife will follow a boom-bust cycle and cannot be a mechanism for sustainable development.

Any way forward in sub-Saharan Africa will require a mix of effective protected area management, helping local communities to secure rights over and manage sustainably their traditional lands and resources, support industrial chicken production in peri-urban areas that is at a scale large enough to meeting urban demand, provide incentives to rural families to intensify their live-

stock production systems, and strengthen enforcement of laws to protect the most at risk and endangered wildlife species such as Great Apes and Elephants.

Regardless of whatever mix of solutions best addresses the local context, we need to take action now to prevent Africa's wildlife going the way of the Passenger Pigeon whose billions were, almost unfathomably, eaten to extinction.

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Section 1: Introduction

Unsustainable hunting of wildlife for food risks: a) loss of an important source of dietary protein and income for many of the poorest families across sub-Saharan Africa (Bennett et al. 2007; Nasi et al. 2011), and b) emptying Africa's forests and savannas of their wildlife and the loss of the important ecological roles these wildlife species play in the functioning and productivity of these ecosystems (Abernethy et al. 2013; Effiom et al. 2013; Lindsey et al. 2011; Nunez-Iturri & Howe 2007).

Both the drivers of and solutions to unsustainable bushmeat hunting are largely known (Foerster et al. 2012; Forget & Jansen 2007; Laurance et al. 2006; Lindsey et al. 2013; Wilkie & Carpenter 1999; Wilkie et al. 2005; Wright et al. 2007), and they vary according to biome, market access and availability of substitutes, human population density and urbanization, and wildlife use rights and governance. This paper explores what we know current about the challenges to conserving and eating wildlife in Africa and offers some practical policies and practices to address these issues in both rural and urban contexts across Africa.

Background

Humans have been eating wildlife in Africa since before our lineage separated from other apes over 6 million years ago. Today, wildlife are hunted in both forested and savanna regions as a source of meat and income, to control agricultural crop pests, to reduce perceived threats to livestock and human safety, and as trophies (Bennett et al. 2007; Lindsey et al. 2013; Nasi et al. 2008; Wilkie et al. 2011). Where hunting pressure is high, it is a more immediate threat to wildlife populations than is habitat loss (Wilkie et al. 2001). Unsustainable hunting not only creates empty forests and savannas and causes the loss of the vital ecological roles wildlife play in the functioning of

these ecosystems (Abernethy et al. 2013; Effiom et al. 2013; Wilkie et al. 2011), it jeopardizes the health and wellbeing of indigenous groups and poor rural families (Bennett et al. 2007; Nasi et al. 2011).

Efe hunter DR Congo. © Wilkie/WCS



Current hunters and consumers

Hunter-gatherers: In central, east and southern Africa small, isolated bands of nomadic hunter gatherers still are able to meet their dietary protein needs exclusively from hunting and eating wildlife (Bogin 2011; Hewlett 2014; Kelly 2013). Though their current nutritional status suggests they are not the original “affluent society” (Bogin 2011). Camps move when hunting returns decline and only return when wildlife populations recover (Kelly 2013). Hunting of all wildlife species can be sustainable when the hunters are few in number and they range across large landscapes that they defend as “their” exclusive territory. This can change quickly to become unsustainable if they switch, as some are doing in central Africa, from being bushmeat consumers to bushmeat traders to supply local or distant markets (Inogwabini 2014; van Vliet et al. 2007).

Village farmers: Across Africa many sedentary rural people still supplement their diets by eating wildlife (Alexander et al. 2014; Foerster et al. 2012; Rentsch & Damon 2013; Schulte-Herbruggen et al. 2013). Their repeated hunting in the same area typically depletes large-bodied wildlife close to home (Coad 2008; Muchaal & Ngandjui 1995; Ngnegueu & Fotso 1998; Van Vliet & Nasi 2008). This means that only small-bodied species that reproduce rapidly and are more resilient to hunting pressure are readily available in or near farmers’ fields to be hunted for food. Large-bodied species might still exist but at less accessible distances from hunter’s homes (Kumpel et al. 2010; Ngnegueu & Fotso 1998). Bushmeat can constitute as much as half of annual protein requirements but is usually much less than this particularly in geographies where wildlife have already been severely depleted or where livestock

production is common (East et al. 2005; Foerster et al. 2012; Schulte-Herbruggen et al. 2013).

Urban families: Where commercial hunters take wildlife from state lands, they typically do so illegally and with little risk of arrest. In this situation, where access by commercial hunters is not restricted and the bushmeat goes for sale in markets located in urban areas, almost all wildlife are rapidly extirpated from the hunted area (Cowlshaw et al. 2005; Gill et al. 2012; Maisels et al. 2001; Wilkie et al. 2011). This leaves landscapes largely empty of animals, and the forested and savanna ecosystems absent wildlife's critical seed-dispersing and ecological engineering functions (Effiom et al. 2013). For most urban families bushmeat is a luxury good that constitutes a small portion of annual dietary protein (Bachand et al. 2015; Barnett 2000; Lindsey et al. 2012; van Vliet et al. 2011; Wilkie & Carpenter 1999; Wilkie et al. 2005). The marginal role of bushmeat in the diets of urban families contributes to their lack of awareness of the aggregate impact of urban bushmeat consumption on wildlife (Nasi et al. 2011; van Vliet et al. 2012). In some isolated urban areas that grew rapidly in size during periods of conflict, and that are close to areas with still abundant wildlife, bushmeat and wild caught fish often remain the principal sources of animal protein available to many families (van Vliet et al. 2011; van Vliet et al. 2012; van Vliet et al. 2015).

Economic drivers

Bushmeat markets and household income

Selling and trading wildlife as food is attractive as an economic enterprise, particularly in enclaved areas isolated from markets (Fa et al. 2003; Fa et al. 2006; Kumpel et al. 2010; Nasi et al. 2011; Van Vliet & Nasi



Daily catch of a commercial hunter. © Wilkie/WCS



2008; Wilfred & MacColl 2010). In places where high transportation times, costs or constraints (i.e., when hunters have to head-carrying produce to market) make the sale of agricultural commodities uncompetitive or impossible, trading bushmeat makes economic sense (Willcox & Nambu 2007), because the value to weight ratio of bushmeat is higher than agricultural crops, and smoked bushmeat is relatively durable without refrigeration (Bennett et al. 2007; Wilkie et al. 2011). Where distance to markets is short, selling agricultural commodities makes more sense because farm production can be more easily increased to match demand, and farmers unlike hunters own their crops and can legally exclude others from harvesting them.

Participation in an unregulated bushmeat trade is initially lucrative when wildlife are abundant and can involve relatively large numbers of families. As wildlife stocks get depleted the value of the market declines as does the number of families the market can support (Barnes 2002; Bassett 2005; Cowlshaw et al. 2005; Fa et al. 2015).

Role of Prices and Wealth in Consumer Demand for Bushmeat in Gabon, Central Africa

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Abstract: *Unsustainable hunting of wildlife for food is often a more immediate and significant threat to the conservation of biological diversity in tropical forests than deforestation. Why people eat wildlife is debated. Some may eat bushmeat because they can afford it, others may eat it because it is familiar, traditional, confers prestige, tastes good, or adds variety. We completed a survey of 1208 rural and urban households in Gabon, Africa, in 2002-2003 to estimate the effect of wealth and prices on the consumption of wildlife and other sources of animal protein. Consumption of bushmeat, fish, chicken, and livestock increased with increasing household wealth, and as the price of these commodities rose, consumption declined. Although the prices of substitutes for bushmeat did not significantly, in statistical terms, influence bushmeat consumption, as the price of wildlife increased and its consumption fell, the consumption of fish rose, indicating that fish and bushmeat were dietary substitutes. Our results suggest that policy makers can use economic levers such as taxation or supply reduction through better law enforcement to change demand for wildlife. These measures will help to regulate unsustainable exploitation and reduce the risk of irreversible loss of large-bodied and slow-reproducing wildlife species. If policy makers focus solely on reducing the unsustainable consumption of wildlife, they may see adverse impacts on the exploitation of fish. Furthermore, policy makers must ensure that raising household wealth through development assistance does not result in undesirable impacts on the conservation status of wildlife and fish.*

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urban consumer eat bushmeat as an occasional treat, as it is typically more expensive than substitutes (Wilkie et al.

Price matters

Evidence shows that consumers are price sensitive and that bushmeat has a negative price elasticity of demand (Apaza et al. 2002; Fa et al. 2009; Godoy et al. 2010; Wilfred & MacColl 2010; Wilkie & Godoy 2001). This means that consumption tends to decrease with increasing price. This explains why bushmeat is chosen by rural consumers when it is the cheapest meat in the marketplace (Rentsch & Damon 2013), and why

2005). We also know that consumers treat both fresh and salt-water fish as dietary substitutes for bushmeat (Brashares et al. 2004), and when the price of fish increases so too does bushmeat consumption (i.e., there is a positive cross-price elasticity of demand). Lastly, there is evidence that consumption of bushmeat follows an inverted U (i.e., Kuznets curve) with household income (Wilkie & Godoy 2001). As price conscious poor households get wealthier they can afford to eat more meat so bushmeat consumption rises initially with income. When households reach a certain income threshold they switch to eating the typically more preferred and expensive meat from domesticated livestock, and bushmeat consumption falls.



<http://naturalistsnotebook.mnapage.info/>

How the regions differ

It should not be a surprise that nations across the continent of Africa vary in ways that raise different concerns and offer different opportunities when attempting to conserve and eat wildlife.

West Africa

Nations like Ghana, Ivory Coast, and Guinea are all examples of post-depletion bushmeat markets. This means that most large-bodied wildlife species populations have been dramatically reduced in numbers with many extirpated. Bushmeat primarily consists of small r-selected species that are relatively resilient to hunting pressure (e.g., cane rat, brush-tailed porcupine, blue duiker). Demand for and hunting of these r-selected species has, in some places, largely reached a stable equilibrium (i.e., where hunting is sustainable for small-bodied species). In others, demand is depleting even small-bodied, r-selected species and the catchment area for bushmeat markets is expanding (Cowlshaw et al. 2005). Rural communities (~50% of the population) continue to eat bushmeat, often trapped in or at the edges of agricultural fields, and for the urban consumer bushmeat is an infrequently eaten "treat" (Wilkie & Lee 2004). Livestock production tends to be largely restricted to the drier, grass-

lands in the north. Outside of urban areas land and resource tenure remains largely vested in the state.

Central Africa

Nations like Cameroon, Gabon, Congo and DR Congo still have blocks of forest with relatively intact assemblages of wildlife that are hunted as bushmeat (Fa & Brown 2009; Wilkie & Carpenter 1999). Some areas of DR Congo and parts of Cameroon with higher human population densities and more intensive hunting more resemble the post-depleted areas typical of west Africa (deMerode & Cowlishaw 2006; Maisels et al. 2001). Most are highly urbanized with over 70-80% of the population living in cities. DR Congo is the anomaly with most people still living in rural areas. Evidence from Gabon shows that overall consumption of bushmeat is roughly equal in urban and rural areas, because the sparse rural population depends on bushmeat for the most of their dietary protein whereas for urban consumers bushmeat only provides about 2% of annual protein requirements and is a basically an infrequently consumed luxury or treat (Abernethy et al. 2002; Wilkie et al. 2005). Livestock production is largely limited to grasslands in the north of Cameroon and in the south and north of DR Congo. Lack of veterinary care results in high morbidity and low productivity of household livestock (Devereux 2014). Land and resource tenure remains almost exclusively vested in the state.



We are “kuku” about chicken

Eastern and Southern Africa

Nations like Kenya, Uganda, Tanzania, Zambia, Mozambique and Namibia have typical larger human populations. Bushmeat remains a source of animal protein in the diets of rural families but is typically extremely rarely eaten in urban areas (Barnett 2000; Lindsey et al. 2013). Industrial scale production of eggs and chicken (e.g., KenChic) and large scale, smallholder production of cattle, sheep and goats means that meat from domesticated animals is relatively readily available in both rural and most particularly urban areas. For Mozambique land and resource tenure remains

largely vested in the state. In Kenya, Uganda, Tanzania, Zambia and most fully Namibia, the state has begun to devolve rights to benefit from wildlife (Child 2013) and the authority to manage or co-manage wildlife to local communities (e.g., community conservancies and Wildlife Management Areas).

Section 2: Challenges

There are three principal barriers to conserving wildlife when bushmeat is an important source of food and income for some families in Africa.

Bushmeat is a state-owned, poorly governed, open-access resource

Across Africa wildlife is typically a state-owned resource (i.e., a public good) and governing access to and uses of wildlife is largely vested in the state (Kabiri & Child 2014). Most communities who live with wildlife typically have no rights to the wildlife on lands they have traditional claims over, and have no rights to exclude others from taking wildlife on “their” lands. As a result most hunting of wildlife for food or sale is illegal from a state law enforcement perspective and thus most hunters are considered poachers (Gibson 1999). That said, many if not all “poachers” would argue that their hunting is legitimate according to customary law and rights (Child 1996; Wilkie et al. 2010). Though most hunting is illegal, most states are too weak or disinterested to enforce national wildlife laws.

As a result, hunters who break national laws that specify who can hunt, what, where, when and how many wildlife, have little fear of being arrested, let alone prosecuted and punished (Wilkie et al. 2010). This ironically results in a scofflaw culture – where people break the laws with impunity and sense that national laws are mostly illegitimate. As



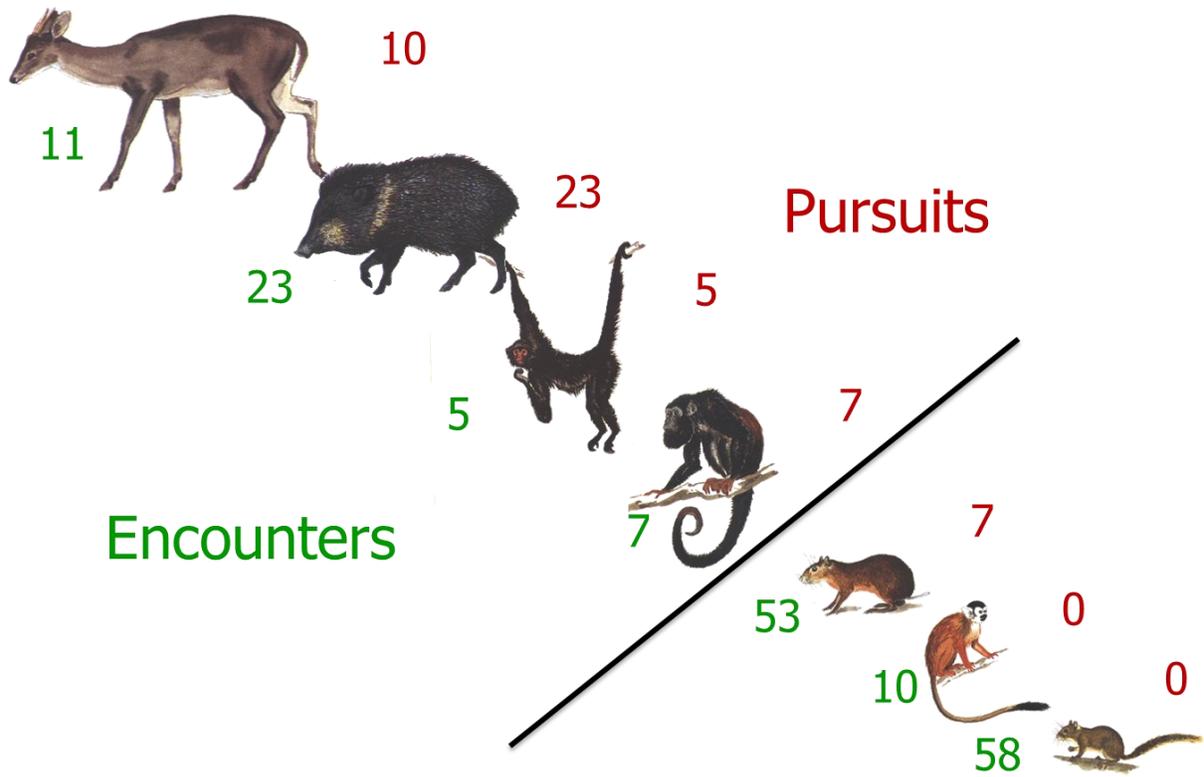
Policeman poaching in Gambia © Wilkie/WCS

both community and commercial hunters do not have the rights to exclude others from hunting, they are perversely motivated to take as many animals as they can as quickly as they can, because if they do not, someone else will. The result is unsustainable hunting for bushmeat and the depletion of an economically and ecologically valuable natural resource.

Even where the state has devolved rights to local communities to reap all the economic benefits from wildlife (i.e., the conservancies of Namibia and Kenya, and the Wildlife Management Areas of Tanzania) the state still retains ownership rights (Jones et al. 2015). Evidence from community conservancies shows that when people benefit tangibly from the wildlife on their land, they feel that poaching is stealing from them and are highly motivated to police their own community members to conform to wildlife conservation regulations, and provide actionable intelligence to national arresting agencies on outsiders they observe coming to steal their wildlife (Silva & Mosimane 2015; Wilkie 2015).

Multi-species hunts will drive large-bodied species to local extinction

Bushmeat hunting is not like trophy or sport hunting where hunters typical target a single or at most a few select species or individuals, and cease hunting in an area if populations of target species become too scarce (Bennett et al. 2007; Robinson & Bennett 2000b). Bushmeat hunters target any wildlife species that can provide meat (Fa et al. 2002; Robinson & Bennett 2004) – which means most wildlife are “fair game”. This has two adverse consequences. First bushmeat hunters can afford to use indiscriminate weapons such as leg-hold snares because almost anything they catch they can eat or sell. And second, unregulated multi-species bushmeat hunting to meet market demand will eventually drive large-bodied wildlife species to local extinction (Wilkie & Godoy 1996).



Though bushmeat hunters will take a large range of mammals, birds and reptiles, they prefer large-bodied species because they generate a larger return on investment (i.e., more kg meat taken for the time and ammunition spent hunting). Large-bodied species are at risk of unsustainable bushmeat hunting. They are more K-selected in that they take longer to reach sexual maturity, have longer gestation periods and inter-birth intervals, and thus have relatively few offspring over their lifespan compared to smaller-bodied more r-selected species. But more importantly is the multi-species nature of bushmeat hunting combined with hunters' economically rational preference for large-bodied wildlife that puts these species at most risk.

In multi-species hunts like those for bushmeat, optimal foraging theory argues (Alvard 1995; Levi et al. 2011; Wilkie & Lee 2004) that hunters will always take a large-bodied species when they are encountered (Stephens & Krebs 1986), regardless of how infrequently that may be (i.e., a hunter may only see a cross-river gorilla once every three years but will attempt to kill it every time he sees one). And in

Evidence from hunter behavior studies show that humans are optimal foragers that only pursue valued game in their "diet set" ignoring others they encounter on a hunt (Alvard 1992). In this example, Piro hunters in Peru frequently encountered species below the line but seldom hunted them. These species are outside their current "diet set." When preferred species (above the line) become less abundant only then do hunters add less preferred species to their "diet set."

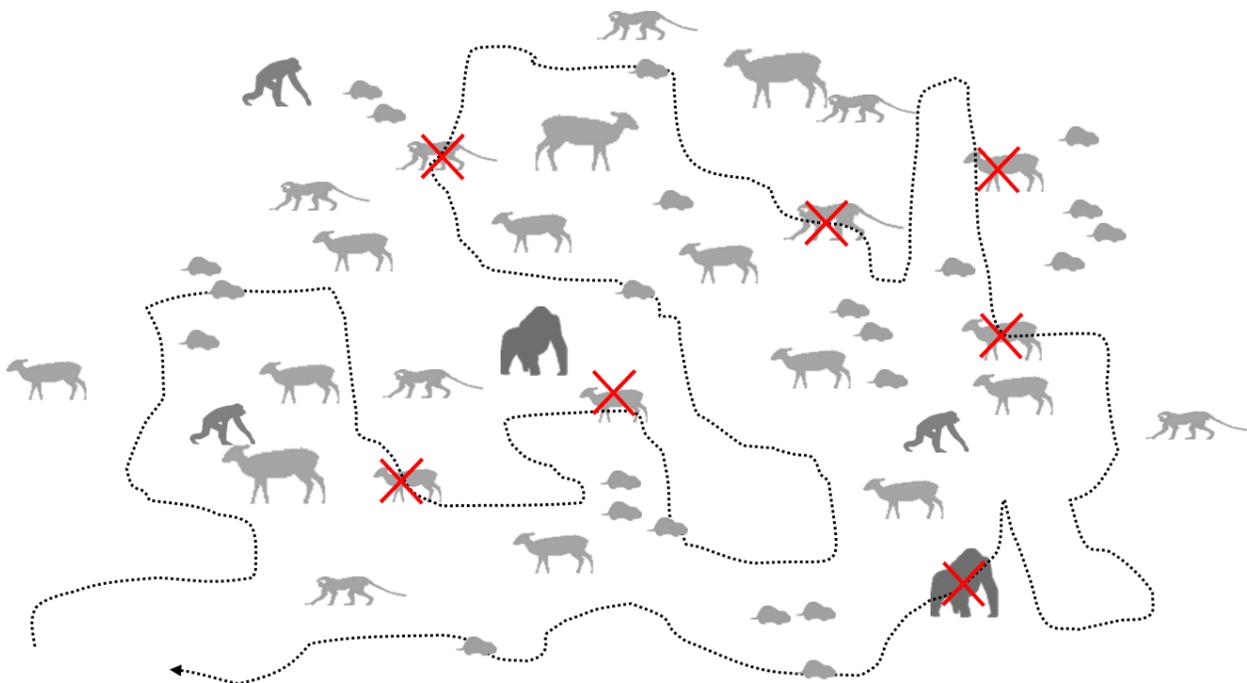
places where there are sufficient numbers of small-bodied species to motivate hunters to continue investing time looking for bushmeat, they will eventually encounter and kill all the increasingly scarce, large-bodied wildlife in their hunting territory. So multi-species hunts where species are effectively interchangeable will inevitably result in the local extinction of preferred, large-bodied wildlife species (Alvard 1993; Maisels et al. 2001; van Vliet et al. 2007; Waite 2007).

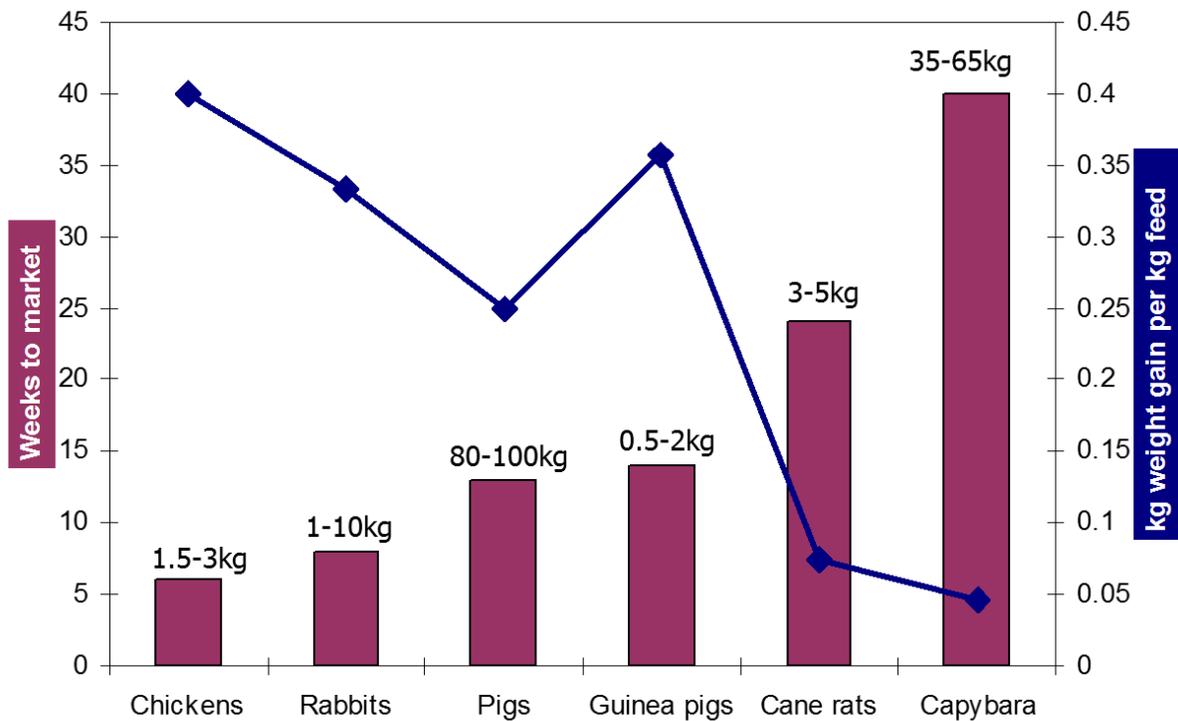
Sustainable wild meat production cannot meet dietary requirements of Africa

For over three decades there have been calls for more or less use of wildlife as either a wild harvested or ranched source of food for people (Cawthorn & Hoffman 2014; Chardonnet 1991; Cooper 1995; Feer 1993; Hoffman & Cawthorn 2012; NRC 1991; Ntiamoa-Baidu 1998; Stelfox et al. 1983).

Hunters will always take large animals when ever they are encountered, during a hunt regardless of how rarely that may happen. This will drive large animals to local extinction

Unfortunately evidence suggests that the supply of wildlife in a context of shrinking habitat will only ever contribute sustainably to a few rural families living in close proximity





to wildlife, and wildlife ranching will never be cost effective relative to raising domesticated livestock.

Domesticated animals have far more efficient feed to meat conversion ratios and reach market weight faster than wildlife

We know that sustainable offtake from tropical forests is approximately 150 kg/km²/year. If we assume that 65% of live weight of harvested wildlife is edible then tropical forest can produce sustainably about 97kg of wildlife meat each year. If the average human adult needs approximately 0.25/kg/day of meat to remain healthy (91kg/person/year) then terrestrial tropical forest wildlife can meet human protein needs only when human population density is about 1 person per square kilometer (Robinson & Bennett 2000a). Even in the most productive tropical savannas are only about an order of magnitude more productive than the most productive tropical forests (Robinson & Bennett 2000a) thus sustainable offtake rates for wildlife could meet the dietary needs of a human population not much greater than 10 people per square kilometer. This suggests that sustainable harvesting of wildlife populations within intact forests and grasslands will only provide dietary protein to a very small percentage of the planet's human population. Similarly anthropogenic landscapes equal-

ly unlikely to provide a substantial portion of humanity's dietary protein consumption needs (Wilkie & Lee 2004).

To increase the annual production of wild roaming animals would require expanding their habitat, removing livestock competitors for forage, or providing supplement feedstuff none of which is practical in most locations.

Mockrin et alia reviewed the available evidence and concluded that inefficient feed conversion ratios and long time frames to reach market weight made wildlife farming uncompetitive with domesticated livestock (Mockrin et al. 2005). A recent appeal to consider collared peccary farming as an alternative to unsustainable hunting in neotropical forests (Nogueira & Nogueira-Filho 2011) failed to explain why raising collared peccaries would be more efficient and produce a more valued meat product than simply expanding the production of domesticated pigs that are raised and consumed in huge numbers in South America.

The most important reason that harvesting or ranching wildlife is unlikely ever to compete with raising domesticated livestock is that the latter have been selectively bred for 10,000 years to increase their docility, tolerance of crowding, and most importantly to maximize their feed-conversion efficiency (i.e., the ratio of feed consumed to meat produced) and to minimize the time they take to reach market weight (Feer 1993). Feed conversion ratios for domesticated livestock range from a high of 8:1 to a low of 1.6:1 (8:1 for cattle, 3:1 for pigs, 2.5:1 for rabbits, 2:1 for poultry, and 1.6:1 for tilapia) and time to slaughter weight ranges from a few weeks (12-16 for poultry) to months (6 months for pigs, 12-18 for cattle). In contrast cane rats (*Thryonomys swinderianus*) takes 6-13 months to reach a marketable (adult) weight of 4-5kg (Houben 1999) and the green iguana (*Iguana iguana*) consumes as much food as chicken but takes 3 years instead of 3 months to reach a slaughter weight of 3kg (Werner 1991). Similarly, captive raising of pacas (*Agouti paca*) though feasible, is economically irrational because the meat would have to be sold for

over \$20 per kilogram to cover production costs (Smythe 1991).

Section 3:

The Way Forward

So what policy and practice options are currently available that might permit wildlife to be both conserved and eaten in the post-depletion context of West Africa, the weak governance context of Central Africa and the more secure community rights context of East and Southern Africa?

Optimistically, given the low intrinsic productivity of wildlife relative to domesticated livestock, a selective, highly regulated and sustainable harvesting of bushmeat from the wild might provide a large portion of rural and urban consumers in Africa with the very occasional meal that largely serves the role of retaining a cultural tradition. Much like Scottish families that eat haggis one time a year to commemorate the life of their most famous poet – Robert Burns. Or it may provide a tiny minority of rural families with a substantial proportion of their annual dietary protein requirements, as long as this tiny minority has exclusive rights to “their” wildlife and have the capacity to enforce these rights. In either case the harvesting of bushmeat would still need to be regulated and to be selective to prevent large-bodied species being driven locally extinct.

In reality, the wellbeing of poor rural families and a few enclaved population centers in Central Africa, that have few options other than consuming wildlife, would be undoubtedly adversely affected if they lost access to wildlife. In contrast, if urban consumers could no longer obtain bushmeat, legally, they would miss a luxury item with cultural meaning but it would have little impact on their diets. This is true for large urban centers across sub-saharan Afri-

ca and more specifically for city dwellers in east and southern Africa. Given this donors and governments should focus more of curbing demand for and consumption of bushmeat in urban areas, and securing sustainable supplies of bushmeat for poor rural families that live in close proximity to wildlife, while at the same time conserving the full assemblage of extant wildlife species that are hunted for food.

Tackling urban consumption

The evidence is clear that, given the biological limits to wildlife production within available habitat, wild harvesting of bushmeat will never meet the protein needs of rapidly growing urban populations and will likely struggle to meet even rare consumption associated with retaining cultural traditions. Knowing this there are three primary interventions that should be deployed in urban centers where bushmeat consumption is still widespread.

Increase access to protein from domesticated livestock

To meet growing demand it is vital to increase consumer access to reliable, affordable, alternative sources of animal protein. Chickens' have the most favorable feed conversion ratios of common domesticated livestock, and they reach market weight quickly. They are prone to the highly

Kenya has demonstrated that village level chicken production can be scaled to industrial scale with the right training and access to veterinary care and medicines





contagious Newcastle disease (paramyxovirus) but use of a thermo-stable vaccine has been demonstrated to protect flocks from the disease (Spradbrow 2013).

Guinea-pigs *Cavia porcellus* are even more efficient if fed high quality feed and can exceed a conversion ratio of 2.8:1 even when only fed green fodder. Guinea-pigs reach slaughter size at around 5 months though their adult body size is small at roughly 0.5.kg). Though efficient building consumer demand for guinea-pigs would be an important step before scaling up production.

Meeting urban demand for animal protein requires industrial scale hatchery, broiler production, and slaughter systems such as those used by Kenchic on the outskirts of Nairobi and Mombassa, Kenya. Though reliable industrial-scale chicken production requires a source of feed such as roasted soybeans (roasting prevents interference with digestion), a regular supply of clean drinking water is even more important.

For chicken to substitute for bushmeat, production has to meet or exceed the estimated annual consumption of bushmeat and be priced competitively. Too few birds sold at too high a price will do nothing to change demand for and consumption of bushmeat by urban dwellers. That said,

In Peru families with only minor capital investment raise Guinea pigs to supplement their income and provide a high quality source of protein.

urban consumer access to competitively priced and readily available alternative sources of animal protein, such as chickens, has huge potential to reduce urban demand for bushmeat, particularly in towns that are close to still relatively abundant sources of wildlife.

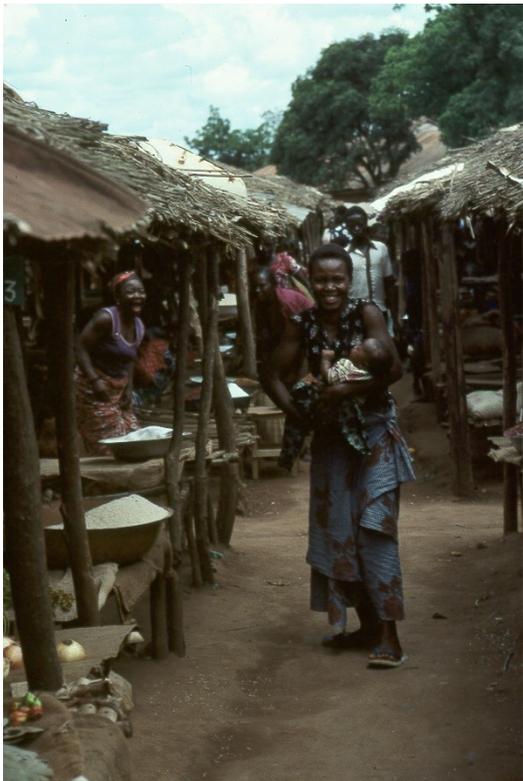
A partial ban on bushmeat sales in urban markets

Where urban consumers are eating wildlife on occasion as a luxury item primarily for cultural reasons, access to affordable substitutes alone is unlikely to curb demand for bushmeat. To prevent urban luxury demand from driving rare wildlife species to local extinction it is important to regulate what is currently, in most locations, an illegal but unenforced black market trade.

Confiscating and publicly incinerating rare and endangered species found for sale in urban markets will dissuade sellers from buying these species in the future, will help protect these species and have almost no impact on consumers

An outright ban on all bushmeat sales in urban markets may result in a consumer backlash that political leaders may want to avoid, and might simply drive this black market trade further into the shadows. Rather it is better to deploy policies designed to tilt sellers and buyers towards resilient r-selected wildlife (e.g., small antelope, and most importantly rodents) and away from at-risk K-selected species (e.g., primates, and large-bodied ungulates). This can be done at least in the short- to medium-term without explicitly legalizing bushmeat markets and incurring the substantial transaction costs of bringing bushmeat traders into the formal economy (Wilkie et al. 2006). It can also be done without arresting and fining market sellers.

One policy option is for police in partnership with public health staff (there are zoonotic disease risks associated with hunting, butchering and eating wildlife) to frequently visit public markets and transportation hubs, on a random schedule, and confiscate all endangered and at-risk species on display for sale. They would then publically set fire to the confiscated bushmeat. This shows everyone in the market that the bushmeat is not just being taken and resold by corrupt officials. Most importantly,





it is a financial disincentive to market sellers to purchase protected species from traders because it amounts to a de facto tax on selling protected species. This is likely politically easier than arresting and prosecuting bushmeat sellers, and as it does not prohibit all bushmeat sales it is unlikely to result in a significant public backlash. This approach should be seen as an incremental step to halting all demand for and consumption of unsustainably hunted bushmeat in urban areas.

Video interview for a local documentary production in the Republic of Congo © <http://www.incef.org/>

Changing attitudes and consumer choices using social marketing

Social marketing efforts to alter demand for bushmeat by adult urban dwellers may have little success absent affordable substitutes and regulatory pressure not to sell at risk wildlife species. That said, urban populations in Africa are predominantly young, and in every generation youth seek ways to differentiate themselves from their elders. Given this, social marketing, targeted at the youth market with a message that eating bushmeat is so “grandparent” and not a “you” generation thing, may gain some traction at least amongst future consumers.

Tackling rural consumption

Though population density is lower than urban areas because of higher per capita consumption rural consumers eat as much bushmeat as is consumed in cities (Barnett 2000; Foerster et al. 2012; Wilkie et al. 2005).

Most rural communities have little vested interest in managing wildlife sustainably because they have no rights to benefit from wildlife nor authority to exclude outsiders or regulate access to and meter use of wildlife they live with (Child 2013). As a result rural communities are often in a race with themselves and others to harvest what wildlife they can when it still exists. Current wildlife laws are often seen as illegitimate and conflict with customary claims over land and natural resources (Gibson 1999; Ribot 1999). And



*Village meeting near
Nduye, DR Congo © Ellen
Brown*

when the laws are almost never enforced and people break them with impunity, it fosters a culture of disrespect for authority and the rule-of-law. Given this it is vital that communities are provided non-market and market-based incentives to manage wildlife use sustainably and provide actionable intelligence to arresting authorities when they detect illegal hunting on “their” lands and adjacent state protected areas. Incentives should be structured, whenever possible, so that their continuing provision is conditional on community adherence to, mutually agreed upon, wildlife conservation and sustainable use rules.

Devolve rights and authority over wildlife

For rural communities to have a vested interest in conserving wildlife it is important, where feasible and appropriate, to help them secure formal legitimate and exclusive rights to benefit from wildlife and fish within lands over which they have traditional claims (Agrawal & Ribot 2012; Child 2013; Ribot & Larson 2013). Benefits would include, in some but not all contexts, food, income from the sale of resilient species, and fees and salaries from trophy hunting, and tourism enterprises. Where appropriate this could be modelled on Southern and East African community conservancies where rural families not only have the rights to benefit from wildlife, they also have the authority to co-manage wildlife. This would require substantial reforms of land rights policies particularly where ex-colonial laws vest all lands and natural resources in the state. It would also require, based on experience with the USAID funded LIFE program in Namibia (App et al. 2008), considerable long-term investment in governance capacity training and mentoring, and would require the timely and competent support of national agencies with the authority to arrest suspected law breakers (Wilkie 2015). Lastly, given the risk that multi-species hunts pose to large-bodied wildlife species, communities with devolved rights would need to establish norms that restrict the use of indiscriminate methods of hunting and place restrictions on harvest levels of at risk species.

Smoothing consumption during shocks

Rural families have long used wildlife as insurance to smooth consumption and pay for unplanned events during and after economic, political and health shocks, thus reducing the risk that they will spiral down into poverty (Enuoh & Bisong 2014; Nielsen et al. 2012; Paumgarten 2005). Schemes for compensating land owners for the loss of their animals and crops to wildlife whose presence on the land is value, at least, by the conservation community has a long and largely successful history (Dickman et al. 2011; Karanth et al. 2012; Treves et al. 2006; Woodroffe et al. 2005). Judicious use of compensation schemes can not only ensure that poor rural families do not unjustly shoulder the costs of living with wildlife, they can help build a constituency for conservation and encourage rural communities to steward rather than mine wildlife resources. In fact, the success of insurance schemes to indemnify rural families from crop and livestock losses from wildlife could be extended to cover additional loss factors such as severe weather and disease. Index-based livestock insurance has

proven highly cost-effective in Ethiopia, Kenya and Mongolia (Jensen et al. 2015; Linne-rooth-Bayer et al. 2011) and could be more widely tested as a conditional incentive (Clements et al. 2013; Ferraro 2011; Ingram et al. 2014) rural families to comply with bushmeat hunting and trade regulations. More

Community mapping of traditional territory in DR Congo © Ellen Brown



broadly, the efficacy of health and life insurance as a mechanism to smooth consumption during shocks and as a conditional incentive not to mine wildlife resources should also be piloted and evaluated.

Additional conditional incentives

Human and livestock health services and education are two basic necessities unavailable to and most often asked for by poor rural families. Provision of mobile public health and veterinary services, where appropriate should be evaluated as an incentive for rural communities to steward not mine wildlife resources.

Education like health services is a basic necessities often unavailable to and most often asked for by rural families. The effectiveness of offering subsidized scholarships that allow rural children to obtain an education as boarders at quality secondary schools as a conditional incentive to steward rather than mine wildlife resources should be evaluated.

Provision of small livestock production and where appropriate fish farming extension services primarily to communities with market access should be evaluated as an incentive for rural communities to steward not mine wildlife resources. Linking this activity with bushmeat traders may provide viable revenue replacement for reduced bushmeat trafficking. That said, a recent review emphasizes how difficult it has proven to implement effective "alternative" livelihood projects in the past (Wicander & Coad 2015).



Monts de Cristal, Gabon
© Wilkie/WCS

Rigorous evaluation of the effectiveness of implemented interventions

Though the available evidence guides us toward likely effective interventions, none have been rigorously tested and evaluated under a range of conditions. Prior to deploying any set of interventions to conserve and eat wildlife in Africa, a clear theory of change needs to be elaborated for each test in each geography. This will make explicit the underlying assumptions as to how interventions are expected to result in desired outcomes. Clear theories of change also provide a framework for monitoring that (CMP 2013; Woodhouse et al. 2015) allows rigorous evaluation of the effectiveness of interventions over time and a clearer understanding of what works in what combination under which conditions. Sufficient funding and effort needs, therefore, to be allocated to assess rigorously the effectiveness of the different mixes of bushmeat interventions in different urban and rural settings.

Section 4: Conclusions

The desire to simultaneously conserve wildlife and eat them in west, central, east and southern Africa faces many challenges. The two most intractable are: 1) the scale of potential supply of wildlife for food compared to the scale of combined rural and urban demand, and 2) the multi-species nature of hunting of wildlife for food which ensures that as long as there is enough game of any size to make hunting worth the investment in time and materials, unregulated or poorly governed bushmeat hunting will result in the eventual local extinction of all large bodied wildlife species.

Given the scale differences between sustainable supply of wildlife as food and the demand for bushmeat, policy makers intent on both conserving and eating wildlife must decide who to preference as consumers of bushmeat – poor rural families who depend on wildlife as a dietary necessity, or urban families who consume wildlife infrequently as a cultural tradition. The former requires policies that provide rural families with exclusive and enforced rights to consume wildlife within their traditional hunting areas which because of repeated hunting over time have most likely already been depleted of most if not all large bodied wildlife species. Conditional incentive schemes may also be necessary to dissuade rural consumers from hunting and eating at risk species should they still persist in traditional hunting areas. Urban bushmeat consumption is best addressed with policy incentives for industrial scale production of affordable livestock alternatives, in combination with partial bans on market sales of protected and at risk species, and social marketing to shift consumer choice away from eating wildlife.

Policies to ensure that bushmeat hunting does not, by its multi-species nature, result in extirpation of K-selected species such as primates, elephants, carnivores, and large-bodied ungulates are few. The most important is to ensure that protected areas have the financial and law enforce-

ment resources sufficient to conserve all wildlife, thus ensuring they serve, over the long-term, as bastion for a full assemblage of native wildlife species. Also important, but with lower certainty of success, are conditional incentives for hunters to take only the most resilient species (i.e., rodents and small antelope), and partial bans on the sale of at risk species in urban markets.

The human population of the planet is predicted to increase from 7 to over 9 billion by 2038 and much of that growth will be in sub-saharan Africa. With ecological constraints on wildlife production and continuing conversion of wildlife habitat to crop lands, supply of wildlife as a source of food will only decrease per capita in the future. Wildlife can only, realistically, be considered an interim source of dietary protein for rural people until production of livestock or non-animal alternatives increase to meet basic needs.

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