

ILLEGAL HUNTING & THE BUSHMEAT TRADE *in* SAVANNA AFRICA:

DRIVERS, IMPACTS & SOLUTIONS *to* ADDRESS THE PROBLEM



Lindsey, P., Balme, G., Becker, M., Begg, C., Bento, C., Bocchino, C., Dickman, A., Diggle, R., Eves, H., Henschel, P., Lewis, D., Marnewick, K., Mattheus, J., McNutt, J.W., McRobb, R., Midlane, N., Milanzi, J., Morley, R., Murphree, M., Nyoni, P., Opyene, V., Phadima, J., Purchase, N., Rentsch, D., Roche, C., Shaw, J., van der Westhuizen, H., Van Vliet, N., Zisadza, P.

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COVER: Buffalo snared
in Save Conservancy.
(Credit: P. Lindsey)

I. Executive Summary

BACKGROUND

In this report, the term ‘bushmeat’ is used to denote meat from wild animals that have been hunted illegally, which aside from being used for personal consumption, is often sold commercially. The bushmeat trade has long been recognized as a severe threat to wildlife populations in the forests of West and Central Africa and is considered a conservation crisis in that biome. Far less attention has been focused on the issue in African savannas, perhaps due to a misconception that illegal hunting for bushmeat in the biome is primarily for subsistence and is largely sustainable. However, there is a growing body of research conducted in the Serengeti ecosystem in Tanzania, and from sporadic studies elsewhere that contradict that perception. This report summarizes a workshop on illegal hunting and the bushmeat trade in the savanna biome organised and sponsored by Panthera, the Zoological Society of London and Wildlife Conservation Society. Growing concern over the impacts of illegal hunting and the bushmeat trade, particularly on large carnivores populations in Southern and East Africa, motivated the workshop. Large carnivores are particularly sensitive to the impacts of illegal hunting and the bushmeat trade and can

act as a barometer of the severity of the problem, and also act as a basis from which to catalyze conservation action. Key experts gathered at the workshop to identify the drivers of illegal hunting and the bushmeat trade and the interventions necessary to address the issue.

Hunting of wildlife is regulated in most African countries through wildlife legislation and permitting systems which specify restrictions on the times and places that hunting is permitted, the species that may be hunted and the hunting methods that may be used. The large majority of hunting for bushmeat contravenes one or more such restrictions. Snaring is the most common illegal hunting method and is particularly undesirable from a conservation perspective as it is highly effective, difficult to control, unselective in terms of the genders or species of animals captured, wasteful, and has severe animal welfare implications due to the manner of capture and confinement, and frequent incidents of severe, non-lethal wounding of wildlife. Other common bushmeat hunting methods include the use of rifles, muzzle-loaders, shotguns, dogs, fire, and in some cases, gin traps, pitfall traps and poison.



Cheetahs resting at
Phinda Private Game
Reserve in South Africa.
(Photo: © L. Hunter)

Several temporal and spatial patterns in the incidence of illegal hunting in savanna areas are emerging. Wildlife has been extirpated from many areas outside of formal conservation networks with the effect that illegal hunters are increasingly focusing their efforts on protected areas. Levels of illegal hunting and the consumption of bushmeat are invariably higher in areas closer to human settlements. Illegal hunting is typically more frequent in areas with poor anti-poaching enforcement, in areas where wildlife concentrates, during the passage of migratory wildlife and during the late dry season when wildlife is concentrated around water-sources. Illegal hunting also tends to spike when food-shortages are severe, and at times of the year when the agricultural time-commitments of communities are low.

Illegal hunting is emerging as one of, if not the most severe, threats to wildlife in several countries in the savanna biome. Ecological consequences of illegal hunting include overall wildlife population declines, reductions in biodiversity, local disappearances of many species from both within and outside protected areas and associated loss of ecosystem functionality, reductions in the effective sizes of protected areas due to edge-effects and, in some cases, complete collapse and disappearance of wildlife populations. Notably, wildlife populations in the savannas of West and Central Africa appear to be collapsing in many areas, though the phenomenon is not restricted to those regions. Large carnivores are particularly affected by illegal hunting because they are wide-ranging (and thus particularly vulnerable to snaring), are killed as by-catch in snares set for other species, specifically targeted for body parts in some cases and affected by the loss of prey populations. Furthermore, they occur at low population densities and even low levels of anthropogenic mortality can drive severe declines and local extinctions.



However, all wildlife species are affected by illegal hunting. The impacts of illegal hunting are likely to increase in future as demand for bushmeat is increasing and supply is declining in many areas, resulting in elevated pressure on remaining wildlife populations.

In addition to severe ecological impacts, illegal hunting can confer serious negative economic and social impacts. Economic consequences include major negative impacts on wildlife industries which can preclude the option to develop wildlife-based land uses. Social consequences include negative impacts on food security in the long term through the loss of a potentially sustainable supply of meat protein through legal hunting, the loss of tourism-based employment and the loss of wildlife heritage. The scale and severity of the threat is such that without urgent intervention, one of Africa's most valuable resources will be lost across vast areas of the continent.

The drivers of illegal hunting for wildlife are varied, and the phenomena tend to fall somewhere on a continuum, from that done to obtain meat for direct consumption (subsistence) and/or immediate community trade, to commercial trade in urban centres or even international markets. There are indications that illegal hunting is increasingly commercial in many areas in response to increasing human populations, and increasing demand for bushmeat both in rural communities and in growing urban areas. In rural areas, often close to wildlife source populations, bushmeat is preferred because it is normally cheaper than alternatives. In urban areas, demand for bushmeat is driven by preference for its taste and is commonly more expensive than other types of protein.

Data on the scale and economic value of the bushmeat trade in the savanna biome are scarce (partly due to the covert nature of the trade). It is clear that illegally sourced bushmeat contributes significantly to economies and to food security in many countries. However, due to the unsustainable nature of illegal hunting, those social and economic benefits are unlikely to be sustainable. Furthermore, most forms of illegal hunting for bushmeat represent an extremely wasteful and inefficient form of wildlife use which captures a tiny fraction of the value of the resource it destroys.

Rotten impala carcass in a snare, Savé Valley Conservancy (Zimbabwe) (Photo: P. Lindsey)

KEY DRIVERS *of* ILLEGAL HUNTING & THE BUSHMEAT TRADE

Increasing demand for bushmeat in rural areas

Demand for bushmeat in rural areas is increasing due to rapid human population growth, which is occurring quicker in Africa than elsewhere, and is occurring quicker than average on the borders of protected areas.

Increasing demand for bushmeat in urban areas

There are increasing populations in African cities, and growing African populations in international cities which drive further demand for bushmeat. Bushmeat in urban centres is considered a luxury product which attracts prices higher than those of alternatives. Increasing local, national and international demand for bushmeat is driving increasing commercialization of illegal hunting, which in turn is resulting in the discarding of traditional taboos on the use of bushmeat or killing of particular species, the disregarding of traditional hunting seasons and hunting methods in favour of more efficient techniques.

Human encroachment into wildlife areas

In many areas, human populations are increasing rapidly on the boundaries of protected areas and in some cases, expanding into wildlife areas. Such trends are driving increased levels of illegal hunting and make the problem more difficult to control. Poorly planned/positioned developments (such as roads, schools, clinics, boreholes) exacerbates influxes of people in or near to wildlife areas that are often poorly suited for human settlement, resulting in reliance on natural resources such as wildlife for survival. Forestry and mining are often practised in wildlife areas and have the effect of increasing access to wilderness and stimulating the influx of large numbers of people, both of which encourage illegal hunting.

Inadequate penal systems and lack of enforcement

In most countries, the gazetted punishments for illegal hunting provide inadequate deterrents and do not reflect the value of the resource being destroyed. Furthermore, wildlife laws are poorly enforced due to inadequate investment (and expertise) in anti-poaching and low conviction rates for illegal hunters. There is a tendency for the police and judiciary to treat wildlife crimes as being of low priority, even in comparison with other environmental crimes.

Lack of alternative livelihoods

Many rural areas in which wildlife occurs are characterized by lack of economic activity or employment opportunities. Illegal hunting and the sale of bushmeat provides an opportunity for quick cash income for people with few alternative livelihood options. However, illegal hunting and sale of bushmeat is unlikely to be a sustainable livelihood option in the long term.

Lack of alternative food sources

Areas in which wildlife persists are often characterised by low annual rainfall and/or poor soils, and the presence of tsetse flies *Glossina* spp., thereby limiting the potential for agriculture and livestock production. Consequently lack of food security is commonplace and few alternative sources to bushmeat exist, creating significant demand for the resource.

Lack of clear rights over wildlife or land, and/or inadequate benefits from wildlife

Failure of governments to devolve user rights adequately to communities and to disburse income from wildlife appropriately means that local people living with and bearing costs from wildlife receive few or zero benefits from the resource in many areas. Consequently, the only means by which communities in such circumstances can benefit meaningfully from wildlife is by hunting it illegally.

Political instability, corruption and poor governance

Illegal hunting appears to spike during periods of political instability or poor governance, due to breakdowns in law enforcement and elevated reliance by people on natural resources for survival.

Demand for wildlife body parts for traditional medicine and ceremonies

In some cases, wildlife is hunted specifically for body parts that are used/sold for traditional medicine and ceremonies. In other cases, such products simply increase the profitability of general illegal bushmeat hunting.

Abundant supplies of wire

The increasing prevalence of fencing, electricity and telephone cables means that there is an increasing abundance of wire in rural areas which is commonly stolen and used for making snares.

POTENTIAL SOLUTIONS

ADDRESSING HUMAN POPULATION GROWTH AROUND PROTECTED AREAS

Interventions needed

- Lobby international community to more explicitly acknowledge environmental problems associated with human population growth inside and on the borders of protected areas
- Lobby governments to acknowledge the issue and to work to find sustainable solutions (e.g. encouraging smaller families, reducing reliance on natural resources, effective land-use planning etc).
- Educational outreach/family planning

Drivers addressed

- Human encroachment into wildlife areas
- Increasing demand for bushmeat in rural areas
- Lack of alternative livelihoods and food sources

Benefits/advantages of the approach

- Addresses multiple drivers and the ultimate cause of the problem
- Will confer significant human welfare benefits

Disadvantages/challenges associated with the approach

- High degree of political and religious sensitivity associated with the issue
- Difficult to achieve

Where applicable

- All countries exhibiting high levels of illegal hunting

Other solutions that the interventions should be employed with

- Land-use planning
- Development of participatory wildlife-based land uses/ devolution of user-rights over wildlife to communities
- Development and enforcement of laws that reflect the value of wildlife resource
- Provision of alternative livelihoods and protein supplies
- Manipulating price of illegal bushmeat

LAND USE PLANNING

Interventions needed

- Creation and maintenance of large protected areas
- Linking protected areas to create transfrontier conservation areas
- Creating buffer zones around protected areas by designating multiple-use zones or developing wildlife-based land uses on community and private land
- Zoning of wildlife areas where communities are present for the benefit of people and wildlife
- Partial or complete fencing of parks in some circumstances to delineate wildlife-areas, minimize edge-effects and limit encroachment (with clear recognition of the potential pitfalls of such an approach and use of appropriate fencing materials to prevent wire being stolen for use as snares)
- Enforcement of laws to prevent human incursion into wildlife areas where human settlement is not permitted
- Carefully plan location of infrastructure development to prevent human influxes to park boundaries
- Prevent, limit or tightly regulate mining and logging in wildlife areas

Drivers addressed

- Lack of land-use planning
- Human encroachment of wildlife areas

Benefits/advantages of the approach

- Can create distance between wildlife and people, reducing hunting pressure and making anti-poaching easier
- Minimizes other human impacts on wildlife areas such as deforestation and exclusion of wildlife from water due to human presence
- Can reduce human-wildlife conflict
- Can allow for more efficient use of land and match ecological boundaries to land use boundaries
- Can allow resources for wildlife conservation and for human development to be allocated in a more focused manner

Disadvantages/challenges associated with the approach

- Land use planning is time consuming and costly and requires buy-in from multiple stakeholder groups
- Many protected areas are already isolated and encroached
- Land use planning is only useful if enforced
- There are potentially harmful ecological consequences of fencing
- Fencing with the wrong type of material can provide virtually limitless material for snares
- Fences are extremely costly to erect and maintain

Where applicable

- On state, private and community lands
- Fencing is particularly appropriate in areas with hard edges between wildlife habitat and adjacent human-dominated lands, where funds and expertise exist to maintain it properly

Other solutions that the interventions should be employed with

- Devolution of user-rights over wildlife to communities
- Development of wildlife-based land uses
- Development and enforcement of laws that reflect the value of wildlife resource
- Provision of alternative livelihoods and protein supplies

ALTERNATIVE LIVELIHOODS

Interventions needed

- Provision of alternative income streams and employment
- Integrated conservation and development projects
- Development of agricultural projects (livestock, irrigation)
- Use of traditional structures for resource management

Drivers addressed

- Lack of alternative livelihoods and food sources

Benefits/advantages of the approach

- Clear human welfare benefits
- Unrealistic to expect hunters to give up hunting in the absence of alternative and more profitable livelihood options

Disadvantages/challenges associated with the approach

- Illegal hunting can provide instant and significant benefits, so difficult to encourage hunters to swap for alternative livelihood options
- Limited evidence of success of such projects at reducing levels of illegal hunting or improving livelihoods/food security (though the number of attempts to provide alternative livelihoods is low, and monitoring of existing projects is often poor)

- Risk that alternative income will be used to augment that from illegal hunting without replacing it
- Risk that bushmeat consumption and demand will increase with increasing wealth
- Risk of a population influx into a wildlife area if the alternative livelihood programmes are successful

Where applicable

- Everywhere communities live within or near wildlife areas

Other solutions that the interventions should be employed with

- Land-use planning
- Development of wildlife-based land uses/devolution of user-rights over wildlife to communities
- Development and enforcement of laws that reflect the value of wildlife resource
- Provision of alternative protein supplies
- Capacitating existing traditional institutions for resources management

ALTERNATIVE PROTEIN SUPPLIES

Interventions needed

- Promote legal production of game meat
- Development of livestock vaccination programmes that are linked to reduced demand for bushmeat
- Protection of freshwater and marine fish stocks (to prevent increased demand for bushmeat if fish protein were to become less available)
- Develop aquaculture
- Promote farming of indigenous mammals
- Ensure that labour forces employed in or near wildlife areas are provided with meat rations so they do not fuel demand for illegal bushmeat

Drivers addressed

- Lack of alternative livelihoods and food sources

Benefits/advantages of the approach

- Unrealistic to expect hunters to give up hunting in the absence of alternative protein supplies
- Human welfare benefits

Disadvantages/challenges associated with the approach

- Illegal hunting can provide instant and significant benefits, so difficult to encourage hunters to stop hunting
- Risk that alternative protein will simply be used to augment rather than replace illegal bushmeat
- Negative environmental externalities associated with livestock production and aquaculture
- Limited evidence of success with the farming of indigenous mammals
- Investments and technical expertise needed for aquaculture
- Legal production of game meat is hampered by veterinary restrictions on the movement of meat and failure of many governments to adequately devolve user-rights over wildlife to communities

Where applicable

- Everywhere communities live within or near wildlife areas
- Legal supplies of game meat need to be made available to urban markets

Other solutions that the interventions should be employed with

- Land-use planning
- Development of wildlife-based land uses/devolution of user-rights over wildlife to communities
- Development and enforcement of laws that reflect the value of wildlife resource
- Creation of alternative livelihoods
- Manipulating the price and supply of illegal bushmeat

DEVELOPMENT OF WILDLIFE-BASED LAND USES

Interventions needed

- Devolution of user-rights over wildlife to communities and private land holders
- Encourage the development of community-based natural resource management (CBNRM) programmes on land occupied by communities and wildlife-ranching on private and leasehold land
- Encourage long term engagement of donor community in development of CBNRM programmes
- Allow full range of wildlife utilization, including through tourism and consumptive use
- Encourage the development of durable public-private-community partnerships relating to wildlife-based land uses on various land tenure types, including linkages between protected areas and neighbouring communities
- On state land, ensure that hunting and tourism operators are granted lengthy leases with clear conditions for community engagement and investment in anti-poaching
- Make provision for the transport and distribution of legally sourced game meat and develop systems (e.g. certification programmes) to distinguish legal game meat from illegal bushmeat
- Consider/experiment with the provision of monetary or other forms of payment to communities in return for achievement of a specified conservation outcomes (payments to encourage coexistence [PEC] with wildlife)

Drivers addressed

- Lack of clear rights over wildlife or land, and/or inadequate benefits from wildlife
- Lack of alternative food sources and livelihoods
- Increasing demand for bushmeat in rural and urban areas

Benefits/advantages of the approach

- Addresses multiple drivers
- Wildlife-based land uses represent a sustainable land use option for marginalized rural areas
- Wildlife-based land uses confer clear economic, social

and conservation benefits

- Creates direct incentives for communities to desist from, and help prevent illegal hunting
- Can contribute positively to human livelihoods
- Payments for coexistence can provide a conduit for the international community to contribute to African wildlife conservation

Disadvantages/challenges associated with the approach

- Requires government understanding of the benefits of wildlife-based land uses
- Governments tend to be reluctant to devolve sufficient user-rights over wildlife
- CBNRM programmes require protracted investment of funding and expertise
- Benefits from CBNRM per household may not be sufficient to create incentives for conservation in areas with high human population densities
- Legal distribution and transport of game meat is hampered by veterinary restrictions in several countries
- Payments to encourage coexistence would require significant levels of funding, indefinitely
- For payments to encourage coexistence it would be challenging to determine how to disburse payments appropriately, to engage all community members, and to ensure that the payments are sufficient to offset wildlife damages
- Payments to encourage coexistence could create worsened attitudes towards wildlife if the programme is developed in some wildlife areas and not others or if the programme is ceased due to lack of funds

Where applicable

- Wildlife-based land uses – on state, private and communal land wherever sufficient natural habitat remains
- Payments to encourage coexistence – on communal land, state land occupied by people, or private land

Other solutions that the interventions should be employed with

- Development and enforcement of laws that reflect the value of wildlife resource
- Land-use planning

STRONGER WILDLIFE LAWS, BETTER ENFORCEMENT OF LAWS*Interventions needed*

- Laws which provide stronger deterrents to illegal hunters and which reflect the value of the resource being destroyed
- Develop regional (e.g. SADC) protocols on law enforcement for crimes against wild fauna and flora, and their by-products, to harmonise domestic legislation on fines and penalties
- Educate police, magistrates and policy-makers on severity of impact of illegal hunting and importance of it being controlled
- Achieve a greater number of successful prosecutions of captured illegal hunters
- Elevate investment in anti-poaching and allocate sufficient funding, manpower and technical expertise for anti-poaching in protected areas
- Control the transport and sale of illegal bushmeat

Drivers addressed

- Inadequate penal systems and lack of enforcement

Benefits/advantages of the approach

- Clear evidence that anti-poaching security can reduce levels of illegal hunting to sustainable levels
- Anti-poaching represents a very direct approach to addressing illegal hunting that can have immediate impacts
- Provides a source of employment for local communities

Disadvantages associated with the approach

- The funding and technical requirements to achieve effective anti-poaching interventions are significant
- Anti-poaching can create animosity with neighbouring communities if not conducted appropriately and if not combined with outreach approaches

Where applicable

- In countries where laws provide insufficient deterrent for illegal hunters
- Anti-poaching is needed in all wildlife areas facing a threat from illegal hunting

Other solutions that the interventions should be employed with

- Efforts to develop legal wildlife-based land uses involving communities/devolve user-rights over wildlife to communities
- Efforts to extend benefits from parks to communities/provide stake to communities in protected areas
- Efforts to provide alternative livelihoods and food sources

Conclusion

Illegal hunting and the bushmeat trade are caused by a complex assemblage of factors, the combination of which is likely to vary from site to site. Consequently, to address the problem an adaptive combination of site-specific interventions will likely be required. The funding needs for such interventions will be significant, and innovative strategies to generate the necessary financial resources will be required. Fortunately, the problems of illegal hunting and the bushmeat trade reflect some inherent development challenges facing African nations and there is scope for attracting funding from both the international development and conservation community. There is an urgent need for much greater focus, effort and investment to be directed at mitigating the threats posed by illegal hunting. In the absence of such actions, one of Africa's greatest assets is at risk of disappearing from many areas in a short space of time.

II. Background to this Document

In recognition of the threat posed by the bushmeat trade, the Convention on Biological Diversity (CBD) has established a liaison group on bushmeat. This liaison group has since established a set of recommendations for addressing the threat (Secretariat of the Convention on Biological Diversity, 2011). These guidelines were used as the basis for discussion at a brainstorming session held in May 2012 by Panthera, the Zoological Society of London and the Wildlife Conservation Society where scientific experts and wildlife managers met to identify priority interventions needed to address illegal hunting and the bushmeat trade in the savanna biome, with particular (though not exclusive) reference to the Southern African Development Community (SADC) region.



Wounding caused by a snare on a wildebeest in Savé Valley Conservancy, Zimbabwe (this animal broke the snare from the tree to which it was attached, and was euthanized after being seen with the snare embedded in its skull) (Photo: T. Labat)

III. Introduction

The bushmeat trade has long been recognized as a major threat to biodiversity in forest areas of Central and West Africa (Noss, 1998; Fa et al., 2003). In those regions, the trade in bushmeat is a significant component of local and even national economies (Bowen-Jones et al., 2003). Bushmeat contributes significantly to food security, often representing the single most important source of protein for communities in rural areas. For example, hunting provides 30–80% of protein to rural households in Central Africa, and virtually 100% of animal protein (Nhasi 2008). However, hunting associated with the bushmeat trade is unsustainable and is resulting in widespread wildlife population declines and extirpation of larger bodied species (Wilkie, 1999; Fa et al., 2000). Consequently, the current food security benefits associated with bushmeat are likely to falter (Bennett, 2002). In African forest biomes, for example, protein supplies from bushmeat are expected to drop by 81% over the next 50 years (Fa et al., 2003). The bushmeat trade is thus a crisis from both a conservation and human development perspective.

The scale and impacts of the bushmeat trade have received much less attention in the savanna biome (Lindsey et al. 2011). This lack of focus has perhaps been due to a misconception that hunting for bushmeat is largely motivated by subsistence and is practised on a limited scale (Barnett, 1998). However, recently, there has been a gradual realisation of the significance of the problem following publication of a number of case-studies. Indications are that hunting for bushmeat trade is an incipient threat which flares up during periods of bad governance or political instability, as observed in the savannas of Central African Republic, Mozambique during and after the civil war there, in north west Tanzania

with the arrival of large numbers of refugees, and in Zimbabwe following the seizures of farms and wildlife ranches during the 2000s (Hatton et al., 2001; Jambiya et al., 2007; Lindsey et al., 2011; Bouché et al., In press). However, the threat posed by illegal hunting and the bushmeat trade also occurs widely during times of peace and stability (Barnett, 1998; Okello and Kiringe, 2004; Secretariat of the Convention on Biological Diversity, 2011). Illegal hunting appears to be a widespread response to a substantial demand for bushmeat. In Tanzania, for example, a mean of 2,078 tonnes of bushmeat are confiscated annually, while in Central African Republic, an estimated 59,000 tonnes of bushmeat are believed to end up on the illegal market each year (Secretariat of the Convention on Biological Diversity, 2011).

A growing body of research is emerging on illegal hunting and the bushmeat trade in savannas, most notably from the Serengeti ecosystem in Tanzania (Hofer et al., 2000; Loibooki et al., 2002; Marealle et al., 2010; Nyahongo et al., 2005; Ndibalema and Songorwa, 2008). The results from a number of sporadic studies have also been published from Mozambique (Lindsey and Bento, 2012), Zimbabwe (Lindsey et al. 2011a,b) and Zambia (Lewis and Phiri, 1998; Lewis, 2005; Brown, 2007). However, the comparative shortage of published material on illegal hunting in the savanna biome reflects an ongoing lack of appreciation of the problem and inadequate efforts by state wildlife-agencies and NGOs to address the issue. This report represents an attempt to collate existing knowledge on the illegal hunting and the bushmeat trade in savannas, and to provide insights into the underlying causes, impacts and potential solutions.

IV. Methods

A literature search was conducted using the Web of Science® and search terms such as: bushmeat trade; bows and arrows; dogs; firearms; gin traps; illegal hunting; poaching; snaring; trapping. The legality of hunting methods was determined for 16 countries in the savanna biome by reviewing the most recent legislation, derived from <http://faolex.fao.org/faolex/index.htm> (accessed June 2012). Information on the prevalence of various hunting methods, the primary motivations for illegal hunting, the key drivers of illegal hunting and the bushmeat trade and impacts of illegal hunting on wildlife populations were gleaned from the literature and from a survey of field practitioners who attended the meeting (n=12).

HUNTING *for* BUSHMEAT & THE LAW

In most African countries, hunting is regulated, with harvests being controlled through systems of licensing and quotas. For example, all SADC countries that allow hunting have permitting procedures in an attempt to control it (Morgera, 2009). Ownership of wildlife is typically retained by the state, with the exception of some scenarios in South Africa, Botswana, Namibia, Mozambique, Zambia, and Zimbabwe where conditional user-rights are granted to private land owners (Bond et al., 2004). In some countries, communities have also been allocated limited user-rights over wildlife, which provide scope for local people to hunt in possession of the appropriate permits/licenses, within specified limits and under certain conditions (Taylor, 2009). In many cases, the rights to hunt on state and communal land can be purchased by private safari hunting outfitters (Lindsey et al., 2007). In some cases, such as in Tanzania, Botswana and Malawi, special hunting licenses are allocated to citizens in certain categories of land for the purpose of obtaining meat (Morgera, 2009). In a minority of countries, such as Malawi, Angola and Mozambique (in forest areas), hunting of wildlife for subsistence needs is allowed without a permit, subject to such harvest not being detrimental to populations (Morgera, 2009).

Hunting laws often stipulate restrictions on the time of year in which wildlife can be hunted (with the imposition of ‘closed-seasons’), restrictions on hunting protected species, prohibitions on hunting young animals or pregnant females, and prohibitions on hunting in national parks and some other categories of protected areas (Morgera, 2009). There are invariably restrictions on the hunting methods that can be used

and the methods commonly used by bushmeat hunters are typically illegal (Table 1). Hunting for bushmeat is typically illegal in many of the contexts in which it occurs due to varying combinations of: lack of licenses/permits; being practised in areas where hunting is prohibited; the use of prohibited methods; and the killing of protected species, sexes or ages of animals. Bushmeat hunting is thus hereafter referred to as ‘illegal hunting’. The term ‘bushmeat’ is used to describe meat from wildlife that has been acquired via illegal hunting, whereas ‘game meat’ is used to describe meat from wildlife that has been hunted legally.



Snares removed from a single ranch in Savé Valley Conservancy, mostly comprised of wire stolen from the perimeter wildlife-proof fence (Photo: P. Lindsey).

Table 1. The legality of various hunting methods in nine African countries^a

Country	Fire	Snares	Poison	Auto- matic weapons	Dogs	Nets	Traps	Reference
Benin	0	0	0	0	0	0	0	Loi n° 87-014 portant réglementation de la protection de la nature et de l'exercice de la chasse en République Populaire du Bénin
Burkina Faso	0	0	0	0	1	1	0	Décret N 96-061, portant réglementation de l'exploitation de la faune. Loi N 006/97/ADP du 31 janvier 1997 Portant Code Forestier
Cameroon	0	?	0	0	0	0 ^b	1	Loi n° 94/01 portant régime des forêts, de la faune et de la pêche (20 January 1994) ; Décret n° 95-466 fixant les modalités d'application du régime de la faune
Central African Republic	0	0	0	0	0	0	0	Ordonnance No. 84.045, portant protection de la faune sauvage et réglementant l'exercice de la chasse
Chad	0	0	0	0	0	0	0	Ordonnance n° 14-63 du 28 mars 1963 réglementant la chasse et la protection de la nature
Botswana	0	0	0	0	1	0	0	Wildlife Conservation and National Parks Act, 1992
Mozambique	0	0	0	0	1	0	0	Forest and Wildlife Act (No. 10/1999)
Namibia	0	0	0	0	0	0	0	Namibia Nature Conservation Ordinance, 1975
Niger	0	0	0	0	0	0	0	Loi N° 98-07 du 29 avril 1998 fixant le Régime de la Chasse et de la Protection de la Faune
Senegal	0	0	0	0	0	0	0	Code de la chasse et de la Protection de la faune. Loi N 86-04 du janvier 1986. Décret N 86-844 du juillet 1986
South Africa	0	?	0	0	0	0	0	Threatened and Protected Species regulations, 2006
Sudan	0	0	0	0	0	0	0	Wildlife Conservation and National Parks Act, 2003
Tanzania	0	0	0	0	0	0	0	Wildlife Conservation Act, 2009
Zambia	0	0	0	0	0	0	0	Zambia Wildlife Act, No.12 of 1998
Zimbabwe	0	0	0	0	1	0	0	Trapping of Animals (Control) Act (2002)
Average	0	0	0	0	.27	.07	.07	

^a The legality of hunting with single-shot firearms, muzzle-loading firearms, shot guns and bows and arrows is more complex as these methods are legal under some circumstances in some countries, albeit when in possession of the necessary permits and in some cases given specific calibres/bow strengths for particular species.

^b 'Modern' nets prohibited

ILLEGAL HUNTING METHODS

The most common method used by illegal hunters is the use of snares (Table 2). Snares (as used in savanna areas) typically comprise a noose attached to woody vegetation and placed where animals are likely to pass (such as along wildlife trails, close to water sources), in gaps in fences of thorn bush erected by the hunter, or along migratory routes (Hofer et al., 1996). Animals are caught when they put their head (or a leg) into the snare and pull it tight as they keep moving (Noss, 1998). In some cases, wildlife is chased in the direction of snare lines by illegal hunters (sometimes using perimeter fencing around reserves to assist in funnelling wildlife (J. Mattheus, unpublished data). Snares can be made from natural fibre or nylon (which are used when targeting small mammals and birds) or wire, which is used when targeting larger mammals (small antelopes and upwards in size). Wire for snares is readily available in many areas, from telephone and electricity lines, and fencing used for livestock and wildlife, and wire extracted from burnt tyres (Hofer et al., 1996; Lindsey et al., 2011). Snares are low cost, difficult for enforcement agencies to detect and if left unchecked, can cause rapid declines in wildlife populations (Lindsey et al., 2011). In Savé Valley Conservancy (SVC) in Zimbabwe, for example, up to 18 animals have been recorded in a single snare line (batch of snares set in one localised area) (Lindsey et al., 2011).

Snares can be used for catching species ranging in size from birds and rodents up to elephants *Loxodonta africana* (depending on the size of the snares and material used) and are largely unselective, frequently resulting in the collateral death of animals that are not the primary target (Hofer et al., 1996; Noss, 1998; Hofer et al., 2000). In the Serengeti, species killed in snares range from dik dik *Madoqua kirkii* and to black rhinoceros *Diceros bicornis*, hippopotamus *Hippopotamus amphibius* and elephants (Hofer et al., 1996). Because of the low value of snares, illegal hunters often check them infrequently, resulting in a high degree of wastage when animals are killed and rot without being retrieved (Noss, 1998). For example, in Savé Valley Conservancy during 2001–2009, 1,410 animals rotted in snares (Lindsey et al., 2011). The carcasses of animals in snares tend to attract carnivores that become snared in turn; consequently snaring represents a significant source of mortality for several predator species (Hofer et al., 1996; Woodroffe et al., 1997). Finally, there are animal welfare issues associated with snaring, as the method results in a slow and painful deaths and high rates of severe, non-fatal wounding (Lindsey et al.,

Wire snare in Niassa Reserve (bottom left, Photo: C. Begg). Wildebeest killed in snares, Serengeti National Park (Photo: M. Borner)



2011). In Central Africa, for example, over one third of animals caught in snares escape with injuries, in some cases leaving a foot in the snare (Noss, 1998).

In addition to snares, dogs are often used by illegal hunters to bay wildlife or chase animals into holes, where they are despatched with spears or bows and arrows (Grey-Ross et al., 2010; Jachmann, 2008a; Lindsey et al., 2011) (Table 2). In some areas firearms are used, including shotguns, single-shot rifles and muzzle-loaders (some of which are home-made) (Brown & Marks 2010; Fusari 2001; Lindsey & Bento 2011), though the use of automatic weapons appears to be relatively rare. In rural Maputo District, illegal hunters use semi-automatic weapons to supply a lucrative trade to Maputo city (Barnett, 1998). In Mozambique, illegal hunters commonly use gin traps, which are manufactured from steel car springs and used to kill animals as large as buffalo *Syncerus caffer* and juvenile elephant (Fusari 2001; Lindsey & Bento 2012). Fire

is commonly used by hunters to flush wildlife (and particularly cane rats *Thryonomys swinderianus*), clear undergrowth, increase visibility, stimulate green growth to concentrate wildlife, and cover tracks (J. McNutt unpublished data, Lindsey & Bento, 2012). In some cases, poison is used by hunters. For example, hunters in Ruaha in Tanzania occasionally poison waterholes to kill wildlife for meat (despite the obvious health risks) (A. Dickman, unpublished data). In Mun-yawana Game Reserve in South Africa, poison is commonly used to kill vultures for body parts for traditional medicine (J. Mattheus unpublished data).

Elephant trunk wounded by a snare, Zambia (Photo: M. Becker/R. McRobb)



Table 2. The prevalence of methods used to hunt wildlife for bushmeat in savanna Africa

(NB that in cases where information was sourced from literature, it may be the case that some hunting methods are used in the study areas but were not mentioned in the papers by the authors) *unpublished data

Area	Snares	Dogs	Muzzle loaders/ Single shotguns/ shotguns	Fire	Bows & arrows	Gin traps	Nets	Small mammal/ bird traps	Pit fall traps	Source
Hunting concessions near Okavango, Botswana	1	1	1	1	0	0	0	0	0	K. Collins*
Tsavo National Park, Kenya	1	0	0	0	0	0	0	0	0	Wato et al., 2006
Sokoke Forest, Kenya	0	1	0	0	1	0	0	1	0	Fitzgibbon et al., 1995
WAP complex, Benin, Burkina Faso, Niger	0	0	1	1	0	1	0	0	0	P. Henschel*
Comoé NP, Ivory coast	0	0	1	1	0	1	0	0	0	P. Henschel*
Batéké Plateau, SE Gabon	1	1	1	1	0	0	1	1	0	P. Henschel*
Gile Game Reserve, Mozambique	1	0	0	1	0	1	1	0	0	Fusari and Carpaneto, 2006
Coutada 9, Mozambique	1	0	1	1	1	1	0	0	0	Lindsey and Bento, 2012
Niassa, Mozambique	1	1	1	1	0	0	1	1	1	C. Begg*
Makuleke concession, South Africa	1	1	0	0	0	1	0	0	0	C. Roche*
Dwesa/Cwebe Reserves, RSA	1	1	1	0	0	0	0	0	0	Hayward, 2009
Munyawana Game Reserve, RSA	1	1	1	0	0	0	0	0	0	J. Mattheus*
Ruaha National Park, Tanzania	1	1	1	0	1	1	0	1	0	A. Dickman*
Serengeti National Park, Tanzania	1	1	0	1	1	0	0	1	1	D. Rentsch*
Udzungwa Mountains, Tanzania	1	1	1	0	0	0	0	0	1	Nielsen, 2006
Urumwa Forest Reserve, Tanzania	1	1	1	0	0	0	0	0	0	Carpaneto and Fusari, 2000
North western Tanzania	1	0	1	1	1	0	0	0	0	Jambiya et al., 2007
Luangwa Valley and adjacent Game Management Areas, Zambia	1	1	1	0	0	0	0	0	0	D. Lewis, R. McRobb, M. Becker*
Kafue National Park	1	0	1	1	0	0	0	0	0	N. Midane*
Private conservancies, Zimbabwe	1	1	0	0	1	0	1	0	0	Lindsey et al., 2012
Gonarezhou National Park, Zimbabwe	1	1	0	1	1	0	1	0	0	H. van der Westhuizen*, Gandiwa 2011
Total	0.86	0.67	0.67	0.52	0.33	0.29	0.24	0.24	0.14	

SPATIAL, TEMPORAL PATTERNS IN ILLEGAL HUNTING

Wildlife is rapidly disappearing from unprotected lands, due to a wide array of threats (Newmark, 2008) and as a result, illegal hunters are increasingly focusing their efforts on protected areas. Within protected areas, illegal hunting is more prevalent in areas close to the borders and near human settlements (Muchaal and Ngandjui, 1999; Hofer et al., 2000; Wato et al., 2006; Marealle et al., 2010). Greater distances mean increased time, effort and costs for hunters to find wildlife and transport meat to their home or place of sale (Hofer 2000). Greater time spent in protected areas also increases the risk of being apprehended by anti-poaching game scouts (hereafter referred to as 'scouts'). In Serengeti NP during a period of high poaching intensity and low levels of enforcement, there was a positive relationship between distance from the boundary and occurrence of buffalo (Fitzgibbon et al., 1995; Metzger et al., 2010). Similarly, in Sekoke Forest in Kenya, the occurrence of hunters' traps declines with distance from the boundary (Fitzgibbon et al., 1995). Bushmeat hunters tend to focus hunting efforts in areas where wildlife concentrates, such as close to water holes or along rivers (Hofer et al., 1996; Wato et al., 2006; Lindsey et al., 2011), or even close to flowering or fruiting trees (Lindsey and Bento, 2012).

There are consistent temporal patterns in the frequency of bushmeat hunting. In some areas peaks occur in the late dry season when wildlife is concentrated around water sources (Brown, 2007; Holmern et al., 2007; Lindsey et al., 2011). Bushmeat hunting is also affected by patterns in agricultural activity which dictate household food availability and the amount of time people have available for hunting (Muchaal and Ngandjui, 1999; Lindsey et al., 2011). In the Serengeti NP, the frequency of bushmeat hunting increases during the passage of migratory wildebeest *Connochaetes taurinus* (Holmern et al., 2007). In Savé Valley Conservancy and Mun-ya-wana there are peaks in hunting with dogs during periods of moonlight, when hunters are more able to see and (in the case of Mun-ya-wana) on rainy nights, presumably due to reduced risks of being apprehended (Lindsey et al., 2011); J. Mattheus, pers. comm.).

Fire set by illegal hunters, Coutada 9, Mozambique (Photo: P. Lindsey). Elephant caught in a gin trap, Coutada 9, Mozambique (Photo: Mokore Safaris)



IMPACT OF ILLEGAL HUNTING ON WILDLIFE POPULATIONS

Recent assessments have highlighted that steep declines in wildlife populations are occurring in most African countries (Craigie et al., 2010) and illegal hunting has been implicated as a key contributing factor (Scholte, 2011). In Kenyan parks for example, illegal hunting and the bushmeat trade is considered to be the primary driver for declining wildlife populations (Okello and Kiringe, 2004), and in Zambia, hunting for bushmeat for commercial trade has replaced trophy poaching as the primary threat to wildlife (Barnett, 1998).

The impact of illegal hunting on wildlife populations appears to fall into three categories (Table 3).

Notable impacts on particular species

There are indications from a number of studies that predators are particularly susceptible to snares. Such susceptibility is likely to be due in part to the attraction of predators to carcasses in snares (particularly for spotted hyaenas *Crocuta crocuta*, lions *Panthera leo* and leopards *Panthera pardus*), and partly because predators are wide-ranging (particularly wild dogs *Lycaon pictus*, and cheetahs *Acinonyx jubatus*) and thus more likely to encounter snares. In Niassa Reserve in Mozambique, 52% of lion mortalities are due to snaring, and they occur at lower densities than predicted by prey availability (C. Begg, unpublished data). In south Luangwa National Park, 20% of adult male lions have been killed or injured in snares (M. Becker/R. McRobb, unpublished data). Wild dogs incur particularly high rates of mortality due to being caught in snares (Woodroffe et al., 2007). In and around South Luangwa National Park, for example, snared dogs occurred in 67% of packs (n=6), comprising 14–50% of adult and yearling pack members (median=20%) and 6–16% of a resident population (median=6%) that is already considered to be at a minimum viable pack size (mean=5.6) (R. McRobb/M. Becker unpublished data). Predators are also affected indirectly by illegal hunting through the loss of their prey-base. In the Batéké Plateau in South East Gabon, for example, lions and spotted hyaenas have been extirpated, partly as a result of over-hunting of their prey (P. Henschel, pers. comm.). In northern Botswana, the impact of illegal hunting on scavengers is exacerbated by the fact that hunters poison carcasses to kill vultures to reduce the risks of them highlighting the presence of carcasses (J.W. McNutt unpublished data).



Lion killed in a snare, Luangwa Valley, Zambia (Photo: R. McRobb/M. Becker)

Predators are not the only species that are disproportionately affected by illegal hunting. In Zimbabwe, sable antelope *Hippotragus niger* are particularly affected by hunting with dogs as they tend to stand to fight rather than run away, making them vulnerable to hunters with bows and arrows (G. Duckworth, Mokore safaris, pers. comm.).

Edge-effects and reduced effective protected area size

In some cases, illegal hunting has resulted in edge-effects and reduced wildlife densities close to park boundaries and/or human settlement (Table 3). For example, in the Serengeti NP, illegal hunting has caused significant declines of resident herbivores in areas close to the boundaries (Hofer et al., 1996). In other cases, edge-effects associated with illegal hunting are exacerbated by the use of fire by hunters (Lindsey and Bento, 2012). Fire results in the loss of dry-season grazing, can force wildlife out of protected areas in search of grazing, has potential to impart negative impacts on small mammals and reptiles, and results in the emission of vast quantities of carbon into the atmosphere (Koppmann et al., 2005).

Dramatic, generalized wildlife population declines

In areas where illegal hunting has been allowed to proceed with little or no control, such as in Mozambique during and immediately after the civil war (Hatton et al., 2001), on Zimbabwean wildlife ranches following settlement during land

reform (Lindsey et al., 2012), and in areas adjacent to refugee camps in Tanzania (Jambiya et al., 2007) the effects on wildlife populations have been devastating, resulting in dramatic population reductions and local extirpations of various species (Table 3). Similarly, wildlife populations in Central and West Africa appear to be collapsing in many savanna areas in addition to the well documented declines in the forest biome (Wilkie et al., 2011). For example, wildlife populations in northern Central African Republic declined by 65% during 1985-2005, primarily due to illegal hunting and diseases transmitted by livestock (Bouché et al., 2010). Wildlife populations in the Comoé National Park in Ivory Coast declined by 60-90% during the 1970s to the late 1990s as a result of illegal meat hunting (Fischer and Linsenmair, 2001). Similarly, wildlife populations in Niokolo-Koba NP in Senegal declined by 60-99% from 1991-2006 (Renaud, 2011).

Illegal hunters typically target larger species due to the higher volumes of meat produced. However, across multiple sites in East and southern Africa, there is a declining prevalence of large-bodied species in bushmeat markets due to over-hunting, and hunters are having to travel further to acquire the preferred species (Barnett, 2002). In Malawi for example, the loss of most large species has resulted in bushmeat traders relying on the smaller species that thrive in human-modified landscapes, such as rodents, birds and insects (Barnett, 1998).

In some countries, vast wilderness areas exist from which wildlife has been largely depleted by illegal hunting, resulting in the 'empty forest' syndrome (Redford, 1992) and also, evidently, the 'empty savanna' syndrome. For example, many of the Zambian game management areas and Mozambican hunting coutadas have large areas of intact habitat, low human population densities and yet very little wildlife (Hatton et al., 2001; Simasiku et al., 2008). While lack of data makes comparisons of the severity of various threats impossible, these examples stress that in some areas, illegal hunting is an even more severe threat than that posed by habitat loss (Wilkie et al., 2005). In many areas, such as the Maasai Marai, the threats of excessive hunting for

bushmeat and habitat loss act synergistically with severe consequences for wildlife (Ogutu et al., 2009; Wilkie et al. 2011). The loss of wildlife as a result of illegal hunting can have severe consequences for ecosystem services. For example, the removal of large herbivores and seed dispersing mammals can affect the structure and species composition of woodlands and forests (Wright et al., 2007; Brodie et al., 2009).

The impacts of illegal hunting can be expected to increase in the future. As wildlife disappears from many areas outside of protected areas, illegal hunters are likely to focus their efforts increasingly on parks networks. With increasing demand (due to increasing human populations), and declining supply, the hunting pressure on remaining wildlife populations is likely to increase. As wildlife populations decline, sustainable harvests will decline accordingly and they will become susceptible to the conservation problems associated with small population sizes (Caughley and Sinclair, 1994). The scale and apparent ubiquity of the threat posed by illegal hunting suggests that without urgent intervention to address the issue, wildlife resources will be lost across large areas of the continent, with severe ecological, economic and social impacts.

Spotted hyaena treated after being severely injured by a snare in Zambia (Photo: M. Becker/R. McRobb).



Table 3. Impacts on illegal hunting observed in multiple sites from the literature and a survey of n=12 attendees at a bushmeat meeting

Area	Pronounced impacts on particular species	Edge-effects	Catastrophic population declines	Notes	Source
Comoé NP, Ivory coast	1	1	1	Near-collapse of populations of large mammals. Near extinction of buffalo, elephant and hippo	P. Henschel, unpublished data
Batéké Plateau, SE Gabon	1	1	1	Decline in large ungulates, local extinction of waterbuck, reedbuck, lions & spotted hyaena (due to loss of their prey base)	P. Henschel, unpublished data
Private conservancies, SE Zimbabwe	1	1	1	Near eradication of wildlife in areas settled during land reform and declining populations in adjacent areas, local extinction of wild dogs in several areas	(Lindsey et al., 2011)
Gonarezhou National Park, Zimbabwe	1	1	1	Wildlife population densities lower in areas adjacent to settlement within the park	H. Van der Westhuizen unpublished data
Makuleke concession, Kruger NP, South Africa	1	1	1	On taking over the concession, illegal hunting had reduced wildlife populations to the point that a reintroduction of impala and zebra was deemed necessary to supplement remaining populations. Lions were entirely absent from the concession	C. Roche, unpublished data
Coutada 9, Mozambique	1	1	1	Reduced wildlife densities close to human settlements Five large mammal species have been extirpated (including endangered African wild dogs), wildlife densities reduced by >90%	Lindsey and Bento, 2012
Niokolo Koba National Park, Senegal	1	1	1	Ungulate populations declined by 66-97%, reduced densities close to edges, large species most affected	Renaud, 2011
Kafue National Park, Zambia	1	1	0	Reduced wildlife densities close to boundaries, high incidence of snaring of large predators	N. Midlane, unpublished data
Luangwa Valley, Upper and Lower Lupande, Lumimba and Sandwe game management areas, Zambia	1	1	0	Declining populations in areas close to human settlements, close to boundary of park, declining eland, buffalo and puku populations, strong edge effects from illegal hunting on large carnivores and herbivores	R. McRobb, M. Becker, D. Lewis unpublished data
Hunting concessions near Okavango, Botswana	1	1	0	Declining populations near human settlements, declining giraffe, impala, wildebeest, lechwe populations	K. Collins, unpublished data
Ruaha Game Reserve, Tanzania	1	1	0	Declining lion population	A. Dickman unpublished data

Area	Pronounced impacts on particular species	Edge-effects	Catastrophic population declines	Notes	Source
Serengeti National Park, Tanzania	1	1	0	Resident ungulates locally extirpated in some areas, reduced densities close to boundaries, 78,000-110,000 migratory wildebeest killed annually, skewed gender ratios in impala and giraffe	Hofer et al., 2000; Nyahongo et al., 2005; Ndibalema and Songorwa, 2008; Marealle et al., 2010
Udzungwa Mountains, Tanzania	1	0	1	Severe depletion of wildlife populations in New Dabaga/Ulangambi Forest Reserve, Blue and Harvey's duiker numbers reduced by 90%, Abbot's duiker extirpated	Nielsen, 2006
WAP complex, Benin, Burkina Faso, Niger	0	1	1	Major population declines have occurred in parts of the complex with weak law enforcement	P. Henschel, unpublished data
Niassa Reserve, Mozambique	1	0	0	Low densities of lion with low litter sizes and instability in prides, rapid turnover in leopard populations, low densities of wildlife around villages.	C. Begg Unpublished data
Dwesa/Cwebe Reserves, RSA	1	0	0	Local extinction of red hartebeest, decline in zebra, wildebeest and white rhinoceros populations	Hayward, 2009
Private farms, Kwa-Zulu Natal, RSA	1	0	0	Declining populations of oribi in some areas	Grey-Ross et al., 2010
Sokoke Forest, Kenya	0	1	0	Large ungulate populations reduced to low densities throughout reserve, the density of small mammals has been reduced for 1-2 km from the boundary	Fitzgibbon et al., 1995; Fitzgibbon et al., 1995; Fitzgibbon et al., 1995; Fitzgibbon et al., 1995
Niassa Reserve, Mozambique	0	1	0	Reduced wildlife densities close to human settlements in the reserve Reduced wildlife densities throughout the reserve	C. Begg, unpublished data
North western Tanzania	0	0	1	Wildlife populations in Burigi and Bi-haramulo Game Reserves were reduced to less than 10% of their former numbers largely through illegal exploitation by refugees and local populations	Jambiya et al., 2007
Ranches in the Kalahari ecoregion of north western Zimbabwe	0	0	1	Reductions of wildlife populations of up to 90% due to excessive harvests to supply the bushmeat trade following the settlement of ranches during land reform	du Toit, 2004
Agricultural farms on the Zimbabwe central plateau	0	0	1	Dramatic declines (50-60%) in antelope populations during the 1-2 years following the land reform programme, due to excessive off-takes for the bushmeat trade, 50% loss of national tsessebe population	du Toit, 2004
Total	0.73	0.68	0.55		

IMPACT *of* ILLEGAL HUNTING *on* WILDLIFE-BASED LAND USES

Illegal hunting can significantly undermine the viability of wildlife-based land uses, or even preclude them. Trophy hunting is financially unviable in a significant proportion of hunting blocks in Mozambique (92.3%), Namibia (66.6%), Zambia (66.6%), Zimbabwe (44.4%) and Tanzania (18.8%), and in most cases the cause is likely the loss of wildlife due to illegal hunting for bushmeat (Lindsey et al., 2012). In Coutada 9 in Mozambique, earnings from trophy hunting are 96% lower than what they would be in the absence of illegal hunting (Lindsey and Bento, 2012). In Savé Valley Conservancy, illegal hunting imposed costs of at least US\$1.1 million per year through lost revenues from trophy hunting and the legal sale of meat (Lindsey et al., 2011). Similarly, in Tanzania, illegal hunting emanating from refugee camps resulted

in reduction in trophy revenues from Burigi and Biharamulo Game Reserves from US\$103,100 in 1994 to US\$33,670 in 1998 (Jambiya et al., 2007). Ecotourism operations are likely to be even more sensitive to illegal hunting, because the viability of such operations is typically dependent on the presence of high densities of habituated wildlife (Lindsey et al., 2006). For example, in the Makuleke concession of Kruger National Park in South Africa, ecotourism operators (and the community owners of the land) ran at a loss for the first six years of operation due to depleted wildlife populations resulting from illegal hunting (C. Roche, Wilderness Safaris, pers. comm.). Animals with snare wounds also have potential to create significant negative publicity for tourism companies and wildlife destinations.



Elephant caught in gin trap (Photo: N. Duckworth)

V. Illegal Hunters, Meat Traders & the Nature of the Trade in Bushmeat

Hunting is an almost exclusively male activity, while women are more likely to do the butchering of the meat (LeBreton et al., 2006; Brown, 2007; Lindsey et al., 2011). In Zimbabwe and Central Mozambique, most hunters are in their 20s and 30s (Lindsey et al., 2011; Lindsey and Bento, 2012). In many cases, illegal hunters are poor, with low levels of education and livestock ownership (Loibooki et al., 2002; Nyahongo et al., 2005; Knapp, 2007; Lindsey et al., 2011; Lindsey and Bento, 2012). In the Serengeti ecosystem however, hunting households are sometimes wealthier than non-hunting households and hunters appear to be those individuals that have the time and opportunity to hunt (Knapp, 2007). In some cases, hunters enjoy elevated social status as a result of their profession (Brown, 2007). In the Dande area of Zimbabwe and the Luangwa Valley of Zambia, hunters are esteemed due to providing meat to village leaders and to the incapable, elderly, or female-headed households (Barnett, 2002). In the Serengeti, women exhibit a preference for men who hunt (A. Lowassa unpublished data). In areas where the hunting grounds are relatively distant from hunters' homes,

such as in the Luangwa Valley in Zambia, meat carriers are employed (all of whom are male) (Brown, 2007).

Illegal hunting for wildlife appears to operate on a continuum, from that done to obtain meat for consumption or trade within hunters' communities, that done partially for subsistence and partially for trade to local markets, and that done for trade to local, urban or even international markets (Brashares et al., 2011). In a minority of instances, illegal hunting is practised primarily for sport. For example, 'taxi hunts' are organised illegally on farms in Kwa-Zulu Natal in South Africa where various hunters set off with dogs to hunt after placing bets on the outcome (Grey-Ross et al., 2010) (Table 4). In virtually all cases, illegal hunters use a portion of their catch for their own consumption and in some areas bushmeat provides a significant contribution to household

Bushmeat being smoked for transport, Luangwa Valley, Zambia (Photo: R. McRobb/M. Becker)



food security (Table 4). In Kitui in Kenya for example, 80% of households consume 14.1 kg of bushmeat per month, and in Kweneng in Botswana, 46% of households consume 18.2 kg per month (Barnett, 1998). However, a proportion of bushmeat is also almost invariably sold, most commonly within local communities (Table 4). Where bushmeat is purchased close to the hunting ground, buyers tend to be those with cash incomes, such as businesspeople or teachers, or even local government officials and policemen (Lindsey et al., 2011; Lindsey and Bento, 2012). Bushmeat sold in areas close to the hunting grounds is usually sold for cash, which is used by hunters to purchase soap, clothes, beer, or to pay for school fees (Brown, 2007; Lindsey et al., 2011). In some instances in rural areas, hunters trade bushmeat for grain (Lindsey et al., 2011). Where bushmeat is purchased in urban areas, buyers are likely to be relatively wealthier than those in rural areas due to the higher prices of bushmeat (Barnett, 2002).

There is an indication in some study-sites that the bushmeat trade is becoming less motivated by subsistence needs, and increasingly commercial in nature due to increasing market demand (e.g. in the Serengeti ecosystem, D. Rentsch, unpublished data) both from local communities and distant urban centres, including international cities (Barnett, 2002; Chaber et al., 2010). In several southern and East African countries, including Zambia, Malawi and Mozambique, well-developed and complex rural to urban trade supply networks exist (Barnett, 2002). Significant quantities of bushmeat enter urban centres such as Lusaka and Maputo on a regular basis (Barnett, 1998). In some cases, commercially-orientated trade outlets have developed for the sale of bushmeat, such as the open-air markets, chop-bars and butcheries that have developed in Kitui, Kenya (Barnett, 1998). Full-time commercial bushmeat traders occur in most southern and East African countries (Barnett, 2002). In the western Serengeti, for example, 34.3% of traders rely on bushmeat as their sole source of income, and sell meat at markets as far as 200km away (Barnett, 2002). In central Mozambique, middlemen purchase bushmeat from hunters to re-sell it in urban centres, after transporting it on bicycles or in cars (Lindsey and Bento, 2012). In Cameroon, bushmeat is transported from the relatively wildlife-rich savanna areas to urban centres by minibuses and trains (Edderai and Dame, 2006). Bushmeat is typically dried or smoked to preserve it for transport (Mendelson et al., 2003).



Bushmeat being transported by bicycle, central Mozambique (Photo: C. Bento). Bushmeat that was confiscated by traders who were transporting it by car, Zambia (Photo: J. Milanzi)

The degree of secrecy with which bushmeat is traded likely reflects the quality of enforcement and degree of risk associated with the trade. In rural Maputo District, bushmeat is often traded in open-air markets, suggesting that enforcement and fear of reprisal among traders is minimal (Barnett, 1998). In Central Mozambique, by contrast, children are often used to sell bushmeat along roads as they are likely to be treated leniently by the authorities (C. Bento, unpublished data). Generally, however, in southern Africa, bushmeat is traded covertly, suggesting that there is at least some degree of enforcement in most countries (Barnett, 1998).

Table 4. The most common reasons for illegal hunting in various savanna sites in Africa

Area	Own use	Local commercial trade	Commercial trade to urban areas	For body parts for traditional medicine/ceremonies	Prestige of hunting /social status	Sport	Source
Hunting concessions near Okavango, Botswana	0	1	1	0	0	0	K. Collins, unpublished data
WAP complex, Benin, Burkina Faso, Niger	0	1	1	1	0	0	P. Henschel
Comoé NP, Ivory coast	1	0	1	1	0	0	P. Henschel
Batéké Plateau, SE Gabon	1	1	1	0	0	0	P. Henschel
Sokoke Forest, Kenya	1	1	0	0	0	0	Fitzgibbon 2005
Gile Game Reserve, Mozambique	1	1	1	0	0	0	Fusari & Carpaneto 2006
Coutada 9, Mozambique	1	1	1	1	0	0	Lindsey & Bento 2012
Niassa Reserve, Mozambique	1	1	0	1	0	0	C. Begg, unpublished data
Makuleke concession, RSA	1	1	0	1	0	0	C. Roche, unpublished data
Various reserves, RSA	1	1	0	0	0	1	Warchol & Johnson 2009
Private farms, Kwa-Zulu Natal, RSA	1	0	0	0	0	1	Grey-Ross et al. 2010
Ruaha Game Reserve, Tanzania	1	1	1	0	1	0	A. Dickman, unpublished data
Serengeti National Park, Tanzania	1	1	1	1	1	0	Hofer 2000; Barnett 2002; Ndibalema & Songorwa 2002; Nyahongo et al. 2005; D. Loibooki et al. 2002; Rentsch unpublished data
Udzungwa Mountains, Tanzania	1	1	1	0	1	0	Nielsen 2006
Ugalla Game Reserve, Tanzania	1	1	0	0	0	0	Wilfred & MacColl 2010
Urumwa Forest Reserve, Western Tanzania	1	1	0	0	0	0	Carpaneto & Fusari 2000
North western Tanzania	1	1	0	0	0	0	Jambiya et al. 2007
Kafue National Park, Zambia	1	1	1	0	0	0	N. Midlane, unpublished data
Luangwa Valley, Upper and Lower Lupande, Lumimba and Sandwe game management areas, Zambia	1	1	1	1	1	0	D. Lewis, R. McRobb, M. Becker unpublished data
Private conservancies, SE Zimbabwe	1	1	0	1	0	0	Lindsey et al. 2011
Gonarezhou National Park, Zimbabwe	1	1	1	1	0	0	H. van der Westhuizen unpublished data
Average	0.90	0.90	0.57	0.43	0.19	0.10	

The relative price of bushmeat

The price of bushmeat is related to the distance of the point of sale from harvestable wildlife populations (Brashares et al., 2011). Estimates derived from the literature indicated that the price of bushmeat relative to alternative meat (live-stock, and/or poultry and/or fish) was higher in urban areas (1.57 ± 0.16 times higher than the price of alternatives, $n=10$) than rural areas (bushmeat was $0.72 \pm n=19$ the price of alternatives) (F Ratio=17.6, d.f.=1, $p < 0.001$). In areas where bushmeat is transported 90 km or more from its source, it costs almost 50% more than fish and chicken (Brashares et al., 2011). Correspondingly, illegal hunters in areas closer to urban centres sell a greater proportion of their catch than those in rural areas (Brashares et al., 2011).

In keeping with these trends, the basis for preference for game meat appears to vary consistently among rural and urban consumers. Rural consumers typically prefer bushmeat to other proteins because it is cheaper or more available (78.5% of $n=19$ sites), whereas at urban sites ($n=10$), selection of bushmeat is invariably (100%) based on preference for its taste ($\chi^2=8.9$, d.f.=1, $p=0.003$). Rural users of bushmeat are frequently food-insecure with high rates of malnutrition, whereas urban users tend to be wealthier and view bushmeat as a luxury good superior to fish or meat from domestic animals (Barnett, 2002). In Maputo for example, the price of red

duiker *Cephalophus natalensis* meat quadruples in the lead up to Christmas as wealthier consumers prefer bushmeat for the festivities (Barnett, 1998).

The scale of the bushmeat trade

In several countries, the bushmeat trade involves vast quantities of meat and generates significant economic returns. In Tanzania, for example, a mean of 2,078 tonnes of bushmeat are confiscated annually with a value of >US\$50 million (Secretariat of the Convention on Biological Diversity, 2011) and in Mozambique 182,000–365,000 tonnes of bushmeat are believed to be consumed per year, with an economic value of US\$365/730 million per year (Barnett, 1998). Estimates of bushmeat harvest from Central Africa are even higher: Gabon 49,000 tonnes; Central African Republic (59,000); Cameroon (234,000); Republic of Congo (189,000) and Democratic Republic of Congo (1.7 million) (Fa et al., 2003; Secretariat of the Convention on Biological Diversity, 2011).

The economic value of the bushmeat trade exceeds that of legal forms of wildlife utilization in some countries, including Mozambique and Tanzania (Barnett, 1998). However, comparisons with the scale of legal forms of wildlife use are not particularly meaningful. First, the illegal bushmeat trade is not sustainable in many areas and so estimates of the scale of the industry represent snapshots reflecting the state of wildlife populations at a given moment in time. Second, legal forms of wildlife-use are extremely under-developed in many countries and if harnessed fully via tourism, trophy hunting, legal meat sales could potentially far exceed the value of illegal trade. In Central Africa, for example, the value of the illegal bushmeat trade has been estimated at US\$42–205 million/year (Davies, 2002) whereas in South Africa and Namibia where legal wildlife-based land uses are well developed, the game ranching industry on private land turns over US\$912 million and US\$166 annually, respectively, in addition to the significant earnings from wildlife on state and communal land (G. Dry Wildlife Ranching South Africa pers. comm; Barnes et al., 2010). In addition, unlike earnings from the illegal bushmeat trade, revenue generated from legal wildlife-based land uses is completely sustainable. However, insights into the scale of the bushmeat trade do demonstrate the scale of the threat and the challenge posed in terms of the need for developing sustainable alternative livelihood options and protein supplies for the people involved.



Child selling dried bushmeat on a roadside in central Mozambique (Photo: C. Bento)

VI. Key Drivers of Illegal Hunting & the Bushmeat Trade

INCREASING DEMAND *for* BUSHMEAT *in* RURAL AREAS

Human populations are growing faster in Africa than in any other continent (http://en.wikipedia.org/wiki/Population_growth#Growth_by_country, accessed May 2012), and population growth in areas close to protected areas is occurring faster than elsewhere (Wittemyer et al., 2008). Many communities have a long tradition of hunting and of consuming bushmeat, and levels of off-take have simply increased with increasing human populations, with the effect that even traditional forms of hunting can impart severe negative impacts on wildlife populations. For example, human densities in the areas adjacent to Serengeti NP are some of the highest in Tanzania, and populations are increasing by 3.5% per year, in an area where mean household bushmeat consumption is 2 kg/week, resulting in a steep increase in demand for bushmeat (D. Rentsch unpublished data).

INCREASING DEMAND *for* BUSHMEAT *in* URBAN AREAS

The populations of African cities are increasing rapidly, and as a result, there is a growing demand for bushmeat from urban centres (Bloom et al., 2008). Bushmeat typically comprises a small proportion of the protein consumed by urban societies (e.g. 2% in Gabon), but the large populations involved mean that demand for the commodity is significant (Wilkie et al., 2011). Demand for bushmeat is also increasing beyond the borders of Africa, with increasing African populations in many international cities. There are significant inflows of bushmeat into Europe (e.g. five tonnes per week into Paris) and the US, for example, where the product is sold for significantly elevated prices (Chaber et al., 2010; Smith et al., 2012).

Increasing demand for bushmeat from rural populations, urban centres in African and international cities is driving elevated prices increased commercialization of illegal hunting and the bushmeat trade (Stiles, 2011; Wilkie et al., 2011). These trends are causing erosion of traditional hunting seasons, ignoring of traditional taboos (which previously caused some species to be left, such as giraffe *Giraffa camelopardalis*, hippopotamus and zebra *Equus quagga* in the Luangwa Valley, and elephant, hippopotamus, warthog *Phacochoerus africanus* and bush pig *Potamochoerus larvatus* in Niassa Reserve, and the discarding of traditional hunting methods in favour of more effective techniques, placing further pressure on wildlife populations (Barnett, 2002). For example, the Maasai and Samburu in Kenya traditionally eschewed hunting and the consumption of bushmeat due to cultural taboos, but have recently started to utilize the resource (Barnett, 1998).

HUMAN ENCROACHMENT *of* WILDLIFE AREAS

Increasing human populations are resulting in increased encroachment of wildlife areas and elevated pressure on natural resources (Kiringe et al., 2007). Several categories of protected areas in Tanzania and Ethiopia are partially settled, as are the game management areas in Zambia. In Mozambique, communities settled many parks and hunting blocks during and after the civil war (Hatton et al., 2001) and steep human population increases are being observed in Niassa National Reserve (C. Begg unpublished data). In Zimbabwe, a large number of private wildlife-ranches and conservancies and part of Gonarezhou National Park were settled in the early 2000s during land reform (Lindsey et al., 2011). In some cases, the settlement of wildlife areas has been facilitated by efforts to control tsetse fly *Glossina* spp. (Muriuki et al., 2005).

The frequency of illegal hunting declines with distance from human settlements (Hofer et al., 1996; Muchaal and Ngandjui, 1999; Lindsey et al., 2011). Similarly, the rate of bushmeat consumption falls with distance of human settlements from wildlife populations, and drops steeply from ~30 km (Brashares et al., 2011). As a result of these (and other impacts), human encroachment of protected areas typically imparts negative ecological impacts and wildlife populations fare better in parks where human settlement is not permitted (Stoner et al., 2007).

Human encroachment is often greatly exacerbated by poorly planned infrastructure such as roads, clinics, schools and boreholes in or close to wildlife areas. Though such developments are well-intentioned, they tend to result in influxes of people into areas that are poorly suited to human settlement, which creates dependency on exploitation of natural resources such as wildlife for survival. In addition, forestry and mining, which are often practised in wildlife areas and can dramatically increase the vulnerability of wildlife to illegal hunting due to the opening of roads and the associated influx of job seekers and their families (Clark et al., 2009; Poulsen et al., 2009). For example, a major spike in illegal hunting was observed in parks in the Democratic Republic of Congo following an influx of people to mine coltan (Hayes and Burge, 2003). In some cases, logging companies perceive bushmeat as a free commodity with which to supplement workers' income (Wilkie et al., 2011). The development of industrial logging in the Republic of Congo, for example, led to a 69% increase in the population of nearby towns and a 64% increase in bushmeat supply, the majority of which accrued to immigrant populations rather than indigenous peoples with a long-standing and legitimate claim to the wildlife resource (Poulsen et al., 2009). While roads are unlikely to have the same impact in savanna areas (which are less impenetrable than forests), they are nonetheless likely to improve access to wildlife populations and decrease the costs and difficulty associated with trading bushmeat and drive an increase in illegal hunting. For example, in Zambia, it is feared that the Chipata-Mfuwe road will increase access and ease of transport of bushmeat from the Luangwa valley to urban centres (R. McRobb/M. Becker, unpublished data).

Table 5. Drivers for illegal hunting and the bushmeat trade in the savanna biome (NB that where information was extracted from literature, the lack of mention of some drivers does not necessarily mean those drivers are not in play in the areas included in the table)

	Inad-equate-enforce-ment	Protein short-ages	Illegal hunting is a money making opportunity	Poverty/ lack of alterna-tive live-lihoods/ employ-ment	Weak penal systems	Corrupt game scouts/ employ-ees	Human influxes/ popula-tion increase	Livestock held as assets/ lack of livestock	Lack of benefits from wildlife
Hunting concessions near Okavango, Botswana ¹	1	0	1	0	1	1	0	1	0
WAP complex, Benin, Burkina Faso, Niger ²	1	0	1	0	1	1	0	0	0
Comoé NP, Ivory coast ³	1	0	1	1	0	0	0	0	0
Batéké Plateau, SE Gabon ³	1	1	1	1	0	0	0	0	0
Sokoke Forest, Kenya ³	0	1	0	0	0	0	0	0	0
Protected areas in Kenya ⁴	1	1	1	1	1	0	1	0	0
Gile Game Reserve, Mozam-bique ⁵	1	1	1	1	0	0	1	0	0
Coutada 9, Mozambique ⁶	1	1	1	1	1	1	1	1	1
Niassa Reserve, Mozambique	1	1	1	1	1	1	1	1	1
Makuleke concession, RSA ⁷	1	1	1	1	1	0	0	1	0
Various reserves, RSA ⁸	1	1	1	1	1	1	0	1	1
Private farms, Kwa-Zulu Natal, RSA ⁹	1	1	0	1	1	1	0	0	0
Kilombero, Tanzania ¹⁰	1	0	0	0	0	0	0	0	1
Ruaha National Park, Tan-zania ¹¹	1	1	1	1	1	1	1	0	1
Serengeti National Park, Tanzania ¹²	1	1	1	1	1	1	1	1	1
Udzungwa Mountains, Tanzania ¹³	0	1	0	1	0	0	0	0	0
Ugalla Game Reserve, Tanzania ¹⁴	0	0	0	1	0	0	0	1	0
Urumwa Forest Reserve, Tanzania ¹⁵	1	1	1	0	0	0	0	0	0
North western Tanzania ¹⁶	1	1	1	1	1	0	1	0	0
Kafue National Park, Zam-bia ¹⁷	1	1	1	1	1	1	1	1	1
Luangwa Valley & adjacent Game Management Areas ¹⁸	1	1	1	1	1	0	1	1	1
Save Valley Conservancy, Zimbabwe ¹⁹	1	1	1	1	1	1	1	1	1
Gonarezhou National Park, Zimbabwe ²⁰	1	1	1	1	1	1	1	1	1
Average	0.87	0.78	0.78	0.78	0.65	0.48	0.48	0.48	0.43

¹ K. Collins, unpublished data; ² P.Henschel, unpublished data; ³ Fitzgibbon et al., 1995; ⁴ Saru, 2012; ⁵ Fusari and Carpaneto, 2006; ⁶ Lindsey and Bento, 2012; ⁷ C. Roche, unpublished; ⁸ Varchol and Johnson, 2009; ⁹ Grey-Ross et al. 2010; ¹⁰ Haule et al., 2002; ¹¹ A. Dickman, pers. comm.; ¹² Hofer 2000, Barnett 2002, Ndiabalema & Songorwa 2002, Nyabongo et al. 2005, Marealle 2010; ¹³ Nielsen, 2006; ¹⁴ Wilfred and MacColl, 2010; ¹⁵ Carpaneto and Fusari, 2000; ¹⁶ Jambiya et al., 2007; ¹⁷ N. Midlane, unpublished data; ¹⁸ D. Lewis, R. McRobb, M. Becker unpublished data; ¹⁹ Lindsey et al., 2012; ²⁰ Gandiwa, 2011

LACK of ALTERNATIVE LIVELIHOODS

In many rural parts of Africa, the opportunities for formal employment are limited and communities are characterized by high levels of unemployment and poverty (Brown, 2007). The urgent need for money for basic necessities, combined with the availability of free time and the quick cash income that can be made from selling bushmeat creates a key driver for illegal hunting (Table 5). In rural Zambia, for example, some hunters are able to earn nearly US\$100 from a single expedition, which approaches the local per capita annual income of US\$120, and hunters are among the wealthiest community members (Brown, 2007). Unemployment also provides individuals with ample time to spend hunting illegally and correspondingly, rates of hunting and household bushmeat consumption decline sharply during times of peak agricultural activity (Knapp, 2007; Brashares et al., 2011). Individuals with low (or seasonal) employment allocate a greater period of time to hunting than those with full time jobs (Brashares et al., 2011).

LACK of ALTERNATIVE FOOD SOURCES

Consumers in areas close to wildlife populations are frequently driven to eat bushmeat due to the lack of alternative protein sources (Foerster et al., 2012) (Table 5). Shortages of carbohydrates also contribute to illegal hunting, as the meat obtained is often traded for grain or used to generate cash for buying food (Lindsey et al., 2011). Lands where wildlife persists are frequently poorly suited to agriculture and low levels of food security are prevalent. For example, in South East Zimbabwe, 93.8% of illegal hunters were forced to skip meals during the last year due to food shortages (Lindsey et al., 2011). Reliance on bushmeat is exacerbated in some areas by an absence of livestock due to the presence of tsetse fly (e.g. Central Mozambique (Lindsey and Bento, 2012)), due to diseases which reduce the productivity of livestock (e.g. Newcastle disease which infects 60% of the chicken (*Gallus domesticus*) population (Lewis, 2005)). Where livestock are present, communities often retain cattle and other domestic animals as capital and cultural assets and use bushmeat to fulfil their daily protein needs (Barnett, 1998).

As a consequence of these factors, bushmeat forms a key component of the diets of communities in many areas and contributes significantly to food security (Nyahongo et al., 2005). In Central Africa, hunting provides 30-80% of protein intakes of rural communities and almost 100% of animal proteins (Nasi et al., 2008), and around the Serengeti, bushmeat constitutes 31% of all meat consumed due to the ready availability of the commodity (D. Rentsch, unpublished data). However, due to declining wildlife populations the contribution of bushmeat to food security is likely to be unsustainable.

INADEQUATE PENAL SYSTEMS AND LACK of ENFORCEMENT

In many countries, the gazetted punishments for poaching provide inadequate deterrents and do not reflect the value of the resource being destroyed (Barnett, 1998). Penalties often include small fines (often of lower value than the meat obtained), community service or warnings (Barnett, 2002; Demeke, 2003). For example, of the 64 suspects arrested for illegal hunting in the NG26 concession in northern Botswana during the last 30 months, none have been convicted (Collins, 2012). In central Mozambique, by contrast, illegal hunters are granted large (US\$485) fines, which are rarely collected (Lindsey and Bento, 2012). Due to a lack of record keeping, magistrates often fail to take into account the criminal history of illegal hunters, with the effect that first time and repeat offenders often receive similarly weak punishments (V. Opyene, unpublished data). Wildlife laws are not harmonized among neighbouring countries, which can create loopholes for illegal hunters. For example, the penalties for illegal hunting in Kenya are lighter than those in neighbouring Tanzania, encouraging hunters from Tanzania to operate across the border (V. Opyene, unpublished data). Wildlife offences are typically granted lower priority than those involving livestock, which has impacts upon the development of legal wildlife-based land uses. In Zimbabwe, for example, convicted stock thieves are granted six years imprisonment for the theft of a goat worth US\$20–30, whereas a poacher convicted of killing a sable antelope worth US\$16,000 would be granted a nominal fine, or community service or released with a warning (Lindsey et al., 2011). In Zambia, the penal system with regards to wildlife works on a maximum sentence but does not allow for a minimum penalty, with the effect that magistrates have the discretion to allocate vastly disparate punishments to illegal hunters based on their personal attitudes (R. McRobb, unpublished data).

Wildlife laws are often not complied with voluntarily (Rowcliffe et al., 2004) and law enforcement in the form of anti-poaching and measures to prohibit the transport and sale of illegal bushmeat are essential to control illegal hunting. However, in many countries, state wildlife agencies lack the resources, expertise and political will necessary (Jachmann, 2008b; Wilkie et al., 2011) and poor law enforcement is the most frequently cited driver of illegal hunting in savanna areas (Table 5).

Budgets for park managements vary widely, from US\$1.8/km² in Mozambique, US\$27/km² in Botswana, US\$110/km² in Namibia and \$265/km² in South Africa (Manousrian and Dudley, 2008) and many protected areas lack the manpower, equipment and vehicles necessary to control illegal hunting (Holmern et al., 2007). During the 1990s in Tanzania, for example, a force of 1,438 personnel was employed to protect 186,000 km² of protected areas and one vehicle was available to wildlife staff per district (Masilingi, 1996). Consequently, illegal hunters operate with impunity in many areas. In the Serengeti NP for example, <1% of illegal hunters are apprehended by scouts (Loibooki et al., 2002). Similarly, in Ethiopia, the density of scouts in Omo National park was reduced from 1/152 km² in the 1970s to 1/370 km² in 2002 due to waning operational budgets (Demeke, 2003). In some cases, anti-poaching security is simply overwhelmed by the scale of the threat. For example, following establishment of refugee camps in North West Tanzania in the mid-1990s, ~9,600 poachers were arrested in a two month period, 7,480 of whom escaped from custody (Jambiya et al., 2007).

The efficacy of anti-poaching is further undermined in many areas by poor morale resulting from low salaries, lack of equipment and lack of supervision (Lindsey et al., 2011). Corruption can also reduce the effectiveness of wildlife law enforcement. Scouts are sometimes bribed by illegal hunters to turn a blind eye, and scouts themselves sometimes hunt illegally in areas they are deployed to protect (Lindsey et al., 2011). Authorities are often hesitant to prosecute offenders connected to anyone in government (including traditional leaders and their advisors). In some cases, government employees/officials are actively involved in illegal hunting or the bushmeat trade. For example in Central Mozambique, police and local government officials are known to buy bushmeat from illegal hunters, creating a clear conflict of interest which contributes to low conviction rates (Lindsey and Bento, 2012). In Central Africa, government officials pay poachers to hunt elephants for ivory, who then sell the meat as a lucrative side-product (Stiles, 2011).

LACK of CLEAR RIGHTS *over* WILDLIFE OR LAND, AND/OR INADEQUATE BENEFITS *from* WILDLIFE

In many countries, communities lack clear rights over their land or the wildlife that they live with. In such areas illegal hunting is often the only means through which communities can access benefits from wildlife. In some places, efforts have been made to remedy this situation through the development of community-based natural resource management (CBNRM) programmes through the devolution of user-rights over wildlife to communities. However, in most cases (such as in Botswana, Tanzania, Zambia and Zimbabwe) devolution is only partial, with the effect that government retains significant proportions of revenue from wildlife (Suich et al., 2009). As a consequence, wildlife-based land uses are greatly disadvantaged relative to alternatives, and the incentives for conservation are weak (Suich et al., 2009).

Communities are also often marginalized from the benefits derived from wildlife in protected areas (or private reserves), which creates strained relations with the wildlife sector (Newmark et al., 1993). In some cases, such relations are worsened by human wildlife conflict, heavy-handed anti-poaching and historical grievances over the loss of land. In such instances, illegal hunting may be practised as a form of protest (Holmes, 2007).

POLITICAL INSTABILITY, CORRUPTION & POOR GOVERNANCE

Illegal hunting for bushmeat typically increases in prevalence during periods of political instability and poor governance. In Mozambique, for example, wildlife populations were decimated through unregulated hunting during and after the civil war (Hatton et al., 2001) and in Zimbabwe, wildlife populations on many wildlife ranches were decimated following settlement during land reform and the associated breakdown in wildlife law enforcement (Lindsey et al., 2011). In North West Tanzania, the placement of refugee camps close to wildlife areas resulted in major spike in illegal hunting and significant reductions in wildlife populations (Jambiya et al., 2007). In Garamba NP in Democratic Republic of Congo, bushmeat hunting increased fivefold during periods of armed conflict (de Merode et al., 2007). In northern Central African Republic, political instability experienced during 2002-2010 hastened the loss of wildlife due to illegal hunting for meat (Bouché et al., In press). In Liuwa Plain National Park in Zambia, civil strife in neighbouring Angola caused a major increase in illegal hunting and severe impacts on wildlife populations (M. Becker, unpublished data).

DEMAND *for* WILDLIFE BODY PARTS *for* TRADITIONAL MEDICINE & CULTURAL CEREMONIES

In some instances, demand for body parts for traditional medicines and cultural practises is a driver for illegal hunting. The additional value that can be attained from selling body parts for medicinal or ceremonial purposes likely enhances the profitability of bushmeat hunting in many cases. In Kilombero in Tanzania, parts of wild animals are used for medicine, making drums and a variety of other ritual and cultural purposes (Haule et al., 2002). A large haul of genet *Genetta* spp. skins were seized in northern Kruger National Park in South Africa in 2006 that were hunted to supply demand for skins for ceremonial dress (C. Roche, pers. comm.). In KZN in South Africa there is a significant trade in leopard skins for cultural and religious dress (Lindsey, 2010b). In Mozambique, hunters obtain US\$83–\$150 for leopard skins in Niassa Reserve, and as much as US\$2,500 in Lichinga town (C. Begg, unpublished data). In Niassa, Ruaha National Park and Mun-ya-wana lion carcasses have been found with body parts removed (C. Begg, A. Dickman, J. Mattheus, unpublished data).

ABUNDANT MATERIAL *for* MAKING SNARES

Controlling illegal hunting is made difficult in some areas due to the abundance of wire which can be used to make snares. In Zambia, the electricity supply corporation, in an effort to increase the extent of the national grid, has greatly increased the amount of wire in rural areas and >60% of snares recovered by the South Luangwa Conservation Society is made from such wire (M. Becker/R. McRobb, unpublished data). In many cases bundles of wire are left unprotected and are stolen by illegal hunters for snare material. Fencing provides a key supply of snare material in some areas. In Savé Valley Conservancy, for example, most of the >84,000 snares removed during 2002–2009 were made from wire from the perimeter fence (Lindsey et al., 2012). Similarly, at Pafuri in the Makuleke concession, cable from the dilapidated western boundary fence was frequently stolen by illegal hunters to make snares to capture hippo and buffalo (C. Roche, unpublished data). In Niassa Reserve, where wire is scarce, a spike in snaring was noted after an NGO erected fences around villages to reduce human-elephant conflict (C. Begg unpublished data). Similar problems have been experienced with NGO-sponsored fencing projects in Zambia (R. McRobb, unpublished data). In areas where wire is largely absent, illegal hunters are forced to rely on methods that are easier to control. In Coutada 9 in Mozambique for example, illegal hunters use steel gin traps which are costly to replace if confiscated by anti-poaching scouts (Lindsey and Bento, 2012).



Unsecured electrical cable (Zambia Electrical Supply Corporation) (Photo: R. McRobb/M.Becker)

VII. Potential Solutions to Illegal Hunting, Bushmeat Trade & Associated Challenges

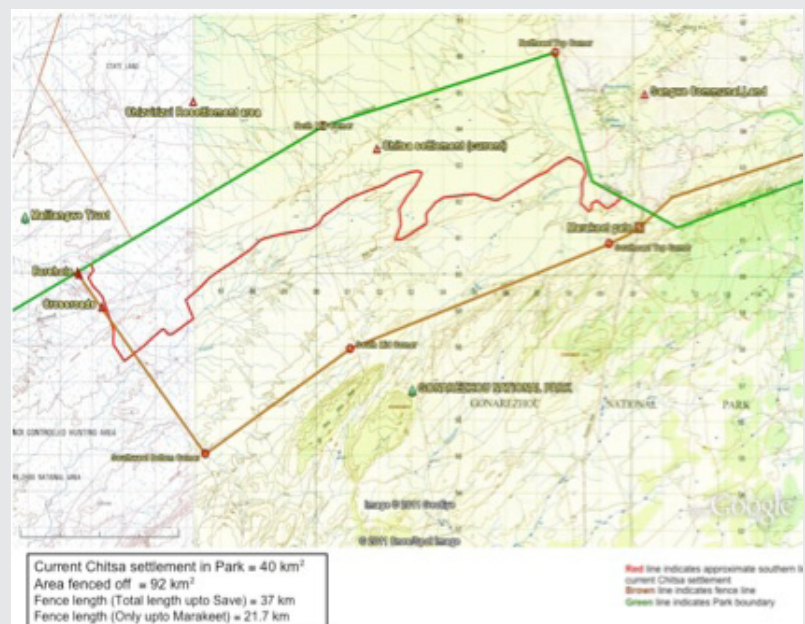
ADDRESSING HUMAN POPULATION GROWTH *within & near to* PROTECTED AREAS

Human population growth represents a politically sensitive topic and one that conservation agencies appear reluctant to address. However, frank discussion of the issue of high levels of human population growth within and near to protected areas is required, because if current trends continue, other interventions to address illegal hunting and the bushmeat trade are much less likely to succeed.

LAND USE PLANNING

Due to the clear relationship between proximity of human settlement with wildlife and levels of illegal hunting, creating distance or minimizing the interface between people and wildlife is a key means of reducing illegal hunting (Lindsey et al., 2011). Several options are available. The development and maintenance of large protected areas is important as there is a clear positive relationship between reserve size and the retention of wildlife diversity (Newmark, 2008). The effective size of protected areas can be increased in some cases through creating links between parks in neighbouring countries via the creation of transfrontier protected areas (Newmark, 2008). The creation of buffer zones surrounding parks can also help conserve critical habitats and reduce edge-effects (Stokes et al., 2010). Buffer zones can be created either through gazettement of semi-protected areas, or through the promotion of wildlife-based land uses in land adjacent to parks. In countries where human settlement in protected areas is prohibited, continued prevention of human incursion is of key importance to limit illegal hunting. Furthermore, movement of people through and within parks should be controlled, as livestock grazing and resource collection is often used as a cover for illegal hunting (Lindsey and Bento, 2012; H. van der Westhuizen unpublished data).

Where human settlement in parks is permitted or tolerated, the zoning of land uses represents one way in which can help to reconcile conservation and human development needs (Naughton-Treves et al., 2005). Zoning can ensure the retention of wilderness areas in which human settlement and access is prohibited and can help prevent the exclusion of wildlife from key resources (such as water) (Lindsey and Bento, 2012). Conversely, zoning can allow assistance for human development to be focused in zones that are established for settlement and agriculture and can help significantly with reducing human-wildlife conflict. Such a zoning plan has been established in the Coutada 9 hunting block in Mozambique and the Sichifulo Game Management Area in Zambia, resulting in reduced illegal hunting and recovering wildlife populations



Position of a fence erected within Gonarezhou National Park (Zimbabwe) to contain human settlement (E. Van Der Westhuizen)

(Lindsey and Bento, 2012) (J. Milanzi, pers. comm.).

Fencing has a potentially important role in land use planning and in controlling illegal hunting. For example, a fence was recently constructed to contain human encroachment and movement within Gonarezhou National Park in Zimbabwe (after ~40 km² was settled in 2000) (H. van der Westhuizen, unpublished data). Fencing can be used to reduce edge-effects in small habitat fragments and can reduce illegal hunting both by reducing wildlife movement out of protected areas and limiting human incursion into parks (Lindsey et al., 2012). Fences can be important in clearly demarcating a protected area and emphasizing the illegality of entering and hunting therein (Hayward, 2012). Fences can also assist anti-poaching security as patrols around the cleared ground maintained within fence lines can reveal whether illegal hunters have moved into a park (Lindsey et al., 2012). Finally, by reducing human-wildlife conflict, fencing has potential to improve the relations between the wildlife-sector and adjacent communities (Lindsey et al., 2012).

Managing the location of infrastructure development is a key step in preventing influxes of people into protected areas, and can potentially be used to draw people away from key wildlife habitats. The proposed highway through the Serengeti National Park for example, would create easier access for illegal hunters in addition to a host of other effects that would exacerbate the ecological impact of the bushmeat trade (Dobson et al., 2010).

Other land uses that occur within and near to wildlife areas, such as forestry and mining need to be managed carefully to ensure that their development does not lead to an increase in illegal hunting. When allocating forestry rights, for example, governments should ensure that concessions are large, contain patches of unlogged forest and include forest with different logging histories (Clark et al., 2009). When allocating mining rights in wildlife areas, care is required to prevent an unregulated influx of people. Finally, care is required with the establishment of refugee camps to ensure that they are not located within or near to wildlife areas (Jambiya

et al., 2007).

Challenges associated with land use planning approaches

Zoning is likely to be a costly and time consuming exercise which is only likely to be effective if local support is achieved (Naughton-Treves et al., 2005). In areas where either wildlife or people are dependent on seasonal migration to exploit natural resources the applicability of zoning approaches is likely to be limited (Goldman, 2003). Interventions based on fencing are clearly not appropriate for all scenarios as fences can have major ecological impacts by blocking migrations and reducing movements of wildlife to access patchy primary productivity (Lindsey et al., 2012). In addition, inappropriately designed fences can create virtually limitless supplies of snare-wire and fences are extremely costly to erect and maintain (Lindsey et al., 2011; Hayward, 2012). In cases where budgets are inadequate to maintain fencing properly, the associated disadvantages are likely to exceed the benefits.

DEVELOPING ALTERNATIVE LIVELIHOODS

The provision of alternative income sources or employment is a potentially important step for reducing reliance of communities on exploiting wildlife for survival and as a means of generating cash income.

Small-scale livelihood projects

A variety of small-scale projects have been attempted in communities close to wildlife areas as a means of providing alternative livelihoods. A variety of possibilities exist, including *inter alia*: honey production; crafts production; development of nurseries; agricultural projects such as the production of chillis, cashews or general food crops. For example, the Anne Kent Taylor Fund works to create economic opportunities through beadwork and employment for the Maasai around Kilgoris and link this to conservation of wildlife (Van Vliet, 2011). Similarly, a bee keeping initiative was launched in Lebialem in south-west Cameroon in 2007 as an alternative to bushmeat hunting (Van Vliet, 2011).

Integrated conservation & development projects (ICDPs)

ICDPs represent one potential means of creating alternative livelihood options and have been established around a number of protected areas (Naughton-Treves et al., 2005). ICDPs are designed to promote sustainable development options (such as ecotourism, agro-forestry and sustainable harvest of biological resources) which are compatible with conservation objectives (Naughton-Treves et al., 2005). Agricultural projects have particularly significant potential due to the relationships between illegal hunting, bushmeat consumption and food insecurity. Investment in research and development should be promoted as such expenditure has declined significantly in the tropics (Milner-Gulland and Bennett, 2003). In Zambia, the community markets for conservation (COMACO) project aims to improve farming skills among communities adjacent to wildlife areas, and to reward conservation-compliant communities with elevated prices for their produce (Lewis et al. 2011). Early indications suggest that the COMACO project is having some success at reducing levels of illegal hunting (Lewis et al., 2011). In Savé Valley Conservancy, European Union funding has been used to rehabilitate irrigation projects in neighbouring communities as a means of creating alternative livelihoods designed to reduce illegal hunting (Lindsey et al., 2011).

Challenges associated with the development of alternative livelihoods

- *Risk that alternative incomes will be used to augment income from bushmeat*

There is no guarantee that income from alternative livelihood options will not be used to augment rather than replace income from the sale of bushmeat. Even in instances where illegal hunters are successfully converted to farmers or bee-keepers, there is a high likelihood that other community members will replace them as hunters and exploit the economic opportunity presented by wildlife resources. Such augmentation may be discouraged by including conditional clauses in alternative livelihood projects whereby participation is contingent on a community involved desisting from illegal hunting (Van Vliet, 2011) and by combining such approaches with effective law enforcement.

- *Risk that bushmeat consumption will increase with increasing wealth*

If poverty levels are reduced and alternative incomes created, there is no guarantee that illegal hunting or bushmeat consumption will decline. The relationship between income and bushmeat consumption is complex and varies among sites (Wilkie et al., 2011; Foerster et al., 2012) and with the environmental and social setting (Fa et al., 2009). On the island of Bioko in Equatorial Guinea, bushmeat consumption decreases as income increases, as more costly and preferred forms of protein are selected (Albrechtsen et al., 2005; Fa et al., 2009). In Western Tanzania, as income from agricultural crops, cattle and goats increased, the frequency of illegal hunting declined (Wilfred and MacColl, 2010). By contrast, in urban and rural households in Gabon and Equatorial Guinea, bushmeat consumption increases with income (East et al., 2005; Wilkie et al., 2005; Fa et al., 2009). Similarly, in the Serengeti ecosystem, bushmeat consumption is highly expenditure-elastic such that if income is increased, there is a large increase in bushmeat consumption (D. Rentsch unpublished data). In South Luangwa, increasing quantities of bushmeat are being purchased by people employed within

the tourism industry who have cash incomes (R. McRobb, unpublished data).

A meta-analysis of the relationship between wealth and bushmeat consumption indicated that the poorest households in rural areas consistently consume the most bushmeat, whereas wealthier households show higher rates of consumption in urban settings (Brashares et al., 2011). This finding stresses the potential importance of developing alternative incomes for the poorest households in areas adjacent to protected areas. However, because of the tendency for bushmeat to increase with increasing wealth within sites, support for alternative income projects could be linked to measures of illegal hunting, and should be combined with increased law enforcement and anti-poaching.

- *Limited evidence of success*

There is a paucity of data on the social, economic and environmental impacts of alternative livelihood projects on levels of illegal hunting (Van Vliet, 2011). ICDPs have been criticised due to the lack of evidence that they succeeded in improving livelihoods or in conferring conservation gains (Naughton-Treves et al., 2005).

- *The attractiveness of illegal hunting and the bushmeat trade*

Illegal hunting and the sale of bushmeat have a number of characteristics which makes them highly attractive for those involved, creating challenges for the development of effective alternatives. These include (taken primarily from (Van Vliet, 2011)):

- o Tradition, prestige and social status associated with hunting.
- o High returns to discontinuous labour inputs, with low risk and minimal capital outlay.
- o Bushmeat has good storage properties and a high value/weight ratio, is easily transported and is an attractive commodity in isolated areas with few alternatives income options.
- o Bushmeat trade represents a commodity chain characterised by high social inclusivity.
- o Associated labour inputs are easily reconciled with the agricultural cycle, and with diversified income-earning strategies.
- o Usage can readily be switched between consumption and trade.

Illegal hunting provides a means to acquire an immediate cash income with little investment. By contrast, alternative livelihood options often require significant investments of time and capital. Consequently, bushmeat is likely to continue to represent an attractive option, particularly during times of financial hardship. Alternative livelihood approaches may have more potential in areas where wildlife populations are depleted and the 'costs' associated with obtaining bushmeat are high, relative to areas where wildlife is abundant and bushmeat is inexpensive to harvest (Van Vliet, 2011).

- *Risk of population influx into the area*

Finally, there is a risk that if development projects are successful, there may be an influx of people into the area, placing further pressure on wildlife resources and habitat. Market forces may encourage farmers to develop larger, commercialized operations with associated negative environmental externalities. Such concerns are particularly valid for land that is designated primarily for wildlife production, such as game management areas in Zambia, coutadas in Mozambique or game controlled and open areas in Tanzania.

PROMOTING ALTERNATIVE PROTEIN SUPPLIES

Providing alternative supplies of protein represents a potentially key step for reducing reliance of food insecure communities on bushmeat, and several possible options exist:

Fish production

There is evidence from some areas that fish represents a direct replacement for bushmeat (Wilkie et al., 2005). In Ghana, for example, bushmeat consumption and the amount of illegal hunting are negatively correlated with fish supplies (Brashares et al., 2004). Fish stocks are declining in some areas, such as in Lake Victoria and off the west and south western African coast (Ogotu-Ohwayo, 1990; Alder and Sumaila, 2004; Lynam et al., 2006) and fish supply per person in Africa declined by 14% during 1984 and 2000 (Ronnback et al., 2002). Given human population growth rates in Africa, fish production per capita is likely to continue to decline (Ronnback et al., 2002). Care is required to ensure the sustainability of fish harvests to prevent increasing dependency on bushmeat. The development of both fresh-water and coastal aquaculture has potential in some areas to increase supply of fish and reduce pressure on wild fish stocks. Aquaculture can be used to produce fish, molluscs, crustaceans and sea weed (Ronnback et al., 2002), all of which could act as potential alternative protein supplies (though the ideal selection of product to farm would have to bear in mind cultural food preferences). The production of fish via farming is increasing rapidly in developing nations, though only modest gains have been achieved in Africa thus far (Ronnback et al., 2002).



rapidly in developing nations, though only modest gains have been achieved in Africa thus far (Ronnback et al., 2002).

Vaccinating chickens for Newcastle disease could improve household food security in many areas (Photo: C. Begg)

Controlling livestock diseases

Addressing veterinary diseases represents an additional intervention to reduce reliance on bushmeat. For example, vaccinating chickens against Newcastle disease (coupled with improved husbandry to protect chicks against depredation) can increase poultry production by 3-4 times (Lewis, 2005). In the Ruaha area of Tanzania, a poultry production project is underway designed to generate protein, and generate income for women, particularly at times of the year when cash is short (Van Vliet, 2011).

Production of indigenous mammals

Farming of indigenous mammals such as cane rats *Thryonomys swinderianus/gregorianus*, Emin's rat *Cricetomys emini* or brush-tailed porcupines *Atherurus africanus*, or giant snails *Archachatina* and *Achatina* has been suggested as having potential for generating alternative protein in forest areas (Jori 1995). Cane rats are widespread in the mesic parts of southern and East Africa and the species could be considered for use in farming programmes.

There are a number of advantages associated with farming with indigenous species (taken from Van Vliet, 2011):

- Most mini-livestock breeding normally takes place in the area where the species being farmed naturally occurs, which means that appropriate feed is available, or can be produced locally.
- The small size of mini-livestock animals means a small amount of input per unit, which in turn means more flexible production.
- Mini-livestock offers the prospect of a regular income source once the volume of production exceeds what the producer wishes to consume.
- Mini-livestock production is also appropriate for the involvement of women who are likely to be greatly involved in the routine management of the animals.
- Mini-livestock can also be easily raised in an urban setting.

Legal supplies of game meat

The legal production of game meat has significant potential to replace bushmeat obtained from illegal hunting. This potential is discussed further in the section on wildlife-based land uses.

Supplying alternative protein sources to labour forces

In areas where commercial activities such as ranching, logging or mining occur in areas with wildlife, efforts to supply employees with protein can be an important means of reducing the extent of illegal hunting (Poulsen et al., 2009).

Challenges with solutions based on alternative protein supplies

- *Price differentials between bushmeat and alternatives*

Promoting the use of alternative supplies of protein is extremely challenging in areas where the price of bushmeat is lower than alternatives. In most rural sites, and particularly those where wildlife is abundant, bushmeat is cheaper than alternatives and is thus likely to remain attractive to buyers regardless of the availability of alternatives. Producing meat from domestic animals at a price equivalent or cheaper than bushmeat in areas with abundant wildlife is likely to be challenging.

- *Risk that alternative protein sources will be used to augment bushmeat*

A key challenge associated with interventions based in generating alternative protein is that there is no guarantee that bushmeat would not simply be exploited as an additional source of money and food. In the Serengeti ecosystem, for example, livestock ownership is a poor predictor of bushmeat use and a vaccination programme for chickens actually resulted in a slight increase in bushmeat usage due to increased cash income for the households involved (D. Rentsch, unpublished data). Livestock is often used as a capital asset and chickens are commonly used for commercial trade rather than for home consumption (Barnett, 1998). In Gabon, the price of chicken and fish is a poor predictor of bushmeat use, possibly due to the relative shortage of those commodities (Foerster et al., 2012).

As a result of these challenges, projects to generate alternative protein supplies must be combined with other interventions such as enforcement and the development of legal means for communities to benefit from wildlife.

- *Cultural preferences for particular types of meat*

In some cases, meat from domestic sources may not be con-

sidered acceptable replacements for bushmeat due to cultural preferences. Understanding the bases for meat preferences in a given area is an important precursor to any efforts to develop alternative protein supplies (Van Vliet, 2011). In Savé Valley Conservancy for example, a challenge associated with efforts to replace illegal supplies of bushmeat with elephant meat arose when it became apparent that some bushmeat consumers would not eat meat from that species (Lindsey et al., 2011).

- *Challenges associated with the production of indigenous species*

Efforts at intensive breeding of such species have had limited success (Bowen-Jones and Pendry, 1999). There are a number of key constraints which undermine the effectiveness of the approach as a means for reducing reliance on bushmeat: the farming of indigenous mammals requires significant capital investment and specialist expertise; hunting is often an easier option; farming of cane rats is generally not viable in areas where the species persists in the wild; productivity sometimes suffers from outbreaks of rat-transmitted diseases among cane rat stock; and, developing breeding programmes involving indigenous species requires supportive legal and policy frameworks, the development of a legal market and extension services to support farmers, all of which are currently lacking (Van Vliet, 2011).

- *Environmental problems associated with livestock production*

Increased livestock production can create environmental problems such as erosion due to overgrazing and competition with wild herbivores. Some domestic species, such as pigs *Sus scrofa* have potential to be invasive if allowed to form feral populations, and pose a significant environmental threat (Van Vliet, 2011).

- *Problems associated with aquaculture*

The development of aquaculture requires start-up capital and expertise which may act as barriers to entry for communities in the absence of protracted technical and donor support. There are a variety of potential environmental problems with aquaculture, including the risk of introducing exotic invasive species (such as the molluscs introduced to South Africa), the reliance of aquaculture on fish meal (which requires harvest of wild stock), the potential for pollution and risk of introducing parasites to wild stock, and habitat conversion (Ronnback et al., 2002). However, there is some debate concerning the negative impacts of aquaculture and many such impacts can be reduced through proper management (Tidwell and Allen, 2001; Ronnback et al., 2002).

MANIPULATING THE SUPPLY & PRICE *of* ILLEGAL BUSHMEAT

The effectiveness of efforts to replace bushmeat consumption with alternative protein supplies may be increased by interventions designed to increase the price and/or reduce the supply of the former. In rural areas, bushmeat is typically preferred because of its availability and cheapness (Barnett, 1998), and so undermining those qualities could reduce consumption. The supply (and thus the price) of bushmeat could be curtailed by providing hunters with alternative livelihood options, through elevated anti-poaching efforts and through imposing controls on the transport of bushmeat. In urban areas where preference for bushmeat is driven primarily by taste, key interventions are likely to be providing legal and sustainable supply of game meat while increasing the price of illegal bushmeat through controls on supply of the commodity.



An array of poachers tools (including home-made muzzle-loader firearms) confiscated from illegal hunters in Coutada 9, Mozambique (Photo: Mokore Safaris)

DEVELOPING FORMAL WILDLIFE-BASED LAND USES

Illegal hunting is an inefficient form of utilization of a wildlife resource due to high levels of wastage, high impacts on populations due to the lack of gender/age selectivity of the harvest, the failure to capture the tourism, trophy or existence values of the animals killed, and due to the low prices often obtained for bushmeat. In Zimbabwe for example, illegal hunters capture <1% of the wildlife resource that they destroy (Lindsey et al., 2012). Through efficient, regulated and selective harvest, legal cropping of wildlife can potentially produce significant quantities of meat on a sustainable basis. Many African ungulates are polygynous and focusing harvest on males in such species can yield large quantities of meat with negligible population impacts. Legal production of meat can also result in the production of a fresher, more hygienic, safer product with lower risks of zoonotic diseases such as brucellosis, and less wastage due to spoiling (Lindsey and Tambling, 2009; Alexander et al., 2012). Furthermore, legal game meat supplies could be used to provide buyers with meat from known and preferred species, avoiding the risk of being lied to about the identity of the species being sold which often happens during transactions with illegal hunters (Lindsey et al., 2011).

Broad-based wildlife-based land uses have potential to capture a much more diverse set of values from wildlife than that derived solely from meat. The potential for generating income from trophy hunting, ecotourism and the sale of by-products such as skins and meat is the reason why wildlife-based land uses have outcompeted livestock production across large areas of private land in semi-arid parts of southern Africa (Child, 2000). Tourism and trophy hunting decouples income from grass production, enabling wildlife-based land uses to provide consistent returns in the variable rainfall regimes that characterize much of the savanna biome (Bond et al., 2004).

There are a number of contexts in which wildlife-based land uses are, or can be, used to replace illegal supplies of bushmeat and thus be used as a tool to address illegal hunting:

Citizen hunting

Several countries make provision for hunting by providing (generally inexpensive) citizen hunting licenses. Approximately 1,400 tonnes of game meat are produced from resident hunting in Botswana, for example, and similar systems

are in place in Zambia and Tanzania (Barnett, 2002). However, there are problems associated with citizen hunting and the systems in place are widely abused. Citizen licenses are heavily subsidized: in Tanzania in 2002, citizen licenses for a buffalo were US\$10, compared to a meat value of S\$211, encouraging over-use (Barnett, 2002). In addition, the citizens benefitting from resident hunting licenses are often not the people living with the resource, thus creating weak incentives for conservation (Lindsey et al., 2007). Finally, resident hunting generates a fraction of the income possible from more lucrative forms of wildlife use, such as trophy hunting or ecotourism. Consequently, citizen hunting as currently practised is probably not an advisable form of wildlife-based land use.

Wildlife-ranching on private land

In several southern African countries, the user-rights over wildlife were devolved to private land owners during the 1960s and 1970s resulting in the rapid growth of wildlife-based land uses (WBLU) across large areas (Bond et al., 2004). For example, WBLU are practised across ~287,000 km² of private land in Namibia, 200,000 km² in South Africa and 27,000 km² in Zimbabwe (prior to land reform, which began in 2000), and smaller (but expanding) areas of land are used for wildlife-ranching in Botswana, Zambia and Mozambique (Bond et al., 2004; National Agricultural Marketing Council, 2006; Lindsey et al., In press). Wildlife is used consumptively on a significant scale on these ranches, resulting in the production of large quantities of game meat. In Namibia, for example, 16-26 million kilograms of game meat are produced annually on private wildlife ranches, 96-97% of which remains within the country (Lindsey et al., In press). In Zimbabwe, 2.4 million kilograms of game meat were produced on game ranches prior to land reform (Le Bel et al., 2004). In South Africa, game meat may contribute as much as 10% of total meat consumption during the hunting season (Dry 2010). These meat harvests have been achieved sustainably and wildlife populations on private land in Zimbabwe (before land reform), Namibia and South Africa have increased dramatically (Bond et al., 2004). In Namibia, for example 1.8-2.8 million wild ungulates occur on freehold farms (Lindsey et al., In press).

Significant potential exists for wildlife ranches to fulfil demand for bushmeat both in urban and rural areas if the product is channelled to the appropriate markets. There is scope for the export of game meat from countries with large areas of private land and significant legal game meat supplies (such as South Africa and Namibia) to countries with high demand and low legal supplies (such as Zambia, Mozambique, and Tanzania). In countries with relatively little private land, governments could encourage the development of wildlife-based land uses on state land by allocating long term leases and commercial user rights to private investors and/or communities. Such developments could even occur in areas where wildlife populations are depleted, so long as governments provide the necessary support in the form of permissions and source animals for wildlife reintroductions.

Wildlife-based land uses on communal land

Significant potential exists for the development of wildlife-based land uses and for the generation of game meat on communal lands in the savanna biome. A vital precursor for this is to create the necessary legal framework to allow communities (and would-be illegal hunters) to capture the value of wildlife legally and sustainably. Such legal frameworks should involve the devolution of user-rights over wildlife to communities. A variety of CBNRM programmes have been developed in southern Africa, including in Zimbabwe (CAMPFIRE), Zambia (ADMADE), Mozambique and Namibia (the conservancy programme) (Suich et al., 2009). The most successful programme is that in Namibia, where a combination of the relatively complete devolution of user-rights over wildlife to communities, adequate technical and funding support and conducive climatic and human density conditions have resulted in the development of 76 communal land conservancies covering ~150,000 km² (http://www.nacso.org.na/SOC_profiles/Namibia's%20Communal%20Conservancies.pdf, accessed June 2012). Tourism and trophy hunting generated US\$14.7 million and US\$11.7 million in Namibian conservancies in 2010 and resulted in the creation of 1,350 full time and 1,500 part time jobs (R. Diggle, unpublished data). At least 315,000 kg of game meat were produced in Namibian conservancies in 2010, resulting in significant quantities accruing to participating households (e.g. 90-120 kg/household/year in Nyae Nyae and Bwabwata) (R. Diggle unpublished data). In response to the development of conservancies, wildlife populations that were previously de-

clining steeply are recovering dramatically. For example, in Kunene since 1982, populations of springbok *Antidorcas marsupialis* have increased from <1,000 to >93,000, Hartmann's mountain zebra *Equus zebra* have increased from <1,000 to >27,000, black rhinos have tripled in number and the lion population has increased from 20 (in 1995) to 130 (R. Diggle, unpublished data). In Ankasa in Ghana, the devolution of user-rights over wildlife to communities has resulted in a massive reduction in illegal hunting and increasing wildlife populations (M. Murphree unpublished data).

There are a number of key advantages associated with the devolution of user-rights and decision-making authority over wildlife to communities, including (M. Murphree, C. Weaver, pers. comm.):

- Allows people to have legal rights, access to and utilisation of wildlife.
- Allows wildlife-based land uses to compete with alternative land uses, thus reducing pressure for land conversion.
- Allows diversification of income sources for communities.
- Can help prevent external hunting pressure by community members controlling the access of outsiders to wildlife.
- Supports law enforcement by enabling communities to enforce laws.
- Can create synergies with agricultural and/or other land uses.
- Communities feel their rights and structures have been formally recognised.
- External bodies have a legitimate partner and structure to negotiate with and act through.
- Can improve local governance and accountability.
- Can strengthen local identities.
- Can provide previously marginalized communities with a voice.
- Can help strengthen community claims to their land.
- Devolution should enable a stronger cooperation between land use and conservation, with new partners where they exist.

A second model that has been pursued in some community areas has been the development of legal wildlife-cropping programmes in an attempt to replace illegal hunting with regulated legal harvest. For example, a communal game

ranch in Guruve in Zimbabwe produced five tonnes of meat in 2004 (Le Bel et al., 2004) and a wildlife harvesting programme has been attempted on the border of the Serengeti National Park (Holmern et al., 2002).

Involving communities in wildlife-based land uses in parks/private wildlife areas

In areas where parks and private game ranches are adjacent to communal lands and suffer from illegal hunting, the involvement of communities in wildlife-based land uses have potential to improve neighbour relations and create disincentives for illegal hunting. For example, in Namibia, the government has developed a concession policy for parks, whereby communal conservancies are granted concessions in parks which they can use to attract business and tourism opportunities (Chris Weaver, pers. comm. June 2010). In South Africa, various models have been attempting to extend the benefits from parks, including the allocation of portions of park fees to neighbouring communities, the involvement of communities on management boards, and an increasing trend for communities to own portions of conservation areas (Grossman & Holden 2008). In several cases in South Africa, ‘contractual parks’ have been developed following successful land claims within parks, and the development of co-management agreements with the conservation authorities (Grossman & Holding 2008). The Makuleke community in South Africa, for example, currently benefitting from leasing their land to an ecotourism operator and receives ~US\$123,000/year. Similar arrangements are possible for private land. For example, Mun-ya-wana Game Reserve chose not to contest a land claim placed on the reserve by neighbouring communities, and instead lease the land back from those communities who now receive a constant benefit stream (J. Mattheus, unpublished data). An alternative means of achieving community stakeholdings in private wildlife areas would be to seek donor funding with which to purchase shares on behalf of neighbouring communities. Such models are business-like and create a link between park-performance (which is adversely affected by illegal hunting) and income for communities, thus creating strong disincentives for illegal hunting: provided the community benefitting from the wildlife-based land use is the community living adjacent to or within the area; and provided the benefits are apparent.

The creation of other forms of business linkages can also help to improve relations between the wildlife sector and

neighbouring communities (Newmark et al., 1993). Such linkages include the preferential employment of people from adjacent communities, the purchase of produce for tourist camps from communities, contracting communities to maintain perimeter fencing and creating opportunities for income generation via curio sales and cultural tourism. Mun-ya-wana Game Reserve, for example, employs 325 people, and Wilderness Safaris employs 1,800 people (across nine countries), and in both cases, at least 85% come from local communities. Employment is particularly important, because salaried workers are able to support 6-8 family members (Snyman, 2012). In Laikipia, Kenya, private wildlife ranches running ecotourism operations contributed USD3.5 million to social development projects among local communities during 2007, which included water provision, road construction/maintenance, healthcare, fencing and assistance with enterprise development (M. Graham, unpublished data).

The sustainable harvesting of wildlife from reserves or private wildlife areas for meat for sale at affordable prices to neighbouring communities could help to address protein shortages and reduce reliance on illegally sourced meat. In the Mun-ya-wana GR, for example, meat is allocated to the local chief for distribution to communities, with the amount donated being linked to the level of illegal hunting (J. Mattheus, unpublished data). In Savé Valley Conservancy, ~54 tonnes of meat are distributed to communities annually following the harvest of elephants (which is practised to control densities of the species) (Lindsey et al. 2011).

Reducing the costs imposed on communities through human-wildlife conflict is a key step to fostering partnerships with communities neighbouring (or living within) wildlife areas and can remove a key source of antagonism (Gillingham and Lee, 2003).

Finally, the provision of environmental education represents another form of benefit from wildlife that can be extended to neighbouring communities. Such education can help to reduce poverty by providing greater opportunities for community members to access employment, including in the wildlife sector. In addition, environmental education can play a role in raising awareness among communities of the threat posed to their natural heritage and to potential benefits from wildlife, through illegal hunting. For example, Wilderness Safaris hosts some 550 children from neighbouring commu-

nities each year for 5-day programmes in their camps, and then follows up with these same children through a series of ‘eco-clubs’ linked to the community schools (C. Roche, unpublished data). Such messages are likely to be more effective if coupled with programmes to provide benefits to communities from wildlife (Newmark et al., 1993), and to provide educational and training opportunities for community members to provide them with the skills necessary to embark on careers in wildlife and conservation.

Payments to encourage coexistence

Payments to promote coexistence of people and wildlife represent an additional potential option to address illegal hunting. Natural ecosystems have significant economic value and the world’s natural goods and services are collectively worth up to US\$61 trillion (Costanza et al., 1997). At a smaller scale, wildlife conservation generates significant income through photographic tourism and trophy hunting (Lindsey et al., 2005; Lindsey et al., 2006), and people, especially those in developed countries, also imbue charismatic species such as lions and elephants with high existence values (Macdonald, 2001). However, people living with these globally valued species are often excluded from the benefits and frequently incur significant costs from living with them. Consequently, wildlife is killed to remove the threat and to acquire the only benefit that is often achievable, that from meat (Thirgood et al., 2005; Loveridge et al., 2010).

To secure effective conservation, a sufficient proportion of the global value of wildlife has to accrue to the people living with it to exceed the costs associated with its presence. One method of achieving this is to pay communities for coexisting with wildlife via payments (which may be monetary or non-monetary) linked directly to a desired conservation outcomes, such as a decline in hunting or the successful reproduction of target species (Hazzah and Dolrenry, 2007; Zabel and Engel, 2010). These approaches have had some marked success (Zabel and Holm-Muller, 2008) but can be complicated (see section on challenges). Diverse income streams (such as income from wildlife, external and governmental financing) could be combined into a ‘Payments to Encourage Coexistence’ (PEC) fund (Dickman et al., 2011). The benefit of this approach is that conservation investment is directly linked to actual conservation success, while the payments may also help reduce poverty and improve the economic security of people living alongside wildlife (Groom and Palmer, 2010; Wunder

et al., 2008). Furthermore, research suggests that this kind of approach attracts a more diverse set of donors and more funding than traditional biodiversity conservation (Goldman et al., 2008).

Challenges associated with developing legal wildlife-based land uses

A challenge associated with the development of wildlife-based land uses is the misconception among some politicians that private or communal land used for wildlife represents a threat to food security by replacing livestock or agricultural crop production (du Toit, 2004). For example the growth of Namibian communal land conservancies has caused concern among some politicians who fear that they are not a productive form of land use (R. Diggle, pers. comm.).

The development of successful CBNRM programmes is associated with a number of challenges. Chief among these issues is the reluctance of governments to devolve user-rights, and forego revenues from trophy hunting and tourism (Jones, 2007) and control over electorates. The development and evolution of CBNRM has been a long process associated with some failures and set-backs which may serve to strengthen the reluctance of states to devolve user-rights, and reduce the willingness of donors to support the process (Jones, 2007). There is a risk that overcoming government reluctance will not happen sufficiently quickly to address the immediate threat posed by illegal hunting and the bushmeat trade. Consequently, there is a case for trying alternative (or ‘devolution-lite’) arrangements in the meantime (though proper devolution would be highly preferable). One such example would be to allow for the development of community game ranches in demarcated areas through partnerships between communities and government, the private sector or NGOs. Other challenges associated with CBNRM programmes include the need for protracted investment of technical expertise and donor input to get them started and functioning (Jones, 2007) and the fact that in areas with high human population densities, potential returns per household are unlikely to provide sufficient incentives to encourage people to desist from illegal hunting.

Challenges associated with replacing illegally sourced bushmeat with legal game meat

A key challenge to using legally produced game meat to replace illegally sourced meat will be ensuring that the price is

similar to or lower than illegal bushmeat. An additional challenge will be overcoming veterinary restrictions on the movement of wildlife products (instituted to restrict the spread of key veterinary diseases) in many countries. In addition there would be a need to ensure that supplies of legal game meat are directed at the markets for illegal bushmeat, which would require quite different marketing strategies to those currently employed by the game ranching industry. There is a risk that illegal bushmeat could be laundered and sold as legal game meat and so some kind of certification system may be required. Concurrently, greater controls are required on the movement of illegal bushmeat by stopping and searching vehicles and bicycles along roads, and by scanning baggage at airports. Controlling the movement of illegally sourced bushmeat is complicated by the fact that the commodity is often hidden, and transported by pedestrians and bicycles, in addition to vehicular traffic (Lindsey and Bento, 2012). Introducing sniffer dogs at airports could assist with the detection of bushmeat and other wildlife products.

Wildlife harvesting programmes have faced a number of challenges, including: low financial viability associated with efforts to produce meat at subsidized prices; elite capture of benefits; lack of funding to cover capital start-up costs; failure to generate comparable quantities of meat to that produced from illegal hunting; over-reliance on meat for income and ignoring of other value streams from wildlife; uncertainty over the appropriate recipients of meat and income; veterinary restrictions on the distribution of meat; and competing claims for shared resources (in the case of migratory wildlife) (Féron et al., 1998; Holmern et al., 2002). The most successful CBNRM have been those that result in the capture of multiple-use values from wildlife (including ecotourism, trophy hunting, and the live sale of wildlife) in addition to the sale of meat (Jones, 2007) and such broad-based forms of wildlife-based land use should be pursued ahead of simple meat cropping programmes. In addition, the development of equitable long-term partnerships with the private sector should be promoted, to provide for sustained financial and technical input.

To support the development of wildlife-based land uses, governments should develop the appropriate legal frameworks, encourage private investment in wildlife-based land uses, provide scope for the development of public-private-community partnerships relating to wildlife land uses, facilitate the rehabilitation of degraded wildlife areas through

provision of wildlife for reintroductions and provide legal avenues for the distribution of meat. As with other interventions to address illegal hunting, the development of wildlife-based land uses is likely to be more effective if combined with other interventions, such as the land use planning, generation of alternative livelihoods and enforcement of wildlife laws (Barrett and Arcese, 1998).

Challenges associated with payments for coexistence

The primary challenge associated with PEC approaches is securing long-term, reliable funding. Once a payment scheme is established, stopping it may result in even greater antagonism towards the target species or wildlife in general (Montag, 2003). There is a risk that if PEC programmes are started in one area, there will be resentment towards wildlife in other areas if they are not replicated. Other challenges include determining: which conservation indicators are reliable enough to determine payment levels; how to deal with fluctuating environmental conditions (such as drought) which may affect the indicator without being related to hunting; who should receive the payments; how to engage all community members; and, how to ensure that payments are sufficient to offset wildlife damages (Dickman et al., 2011). There is a risk that the PEC approach will entrench the idea that wildlife is a liability only to be tolerated on receipt of financial compensation. Overall, PEC approaches have potential, but would require massive funding, detailed understanding of local situations, and careful implementation.

ADEQUATE LEGAL PROTECTION & ENFORCEMENT *of* WILDLIFE LAWS

While ‘fortress conservation’ (conservation based purely on the exclusion of local people) has been rightly eschewed in favour of approaches that combine conservation and local development goals, legal protection for wildlife is of key importance for conservation and for the development of formal wildlife-based land uses. The need for legal protection of wildlife, and effective law enforcement is acknowledged in the Lusaka Agreement (<http://www.lusakaagreement.org/Documents/3.5.pdf>, accessed May 2012) and the African Convention on the Conservation of Nature and Natural Resources (<http://www.africa-union.org/root/au/Documents/Treaties/Text/nature%20and%20natural%20resource.pdf>, accessed May 2012).

Reform of wildlife laws

There is a need for refinement of existing wildlife laws such that there is greater uniformity among SADC nations, more effective deterrents against illegal hunting, and to ensure that the penalties reflect the value of the resource being destroyed. Revised laws should take into account international and African treaties, conventions and agreements, and protocols that have been approved within SADC which incorporate illegal hunting and trade in wildlife products. Ideally, a new SADC protocol is required on law enforcement for crimes against wild fauna and flora to harmonize domestic legislation and provide guidelines for penalties. Within national laws and the recommended regional protocol, there is a need for recognition of illegal hunting and illegal trade in bushmeat to be specifically recognized as a priority offence. There is also need for the development of databases of illegal hunters to enable repeat offenders to be identified and dealt with appropriately. An additional key step is an effort to raise awareness among policy-makers (and subsequently magistrates and the police) of the severity of the threat posed by illegal hunting. Such education will help ensure that individuals accused of wildlife crimes are prosecuted, and that wildlife laws are upheld. In Uganda, for example, a joint initiative was recently undertaken by the Uganda Wildlife Authority and the Bushmeat-free Eastern Africa Network to train wildlife crime law enforcement partners, including police, prosecutors, magistrates and wildlife wardens on wildlife laws, the value of wildlife to the

economy, and on challenges associated with prosecutions for wildlife crimes (V. Opyene pers. comm.). That training resulted in a shift from minor penalties for first time illegal hunters such as small fines (~US\$10-20) or community service to custodial sentences of 6-12 months (V. Opyene pers. comm.).

Improved anti-poaching security

Enforcement of legal protection through anti-poaching security remains a vital step necessary to conservation wildlife effectively. The significance of enforcement is further emphasized by the fact that anti-poaching security is a key component of even the most successful CBNRM programmes (Campbell and Shackleton, 2001; Stuart-Hill et al., 2005; Taylor, 2009). There is abundant evidence that elevated anti-poaching security can be effective at reducing illegal hunting (Hilborn et al., 2006; Jachmann, 2008a; Stokes et al., 2010). There is also compelling evidence that stiff punishments for illegal hunting are ineffective if the risks to hunters of being caught are low (Leader-Williams and Milner-Gulland, 1993; Hofer et al., 2000). Protected areas are generally less effective at controlling illegal hunting relative to other threats (Bruner et al., 2001) and there is a clear need for elevated investment in anti-poaching in many wildlife areas. An increase in funding of 3-10 times is recommended to stem wildlife population declines in African protected areas (Scholte, 2011).

There are several key elements to effective anti-poaching security (as suggested by the literature and expert input from meeting attendees, and notably the presentation by Hugo Van Der Westhuizen):

- a) Adequate funding. The allocation of adequate funding can have a significant positive impact on efforts to control illegal hunting (Jachmann, 2008a). However, the level of funding that is actually needed to control illegal hunting effectively is poorly understood. In Ghana, snaring was effectively controlled in six (relatively small) savanna parks with an enforcement budget of US\$51/km²/year (Jachmann, 2008a). In the 3,872 km² Coutada 9 in Mozambique, an expenditure of US\$28.4/km² on anti-poaching has been sufficient to

enable wildlife populations to start to recover following high levels of illegal harvest (Lindsey and Bento, 2012). However, in the 3,500 km² Save Valley Conservancy, a security budget of US\$72/km² was not sufficient to prevent wildlife population declines in high-pressure areas close to human settlement (Lindsey et al., 2012). Significant resources are invested in anti-poaching in the 210 km² Mun-ya-wana Game Reserve in South Africa (US\$1,244/km²/year) and illegal hunting is controlled effectively (J. Mattheus, unpublished data).

The extent of funding (and manpower) needed to control illegal hunting is likely to vary with factors such as: the degree of threat from illegal hunting; terrain (achieving control is likely to be harder in more rugged terrain and in areas with thicker vegetation); the size and shape of the wildlife area (funding needs/km² are likely to be lower in parks with a lower surface area : volume ratio); and, the presence/absence of rhinoceroses (which are a key target for trophy poachers).

- b) Adequate manpower. Snaring levels in savanna parks in Ghana were reduced to acceptable levels when patrol effort was increased to 0.40 effective man-patrol days/km² (Jachmann, 2008a). Effective deployment of scouts is crucial, to ensure that: sufficient effective patrol days/scout/month are achieved; scouts are not deployed in predictable patterns, and that scouts are deployed in line with temporal and spatial trends in the distribution of illegal hunting.
- c) Employment of experienced, qualified staff. Anti-poaching security is a specialised venture and requires suitably qualified employees. Note that ‘qualified’ does not necessarily mean school-educated, rather proficient and experienced in tracking and other forms of bush craft.
- d) Implementation of training programmes is important to maintain and improve the skills of scouts. Provisions should be made for managers to rapidly remove staff proven to be incompetent and/or corrupt to maintain standards and morale.
- e) Adequate working conditions, salaries and equipment are important to maintain morale, to prevent high rates of staff turnover and to reduce the likelihood of collusion between scouts and illegal hunters. Scout salaries were positively associated with the performance of scouts in controlling elephant poaching in the Luangwa Valley during the 1990s, for example (Jachmann and Billiouw, 1997). Essential equipment for scouts includes uniforms, hats, boots, radios, handcuffs, GPS units, and firearms. The timely payment of sufficient bonuses for arrests or confiscation of weapons can greatly improve the effectiveness of anti-poaching scouts (Jachmann and Billiouw, 1997).
- f) Adequate management involvement in anti-poaching, supervision and guidance of scouts is important to maintain morale, reduce the risk of scouts colluding with illegal hunters and ensure optimal allocation of effort. In Ghanaian parks, visits of scout camps by senior staff members increased the effectiveness of anti-poaching patrol teams (Jachmann, 2008a).
- g) Intelligence gathering. Information on illegal hunters and their planned activities has potential to dramatically improve the effectiveness of anti-poaching. Such information can be gathered by employing appropriately connected individuals and/or by paying informants within communities occurring in or next to wildlife areas. For example, in the early stages of the development of Namibian conservancies, the employment of local game guards was an essential step for reducing illegal hunting as they lived in the area and were able to gain intelligence from tip-offs which dramatically improved the effectiveness of enforcement efforts (R. Diggle, unpublished data).
- h) Ensuring that anti-poaching is practised continuously, and not simply in response to a discrete incident or set of incidences of illegal hunting. The degree of enforcement can be managed adaptively in line with the threat, but some level of anti-poaching is likely to be required indefinitely.
- i) Developing a good working relationship with the police and local magistrates is essential to ensure effective processing of detainees following capture of illegal hunters.

- j) Adequate monitoring of illegal hunting and anti-poaching. Monitoring of illegal hunting can ensure that anti-poaching resources are allocated adaptively, in line with spatial and temporal trends in illegal hunting threat. In addition, the monitoring of illegal hunting can provide insights into the efficacy of other interventions such as community outreach projects – or highlight where such projects are most needed. In Ghanaian parks, evaluation of the effectiveness of anti-poaching patrol teams created a spirit of competition among parks which resulted in improved performance (Jachmann, 2008b). Monitoring of anti-poaching efforts can also reveal where staff members are not performing and insights into whether personnel training or changes are required. The event book monitoring system is a simple method for monitoring the incidence of illegal hunting which is easily applied and interpreted by anti-poaching scouts and not reliant on high levels of training or education (Stuart-Hill et al., 2005). Hunter reporting of catch per unit effort represents an additional potential method for assessing the sustainability of bushmeat harvests (Rist et al., 2010).
- k) Monitoring of the bushmeat trade. Monitoring trade in bushmeat is a potentially important tool for assessing the impacts of illegal hunting, as changing quantities of bushmeat or changing species compositions in markets can be indicators of unsustainable harvests (Fa et al., 2000).

Challenges associated with improving wildlife laws and their enforcement

A potential challenge associated with enforcing wildlife laws is a perception that controlling illegal hunting represents a return to exclusionary fortress conservation that threatens rural food security and undermines traditional rights of communities, particularly given that the people who rely most on bushmeat are often those who are the poorest and most food insecure. However, effective anti-poaching to prevent unregulated losses of wildlife is an essential step towards enabling the food security and other benefits from wildlife to be maximized, and sustained over the long term. Furthermore, negative human livelihood impacts of law enforcement can be reduced by simultaneously working to provide communities with livelihood alternatives and legal benefits from wildlife (Brashares et al., 2011).

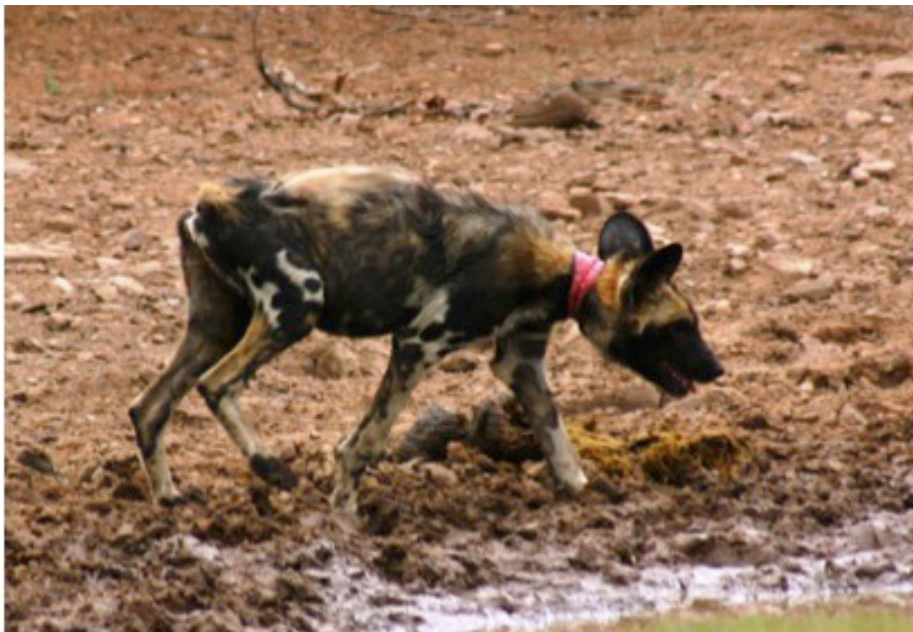
There are also challenges associated with the practical implementation of anti-poaching. Anti-poaching is expensive, specialized and can create animosity if not handled in a sensitive manner and if not coupled with efforts to extend benefits from wildlife to communities (Keane et al., 2008).



Elevated investment in anti-poaching security is needed in many wildlife areas (Photo: C. Begg)

REDUCING AVAILABILITY *of* SNARE WIRE

Reducing the availability of wire in areas in which it is freely available, and limiting the introduction of wire in areas where the commodity is largely absent are key steps for controlling snaring. Fencing constructed from barbed or steel wire is a major source of snare-wire. If fencing is constructed with mesh (Bonnox/Veldspan™) fencing, the kinked wire cannot readily be used to make snares and the risk of wire theft by illegal hunters for making snares is lower (Lindsey et al., 2012). In many cases, wire for electricity or telephone cables is often left in bundles that are unguarded, providing easy targets for theft for making snares. Reducing the supply of wire could potentially be achieved by raising awareness among governments, industry, business and landowners about the negative environmental impacts of wire, promoting the use of mesh rather than steel-wire fencing, and the importance of securing wire bundles to ensure that they cannot readily be stolen.



Wild dog severely wounded by a snare, South East Lowveld, Zimbabwe (Photo: Rosemary Groom)

FUNDING THE NECESSARY INTERVENTIONS

Controlling illegal hunting and the bushmeat trade is likely to require interventions that are costly and thus dependent on the sourcing of adequate funding. There is a need for significantly elevated government funding for state wildlife agencies in many African countries. In addition, encouraging greater reinvestment of earnings from protected area networks (from tourism and trophy hunting) into park management rather than feeding earnings into central treasuries is of key importance. Maximizing the economic value of wildlife and harnessing that value to generate incentives for conservation and income for wildlife management is important. Arbitrary restrictions on legal sustainable use (such as the ban on trophy hunting in Kenya, or the ban on lion hunting and the 25 km no-hunting buffer around protected areas in Botswana) are thus unadvisable (Norton-Griffiths, 2007; Lindsey, 2010a). In areas where state land is leased to tourism and hunting operators, long term leases should be allocated to incentivize investment in protecting the wildlife resource, and contracts should stipulate minimum contributions to anti-poaching (Lindsey et al., 2007).

There is a need to raise awareness among international community and among conservation NGOs of the threat posed by illegal hunting and the bushmeat trade, to encourage the allocation of funding to address the problem. Because of the obvious links between the bushmeat trade and food security and the need to replace unsustainable harvests of wildlife with more sustainable protein creation options, gaining funding from development and humanitarian agencies is a realistic possibility (Lindsey et al., 2011).

The developing market for carbon offset credits represents a possibility for generating funds to address illegal hunting and

the bushmeat trade where these occur in forested or wooded habitats. However, the scope for such funds to be harnessed to address illegal hunting in the savanna biome is limited by four factors: first, current programmes only generate carbon credits where a risk of tree loss can be demonstrated; second, programmes such as REDD+ (Reducing Emissions from Deforestation and Forest Degradation), do not adequately acknowledge the importance of biodiversity for ecosystem services (and so would not reward the presence of wildlife to a significant degree); third, because the carbon-value of dry savanna is relatively low; and, fourth, because the purchase of carbon off-sets is not yet compulsory and so the market for carbon is limited (Venter et al., 2009). If the purchase of carbon off-sets were to become compulsory in future and if international programmes such as REDD+ were adjusted to take into account biodiversity (and/or if buyers could be encouraged to preferentially invest in areas with healthy wildlife populations) some potential for generating funds for wildlife-management would exist, particularly in the wetter savanna areas (notwithstanding the challenges posed by the high entry costs associated with feasibility assessment, certification and ongoing assessment).

Similarly, the development of an international market for biodiversity credits (whereby companies or countries can offset the impacts of development by providing funding for the preservation of land with high biodiversity through the purchase of biodiversity credits) has potential in the future to generate funds for interventions to address illegal hunting. However, a system for biodiversity and other land-use credits has not yet been properly developed or implemented, nor is there any consensus on valuation.

VIII. Differences *between Savanna & Forest Biomes* Relating to the Bushmeat Trade

The large majority of literature on the bushmeat trade in Africa has focused on the issue in the forest biome (Barnett, 1998; Lindsey et al., 2011). While some key insights arise from that body of research, a number of key differences exist between the forest and savanna biomes and recommendations from work done in the former do not always apply to the latter. Several of these differences provide reason for optimism that illegal hunting and the bushmeat trade may be easier to control in the savanna biome and that there is greater scope for the development of legal and sustainable wildlife-based land uses:

- a) Wildlife is easier and cheaper to protect in savanna areas than in forests, making control of the illegal bushmeat trade a more realistic prospect (Jachmann, 2008a).
- b) There is a longer tradition of wildlife-based tourism and trophy hunting in the savanna biome and much more developed wildlife-based industries in southern and East Africa than in the forest biome (Wilkie and Carpenter, 1999; Lindsey et al., 2007; Roche, 2011). In addition, there are significant domestic markets for wildlife-based industries in East and southern Africa, particularly in South Africa (Lindsey et al., 2007).
- c) In several countries in southern Africa there have already been effective legislative changes to allow private land owners and communities to benefit legally from wildlife production (Bond et al., 2004).
- d) The savanna biome is considerably more productive than forest areas, and sustainable wildlife-based land uses including consumptive utilization, are more likely to be viable (Robinson and Bennett, 2004).

- e) Partly as a consequence of the established tourism value of wildlife, there is likely to be stronger political recognition of the value of wildlife, and greater wildlife-management and scientific capacity in countries in the savanna biome.
- f) Savanna habitats generally have higher carrying capacities for livestock than forest areas, thus providing for comparatively lower reliance on bushmeat for survival (H. Eves, pers. comm.).

As a result of these differences, there is a strong case for a different approach to addressing the problems of unsustainable hunting for bushmeat in the savanna biomes. The idea that the bushmeat trade needs to be accepted and regulated to reduce harvests to more sustainable levels is a common position in the current literature on bushmeat trade in forest biomes. Some controversial proposed interventions include: establishment of hunting and no-hunting zones, taxes on hunting, quota systems, encouraging more sustainable bushmeat hunting, (such as by compromising on the illegality of snaring, implementing less wasteful techniques such as more frequent checking of snares and, restricting the distance that snares can be set from villages), and restricting trade to meat collected by resident (non-immigrant) hunters, (Bowen-Jones and Pendry, 1999; Muchaal and Ngandjui, 1999; Wilkie et al., 2005; Mockrin et al., 2011). In contrast, in savanna areas, due to the potential (and in numerous cases, actual) economic value of wildlife, accepting the illegal, uncontrolled and inefficient hunting of wildlife as a legitimate form of wildlife/land use is inadvisable. Rather, the legal and sustainable utilization of wildlife should be pursued in a manner that confers maximal benefits to communities and governments in conjunction with the other interventions highlighted in this report (as appropriate for the given scenario).

IX. Conclusions

Illegal hunting and the bushmeat trade represent a severe threat to wildlife in savanna areas as it does in the forest biome. The drivers of illegal hunting are numerous and varied. Consequently, multiple and site specific interventions will be required to counter this threat. However, a number of general interventions apply to the majority of sites investigated in this review in which illegal hunting occurs. These range from ‘carrot’ approaches, such as providing alternative livelihood and protein options and extending benefits from wildlife to communities, to ‘stick’ approaches such as strong legal disincentives for illegal hunting and enforcement of those laws via anti-poaching. Perhaps the greatest potential comes from replacing the inefficient, wasteful and relatively low-profit snaring of wildlife with higher value and more sustainable forms of wildlife-use. To allow such legal benefits to be de-

rived from wildlife, devolution of user-rights over wildlife on communal lands to communities is essential. Such devolution should ensure that communities are able to retain benefits from wildlife on communal land (and that governments do not extract revenues, other than via tax earnings) and have significant decision-making authority over their wildlife resources within the legislated structures in the country.

Urgent efforts are required to raise awareness among policy-makers and the international and donor communities of the severity and urgency of the threat posed by illegal hunting and the bushmeat trade. Failure to address the problem will have dire consequences for biodiversity conservation, will preclude the sustainable use of wildlife as a development option and have long term negative impacts on food security.



Leopard at Maasai Mara
National Park, Kenya.
Credit: © Philip J. Briggs

Attendees at the bushmeat brainstorming session, Shumba Valley Lodge, Lanseria, Johannesburg, May 9-10th 2012

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About Panthera

Panthera, founded in 2006, is the world's leading organization devoted exclusively to the conservation of wild cats and their ecosystems. Utilizing the expertise of the world's premier cat biologists, Panthera develops and implements global conservation strategies for the largest, most imperiled cats – tigers, lions, jaguars, and snow leopards. Representing the most comprehensive effort of its kind, Panthera works in partnership with local and international NGOs, scientific institutions, local communities and governments around the globe.

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