

Financial and economic values of bushmeat in rural and urban livelihoods in Cameroon: Inputs to the development of public policy

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SUMMARY

Traditional wildlife hunting has been described mainly from studies of local practices and from the monitoring of urban bushmeat markets. However, the overall value chain connecting hunters to end consumers remains largely unknown, thus preventing any estimate of the actual socio-economic importance of the bushmeat sector. On the basis of existing literature, this paper provides an order of magnitude for the financial and economic benefits of the bushmeat commodity chain in Cameroon. The following conservative conclusions were arrived at:

- (1) The annual turnover of the bushmeat sector in the country is likely to be close to €97 million, i.e. 36% more than the official assessment derived from public accounts.
- (2) The bushmeat sector may contribute 0.17% to Cameroon's GDP (non-oil), as much as the mining sector.
- (3) Self-consumption of bushmeat in rural areas may amount to gross annual economic benefit of more than €142 million.

However, bushmeat in a country like Cameroon needs to be managed so as to guarantee the food security of urban and rural populations, as well as maintain a substantial source of revenue for communities, all of this without depleting the resource. Achieving this goal requires policy makers to disassociate wildlife harvesting from 'poaching' and the extirpation of species. It is crucial to go beyond the dominant narrative of a (real but over simplified) notion of a conservation crisis, to address its important livelihood and welfare dimensions.

Keywords: hunting, livelihoods, commodity chain, game meat

Contributions financières et économiques de la viande de brousse aux conditions de vie rurales et urbaines au Cameroun: Éléments pour le développement d'une politique publique

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La chasse traditionnelle a été décrite surtout sur la base d'études des pratiques locales et de suivis des marchés urbains de gibier. Toutefois, la chaîne de valeur globale qui relie les chasseurs aux consommateurs finaux demeure largement inconnue, ce qui empêche toute estimation de l'importance socio-économique réelle de ce secteur. Sur la base de la littérature existante, cet article fournit un ordre de grandeur des avantages financiers et économiques de la filière de la viande de brousse au Cameroun. Plusieurs estimations conservatrices sont fournies pour ce secteur:

- (1) Le chiffre d'affaires annuel de cette filière au Cameroun est probablement proche de 97 million d'Euros, soit 36% de plus que l'estimation officielle de la comptabilité nationale.
- (2) La filière de la viande de brousse peut contribuer à 0.17% du PIB (hors-pétrole) du Cameroun, autant que le secteur minier.
- (3) L'autoconsommation de gibier en milieu rural peut atteindre un avantage économique brut dépassant 142 million d'Euros par an.

Cependant, la viande de brousse dans un pays comme le Cameroun a besoin d'être gérée afin de garantir la sécurité alimentaire des populations urbaines et rurales, ainsi que de maintenir une source importante de revenus pour les communautés, tout en n'épuisant pas la ressource. Atteindre cet objectif nécessite que les décideurs désassocient le prélèvement de la faune au braconnage et à l'extinction des espèces. Il est crucial d'aller au-delà du discours dominant sur la notion (réelle mais simplifiée à l'excès) de crise de conservation pour considérer les impacts significatifs sur les conditions de vie et le bien-être humains.

Valor financiero y económico de la carne de animales salvajes en los medios de vida rural y urbana en Camerún: Insumos para el desarrollo de políticas públicas.

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La caza tradicional de fauna salvaje ha sido descrita principalmente a partir de estudios sobre prácticas locales y a partir del monitoreo de mercados urbanos de carne de animales salvajes. Sin embargo, la cadena de valor global que conecta a los cazadores y los consumidores finales sigue siendo desconocida, impidiendo así cualquier estimación de la actual importancia socio-económica del sector de carne de caza. Sobre la base de la literatura existente, este artículo ofrece un orden de magnitud de los beneficios financieros y económicos de la cadena de producción de carne de caza en Camerún. Se alcanzaron las siguientes conclusiones conservadoras:

- (1) El volumen de negocios anual del sector de la carne de caza en el país es probablemente cerca de 97 millones de €, es decir, 36% más que la evaluación oficial derivada de las cuentas públicas.
- (2) La industria de la carne de animales salvajes podría contribuir 0.17% al PIB de Camerún (no petrolero), tanto como el sector minero.
- (3) El auto-consumo de carne de animales salvajes en las zonas rurales puede equivaler a un beneficio económico bruto anual de más de 142 millones de €.

Sin embargo, la carne de caza en un país como Camerún debe gestionarse de modo que se garantice la seguridad alimentaria de las poblaciones urbanas y rurales, así como mantener una fuente importante de ingresos para las comunidades, todo esto sin agotar el recurso. Para lograr esta meta se requiere que los responsables políticos disocien la cosecha de la fauna de la «caza furtiva» y la extirpación de especies. Es fundamental ir más allá de la narrativa dominante (real pero sobre-simplificada) de una crisis de conservación, y abordar también las importantes dimensiones sociales y económicas vinculadas a la carne de animales silvestres.

INTRODUCTION

Poaching of the large, emblematic African mammals (elephants, rhinoceroses, great apes) is currently the subject of much attention and of numerous publications (Brashares *et al.* 2014, Maisels *et al.* 2013). The perpetrators of such acts are often connected to international criminal networks, have sophisticated equipment and influential patrons, who facilitate the trade in dead animals and parts at an international scale (Nasi *et al.* 2008). Despite its worrying scale and increasing volume, such poaching is not typical of hunting practices in Central Africa. Wildlife hunting is mainly undertaken by rural populations to meet their nutritional needs and to earn income from the sale of game at local or national markets. This type of hunting often faces some legal restrictions (such as a ban on harvesting protected species and on the use of firearms and steel cables) but implementation is largely ad-hoc or absent. In most Congo Basin countries, the products of local hunting cannot be legally traded without an expensive official hunting permit. Although this regulation does not hinder subsistence hunters, who hunt to meet their food needs, it places those who specialize in this activity (commercial hunters) and who draw most of their income from it, in an illegal situation. Most hunters sell a more or less large share of the game they extract from forests by exercising their customary use rights. The difficulty in legally selling these products is a major obstacle to the formalization of traditional hunting, while this activity is putting mounting pressure on the wildlife populations in the forests of Central Africa. Game extraction in the Congo Basin is estimated at about 5 million tons (Nasi *et al.* 2011), with 60% of the species being harvested at unsustainable rates (Fa *et al.* 2003). With growing human populations (Fa *et al.* 2005), improved hunting

equipment (Feer 1996, MacDonald *et al.* 2012), expanding road networks (Laurance *et al.* 2006), lack of alternatives for accessing protein in rural areas (van Vliet *et al.* 2012) and competitive pricing of bushmeat (Fargeot 2006), Central Africa faces a substantial rise in wildlife extraction, which could result in a drastic reduction in animal populations over the medium or long term.

Wild meat depletion will have negative impacts on food security and increase malnutrition in the human populations across Central Africa (Fa *et al.* 2003). Despite this, the topic of hunting is of minor concern in the forest policies and national development strategies of the countries involved (Brown and Williams 2003). For example, while the Commission of Central African Forests enacted sub-regional guidelines for the sustainable management of plant Non-Timber Forest Products, there is no equivalent for animals. Moreover, before June 2015, no meeting of the Congo Basin Forest Partnership, the foremost consortium of governments and NGOs in Central Africa, has focused on the bushmeat issue. Similarly, few development agencies have contemplated taking action on bushmeat issues as a major priority in Central Africa (Davies 2002).

Given the above, the bushmeat sector remains largely outside the political agenda of Central African forest policy. At least three reasons may explain this. Firstly, bushmeat consumption is usually assessed by conservationists and therefore attracts little attention from national political and economic leaders. Secondly, wildlife management is often considered from a conservation perspective, with little concern for socio-economic development issues at either the local or national level (Brown and William 2003). Lastly, hunting has a strong social legitimacy in the Congo Basin countries without the social stigma attached to this activity in Western conservation circles (Fargeot 2005, Solly 2007).

The purpose of this article is to estimate the financial (trade) and economic (self-consumption) importance of hunting of wildlife for food in Cameroon to justify its greater consideration in the policy domain. A comprehensive view of this sector is still lacking, despite the fact that a significant number of studies have been undertaken, most site-specific and of short duration (Taylor *et al.* 2015). Likewise, hunting activities remain poorly integrated in national-level accounts (Davis 2002). For instance, in Cameroon, the system of public accounts and the Growth and Employment Strategy Paper define hunting as a sub-category of rearing.

Given the complexity, heterogeneity and informality of the bushmeat sector, it is not possible to quantify precisely the benefits of this activity. However, there is enough information to generate a broad understanding of these benefits that can be compared to the official estimates of this activity in the national accounts.

Existing studies of bushmeat are highly fragmented, due to the heterogeneity of hunting practices and of game consumption patterns (Fargeot 2005, Nasi *et al.* 2008). In this study, we conducted financial and economic analysis for an “average” bushmeat commodity chain in the humid area of Cameroon, elaborated with simplistic assumptions, on the basis of current socio-economic data. Two approaches were used here to describe and quantify the economic importance of the bushmeat commodity chain: a Market Chain Analysis (MCA) to define the structure of this commodity chain and a Cost-Benefit Analysis (CBA) as a systematic process for calculating and comparing benefits and costs of the bushmeat extraction and trade.

METHODS

Analyses

An MCA was used to describe the range of activities and stakeholders required to provide a product to the final consumer (Kaplinsky and Morris 2001). A full commodity chain analysis has rarely been applied to the study of bushmeat in West and Central Africa (Bowen-Jones *et al.* 2003), except for the Takarodi market in Ghana (Cowlshaw *et al.* 2005, Mendelson *et al.* 2003).

Then, a CBA was employed to evaluate the financial and economic benefits of the extraction and trade of bushmeat in the humid area of Cameroon. By definition, the financial benefits relate to the revenue streams (in monetary terms) to the different actors (Brent 2006). Within the CBA, inflows consist of bushmeat sales and of the products associated with this activity, i.e. gross financial benefits, or turnover. Outflows are the actual costs incurred by the actors to obtain financial benefits. The total financial cost aggregates investment, operating and transaction costs. The difference between the gross financial benefit and the financial cost is the net benefit, i.e. the profit that the actors draw from the activity.

The economic benefits and costs of hunting reveal the contribution of bushmeat to livelihoods, i.e. the consumption of bushmeat by rural populations and the self-employed time they spend hunting. Self-consumed bushmeat and hunting

time were valued in this analysis on the basis of the local prices that are established on competitive markets in rural Cameroon (Lescuyer 2008). The assessment assumed that the net economic benefit of hunting consists of the value of self-consumption from which operational costs and the value of time spent on this activity are deducted. The net economic benefit also includes net financial benefit to estimate the overall level of well-being derived by all stakeholders from hunting activities. In this assessment, these two types of benefits were distinguished to assess the respective benefits of the bushmeat trade and of its consumption by the rural population of the humid zone of Cameroon.

In contrast with a standard CBA, our analysis covered only one year, without predicting the evolution of the bushmeat sector over the medium and long term. The objective was to evaluate its financial and economic importance on a national scale and for one year in order to compare this assessment to macroeconomic aggregates such as Gross Domestic Product (GDP). To do this, the added value of this sector was calculated by conventionally aggregating net financial benefit, payroll, depreciation of equipment and taxation.

Data

Data were obtained from secondary sources from a non-systematic review of scientific publications and technical reports on bushmeat extraction and trade in the rainforest zone of Cameroon. Scientific references were mainly selected from Taylor *et al.* (2015) with a focus on Cameroon. Other scientific publications were also considered, such as articles published in scientific journals, unpublished Ph.D. theses and some books. Moreover, technical documents were consulted from two main sources: (1) websites such as PSFE (<http://www.cameroun-foret.com/>), SAILD (http://pmb.sicac.org/opac_css) and CBFP (<http://pfbc-cbfp.org/>); (2) internal documents and M.Sc. theses that were collected through professional relationships with institutions, universities, projects, enterprises and consultants. Information from the scientific literature was preferred to data from technical reports. When data were different for the same variable, the smallest estimate was used in order to limit the risk of an overstatement of income or cost.

Despite a broad review of existing data on bushmeat extraction in Cameroon, much information (notably on the intermediary levels of the commodity chain) is missing or only partially available to estimate the financial and economic benefits of hunting on a national scale. Several assumptions were therefore made for the calculations. Instead of a long list of hypotheses presented in this section, they are made explicit with the presentation of the results to show how they influenced the estimation of the orders of magnitude.

RESULTS

The different sets of results are shown in five steps. The first phase presents the structure of the bushmeat commodity chain

in Cameroon, which distinguishes three levels of production and consumption. The evaluation of the financial (sales) and economic (self-consumption) benefits of using bushmeat in rural areas is the second step of the analysis. The third stage estimates the financial benefits of the bushmeat trade in town while the fourth step focuses on the financial benefits of exporting. Lastly, the fifth step summarizes all these financial and economic benefits for comparison with the official statistics of Cameroon.

Step 1—Qualitative description of the bushmeat commodity chain in Cameroon

Trading and consumption of bushmeat in Cameroon takes place along three main channels—at the village level, in cities, and for export—involving three main stakeholder groups—producers (subsistence and commercial hunters) middlemen and consumers (Figure 1).

The bushmeat sector is scarcely controlled by the State in Cameroon, as indeed is the case throughout the Congo Basin (Fa 2007). It is not regulated by economic operators on the supply or demand side. Bushmeat extraction and trade on a local scale are the most documented today. At village level, there are five options for selling bushmeat: (1) direct sales to rural inhabitants; (2) display of game at the roadside for sale to passing travellers; (3) local markets; (4) direct sale on an urban market; (5) sale to a trader/dealer who comes to take his order directly from the hunter. Many variables influence the level of sales to rural consumers or to urban markets but, for Cameroon, van Vliet *et al.* (2011) propose a global proportion of 30% of bushmeat sales to rural populations and 70% to urban clients, often through a trader. There is frequently a trusting and lasting relationship between hunters and traders (Bahuchet 2000, Fargeot 2005, CEW 2008), but the relationship can also alienate the hunters through a system of indebtedness (Bahuchet and Ioveva 1999, Makazi 2012).

Studies of urban markets and assessments of bushmeat consumption in towns have frequently been carried out

(Taylor *et al.* 2015). Urban consumers are supplied either directly by hunters and dealers, by buying on specialized markets, or by consumption in restaurants or chop bars. In Yaoundé, the sale of bushmeat on meat markets and in restaurants is mostly in the hands of women (84% of the 249 jobs listed by Edderai and Dame 2006), while the trader-dealer service is mostly in the hands of men (Bahuchet and Ioveva 1999). Throughout the country, women buyers and sellers occupy a powerful position within the circuit (Ellis 2000). Much less is known on the potential middlemen who bring bushmeat to foreign consumers: this connection may vary from a direct and personal link between the buyer and the consumer to various intermediary steps (specialised exporters, markets, restaurants...).

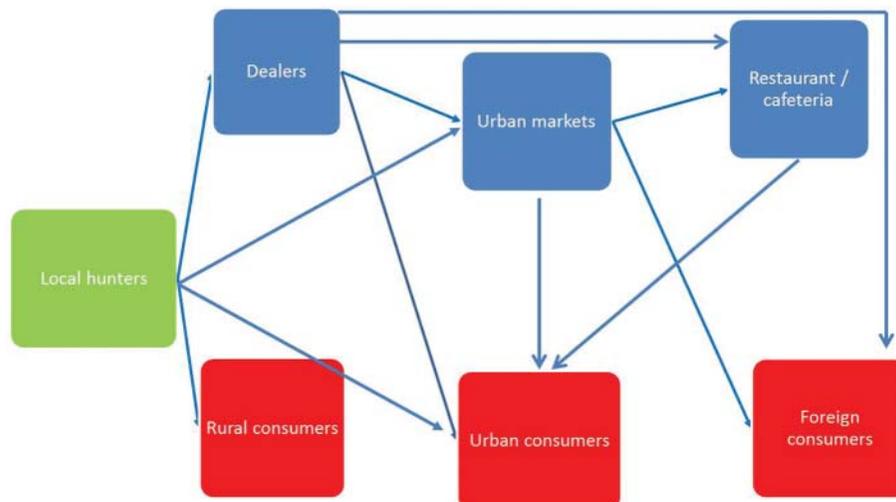
Three parts of this commodity chain remain largely ignored by the scientific and technical literature: the sale of cooked bushmeat, international exports and the steps between rural production and urban consumption. Unlike in the situation described by Cowlshaw *et al.* (2005) in Ghana, wholesalers do not seem to be active in the bushmeat chain in Cameroon. As in Bangui (Fargeot 2014) and in Brazzaville (Mbeté 2012), Cameroonian cities are probably supplied with bushmeat by traders who simply buy up bushmeat from hunters, rather than by wholesalers who would organize and pre-fund the connections between production and consumption.

Step 2—Estimating the financial and economic benefits of the bushmeat sector in rural areas

Estimation of the gross financial benefit of bushmeat trade in rainforest areas

The turnover of bushmeat sales in rural areas within the humid forest areas in Cameroon can be estimated from an approximation of the number of active hunters operating in this biome, and their average annual turnovers. But, because there is no data on the number of active hunters in forest areas in Cameroon, numbers can be estimated based on three main assumptions:

FIGURE 1 Trade-flow patterns of the bushmeat commodity chain in Cameroon (with producers in green, middlemen in blue, and consumers in red)



- Only regions within the humid forest were included in the hunter estimations, hence five regions were fully (Adamawa, North, Far North) or partly (Northwest and West) excluded from the calculations as they are outside the rainforest area.
- In the forested regions, as shown by all reviewed case studies, only rural men are hunters. There are 1.84 million male individuals in these rural areas, half of them considered adults (RGPH 2010).
- There are two types of hunters (Bahuchet 2000, Fargeot 2005): (1) regular hunters, usually young and unmarried, and whose revenues from commercial hunting contribute significantly to their total income; (2) occasional hunters who practise subsistence hunting in agroforestry areas near the village, mainly for their own consumption. TABLE 1 shows the importance of these two categories of hunters in the case studies. Based on this review, a conservative 60% of the adult men was assumed to practise subsistence

or commercial hunting in the forested areas of Cameroon, i.e. about 552,000 individuals.

- From studies of at least a few months duration, that have monitored income accrued by regular and occasional hunters (TABLE 1) an annual income of €80 per average hunter in Cameroon is possible.

The product of the average individual income and the estimated number of active hunters provides an annual amount of bushmeat sales in rural areas of about €44.2 million. As the carcass price is principally associated with body mass (MacDonald *et al.* 2011) and as most bushmeat is traded at the forest or village borders (Dame Mouakoale 2011, Meli *et al.* 2012, Solly 2007), the local price of bushmeat can be used to assess the total traded volume of bushmeat in the rural areas of Cameroon. TABLE 2 presents an overview of local prices for bushmeat in different periods and areas, ranked from the oldest to the most recent estimations.

TABLE 1 Proportions of regular and occasional hunters, and estimation of their annual incomes (€/yr)

Geographical characteristics	% of regular hunters	% of regular and occasional hunters	Annual individual income of regular hunters (€)	Annual individual income of regular and occasional hunters (€)	References
Bantu villages around the Banyang-Mbo wildlife sanctuary, Southwest region	5% of the rural population		414		Abugiche 2008
Bantu villages, East region		57% of the male population			Bahuchet 2000
Bantu villages, South and East regions		79% of the male population		44–148	Déhu 2013, Levang <i>et al.</i> 2015
Bantu villages near the Dja Reserve, East region	10% of the rural population	54% of the male population	457		Dethier 1995
Bantu villages in the Campo Ma'an Reserve, South region			340		Dounias 1999
Bantu villages near the Dja Reserve, East region				122	Ekodeck 2003
Bantu villages near the Dja Reserve, East region	6% of the rural population		549		Fotso and Ngnegueu 1997
Bantu villages near the Dja Reserve, East region		74% of the male population		75	Solly 2007
Bantu villages, East region		60% of the male population		38–53	Takforyan 2001, Lescuyer 2010
Bantu villages around the Banyang-Mbo wildlife sanctuary, Southwest region	5% of the rural population			79–130	Wilcox and Nambu 2007
Pygmy village near the Lobeke national park, East region			500		Yasuoka 2005
Bantu villages near the Lobeke national park, East region			61–458		Zouya Mimbang 1998

TABLE 2 Average price of one kg of bushmeat in rural areas (€)

Location	Price (€/kg)	Reference
Bantu villages in the Campo Ma'an Reserve, South region (1991 price)	0.5	Dounias 1999
Bantu villages in East region (1998 price)	0.3–0.9	Bahuchet 2000
Bantu villages around the Banyang-Mbo wildlife sanctuary, Southwest region (2000 price)	0.3–1.5	Wilcox and Nambu 2007
Rural markets, Southwest region (2002 price)	1.3–2.3	Macdonald <i>et al.</i> 2011
Bantu villages near the Nki national park, East region (2004 price)	0.35	Ndinga 2005
Bantu villages around the Banyang-Mbo wildlife sanctuary, Southwest region (2006 price)	0.6–1.15	Abugiche 2008
Bantu villages in East region (2011 price)	0.4–3.3	Meli <i>et al.</i> 2012
Bantu villages in South and East regions (2012 price)	0.9–2.9	Déhu 2012

Using a 2012 average price of €2.3 /kg for bushmeat sold, the total traded volume of bushmeat in the rural areas could be estimated at about 19 200 tons per year.

Estimation of the net financial benefit of bushmeat trade in rural areas

The extraction and trade of bushmeat generate three types of financial costs: (1) right to access the resource (formal or informal), (2) equipment, (3) remuneration.

Expenditure to access the wildlife resource may be of two kinds: a local payment to customary owners of hunting areas and an official payment for the administration to issue a hunting licence. Local hunters do not have to bear financial costs for access to hunting areas on which they hold customary rights (Takforyan 2001, van Vliet *et al.* 2011). From a legal standpoint, Decision 857/D/MINFOF of 10 November 2009 requires that commercial hunters should be in possession of a harvesting licence. However, this regulation is never enforced. Therefore, the assumption was made that access to resources is financially free for local hunters.

There are mainly two types of hunting: trapping and shotgun. These hunting activities are usually carried out in different areas within the customary lands (Fargeot 2005). Trapping is mainly practised in agroforestry areas, which includes fields, fallows, and degraded forests. Harvested animals are mainly rodents—notably the brush tailed porcupine (*Atherurus africanus*) and the cane rat (*Thriomys swinderianus*)—and also other pests, including many small monkeys. This hunting is largely predominant in Cameroon (Fa 2007) and is practised throughout the year (Delvingt 2001, Takforyan 2001). The assumption was made that occasional hunters visit their trap lines every three days in order to limit the waste by decomposition of the game (Abugiche 2008, Fargeot 2004, Meli *et al.* 2012, Takforyan 2001). The common practice is to spend half a day to inspect the entire line of traps because such checks are often combined with other activities (Abugiche 2008, Solly 2007, Takforyan 2001). Trap hunting is based on wire cables, simple and cheap equipment. On average, a hunter installs 60 snares per year (Dame Mouakouale 2011, Vermeulen *et al.*

2009), equivalent to two rolls of cable per year (Fialla 2011, Yasuoka 2005). The price of a roll of cable is around €4 (Abugiche 2008, Fialla 2011, Solly 2007).

Shotgun hunting is practised in more distant forests with higher densities of large-size species. It is especially practised during the long rainy season due to increased efficiency (Fialla 2011, Meli *et al.* 2012). Shotgun hunting was assumed to be undertaken only for thirty-five days a year. This average duration combines the practices of occasional hunters—estimated at around twenty days of gun hunting per year (Takforyan 2001, Meli *et al.* 2012)—and of regular hunters whose activity can last 100 days per year (Fialla 2011). At each visit, the hunter spends a full day in the forest, accompanied by a carrier who helps bring the game to a point of sale. Shotgun hunting has a higher operating cost: first, a rifle must be acquired—or rented—at a price of around €40 for the current home-made model (Abugiche 2008, Ekodeck 2003), which is amortized over a period of 20 years. But the major expense is purchasing cartridges, for which the unit price is €1 in Cameroon (Abugiche 2008, Fialla 2011, Jeanmart 1998, Mazaki 2012). As frequency data are not available for Cameroon, Kumpel's average for Equatorial Guinea, of 1.3 cartridge per day, was used (Kumpel *et al.* 2010).

Lastly, the assumption was made that local hunters operate on their own account and do not remunerate themselves. It was assumed that the bushmeat carriers are paid at a rate of €0.3/kg (Takforyan 2001).

Under these assumptions, the total operating costs of hunting in rural areas are presented in Table 3.

Under the assumptions made, local hunting appears to be a financially profitable business with a profit margin of around 22%. This simulation is simplified because there is a wide variety of hunting strategies and only some of them appear geared towards profit maximization (Zouya Mimbang 1998). Many hunters appear to sell their game to meet urgent expenses without prior financial calculation. This type of sale may take place with a low or even negative profit (Bahuchet 2000, Dethier 1995).

If this annual net financial benefit is 'grossed up' to the estimated 552 000 hunters in Cameroon, the global net

TABLE 3 Evaluation of the net financial benefit of bushmeat trade in rural areas (€/yr)

	€/hunter	Total for Cameroon (552 000 hunters)	including VAT
Gross financial benefit (turn over)	80.00	44 160 000	
Selling price in rural areas (€/kg)	2.29		
Quantity sold (kg/yr)	34.93	19 283 200	
Harvesting cost			
Access to resources	0	0	
Hunting permit	0	0	
Equipment – Wire cable	7.63	4 213 740	811 145
Equipment – Rifle and cartridges	43.59	24 060 458	4 428 852
Remuneration – Hunter	0	0	
Remuneration – Carrier	10.62	5 862 595	
<i>Total harvesting cost</i>	<i>61.84</i>	<i>34 136 794</i>	
Net financial benefit	18.16	10 023 206	

financial benefit of hunting in rural forested areas amounts to €10 million per year.

Estimation of the gross and net economic benefit of bushmeat consumption in rural areas

For a large majority of hunters, there is no clear distinction between subsistence and commercial hunting, with bushmeat being used according to circumstances to feed the family or increase revenue (Fargeot 2005, Nasi *et al.* 2008). Table 4 summarizes estimates of the quantities of game consumed in rural Cameroon (from Fargeot 2005, modified).

There is broad variability in the individual quantities of consumed bushmeat, depending on the ecological and socio-economic characteristics of the surveyed sites. This estimate assumed a mean of 20 kg/p/yr of game consumption in the rural areas of Cameroon, which is below the range of existing estimates, so as to take into account the less densely forested areas than those presented in Table 4.

The bushmeat-consuming populations were assumed to be the same as those who practise hunting, i.e. the rural populations of the Centre, South, East, Littoral, Southwest regions and half of the rural populations of the Northwest and West regions, with an overall population of 4.4 million individuals. According to the RGPH (2010), children between 0–4 years, 5–9 years and 10–14 years account for 17%, 14% and 12% of

this population respectively and exhibit lower food consumption levels, at 0.3, 0.54 and 0.79 of the Adult Male Equivalent level, respectively (Cossins and Upton 1987, Weisell and Dop 2012). Similarly, the elderly (i.e. more than 60 years old) amount to 4% of the total population and show a consumption level of 0.75 of the Adult Male Equivalent level. The size of the population of bushmeat consumers was therefore reduced by 22% to account for the lower consumption levels of children and the elderly. It was estimated that the game-consuming population is equivalent to 3.43 million adults in Cameroon; hence the total annual consumption is about 68 600 tons per year. If the 19 200 tons from the bushmeat trade are added, the total volume of bushmeat consumed in Cameroon is around 87 800 tons per year, which is 12% above the assessment of Wilkie and Carpenter (1999) in the mid-1990s.

As previously noted, the average selling price of bushmeat in rural areas was assumed to be €2.3/kg. In general, bushmeat is traded on competitive markets in Cameroon, where prices can be used to estimate the economic value (Lescuyer 2008). Under these assumptions, the gross economic benefit from bushmeat self-consumption is around €142.7 million per year.

The estimate of the economic costs of hunting was based on the same assumptions as the financial assessment

TABLE 4 Individual adult consumption of bushmeat in rural areas of Cameroon

Geographical characteristics	Level of consumption	References
Bantu villages, South region	67 kg/p/yr	Bahuchet and Ioveva (1999)
Pygmy villages, South region	79 kg/p/yr	
Bantu villages near the Dja Reserve, East region	28 kg/p/yr	Auzel (1997)
Bantu villages near the Dja Reserve, East region	27–59 kg/p/yr	Delvingt (2001), Vermeulen <i>et al.</i> (2009)
Bantu villages near the Dja Reserve, East region	53 kg/p/yr	Ekodeck (2003)

of operating costs, but it also included the time spent in hunting. In the absence of a formal labour market in rural areas, a daily remuneration of €1.5 was assumed, which is the amount paid for one farming day (Lescuyer 2008). This remuneration was taken to be the opportunity cost of a day of hunting. With the same assumptions as for the financial analysis, a hunter using a rifle spends 35 days a year for hunting, while a hunter with traps devotes 122 half-days to check his snares, and a bushmeat carrier is paid €0.3/kg. Table 5 shows the estimate of the annual net economic benefit of bushmeat consumption in rural areas per person and nationwide.

The extrapolation of this economic benefit to all hunters in Cameroon gives a total net economic benefit of hunting practised in rural areas of approximately €24 million per year.

Step 3—Estimating the financial benefits of the bushmeat commodity chain in urban areas

Estimation of the gross financial benefit of bushmeat trade in urban areas

In the mid-1990s, Bahuchet and Ioveva (1999) monitored the four main entry points of bushmeat in Yaoundé on a daily basis. The average sales amounted to 2 300 kg/day. They also estimated that a third of the bushmeat inflows did not go through markets. On this basis, the quantity of bushmeat consumed in Yaoundé would be about 3 tons per day. It is, however, difficult to be sure of the bushmeat flows outside market channels. According to Fargeot (2004), in the Central African countries, these “home sales” account for 30 to 50% of the urban supply of bushmeat, and build on the close ties between the elites living in the city and their relatives in the villages. In Yaoundé, Edderaï and Dame (2003) estimated that more than 40% of the bushmeat supply to restaurants and cafeterias does not pass through urban markets. In Yokadouma, Zouya Mimbang (1998) indicated that the vast majority of bushmeat transactions are carried out in private homes.

Based on the low estimation of these direct flows of bushmeat by Bahuchet and Ioveva (1999) and the growth in the size of the population in Yaoundé estimated at 6% per year over the last decade (CUY 2008), the volume of bushmeat consumed in Yaoundé appears to amount to 6 tons per day, or 2 190 tons per year. This equates to an individual consumption of 4 g/person/day for Yaoundé, which is a level close to those of the cities of Mbandjock in Cameroon and Libreville in Gabon (Nasi *et al.* 2008).

The assumption was made that bushmeat consumption in Yaoundé amounts to a fifth of the total urban consumption in Cameroon, based on the size of the urban population in the southern part of Cameroon. The amount of bushmeat sold in major cities in southern Cameroon is thus estimated at about 10 950 tons per year. It is about half of the volume of bushmeat sales from rural areas, which was evaluated at 19 200 tons per year. This difference is explained by bushmeat sales to rural consumers and the seizure by government officials of game during its transport to urban markets.

Bushmeat prices on urban markets are also difficult to assess due to: (1) the diversity of species on sale; (2) the state of the game (fresh or smoked); (3) the extent of processing.

Part of the game is sold without processing on the markets of Yaoundé. In this case, the average price is around €3/kg for medium-sized species such as brush-tailed porcupine (*Atherurus africanus*) or blue duiker (*Cephalophus monticola*) (Macdonald *et al.* 2011). But some of the game is cut up or cooked, with a significant increase in the price to the final client. Edderaï and Dame (2006) estimated that 1 052 plates of bushmeat were sold every day in Yaoundé. Bahuchet and Ioveva (1999) indicated that the selling price can be multiplied by 3–8 depending on the extent of processing. Overall (and in line with Dame Moukouala 2012), an average price of €4.6/kg was adopted for bushmeat sold on urban markets, as a generic figure without reference to species and without considering the state of the game.

TABLE 5 Evaluation of the net economic benefit of bushmeat consumption in rural areas (€/yr)

	€ or kg /hunter	Total Cameroon (552 000 hunters)
Gross economic benefit	258.46	142 671 756
Selling price in rural areas (€/kg)	2.29	
Quantity sold (kg/yr)	112.9	62 300 000
Harvesting cost		
Access to resources	0	0
Hunting permit	0	0
Equipment – Wire cable	7.63	4 213 740
Equipment – Rifle and cartridges	43.59	24 060 458
Remuneration – Hunter	146.56	80 903 817
Remuneration – Carrier	17.23	9 511 450
<i>Total harvesting cost</i>	<i>215.02</i>	<i>118 689 466</i>
Net economic benefit	43.45	23 982 290

By multiplying the bushmeat inflows in the main cities of southern Cameroon by the average price on urban markets, revenues from bushmeat trade in the cities of Cameroon were estimated at around €50 million per year.

Estimation of the net financial benefit of bushmeat trade in urban areas

In order to build up a picture of the operating costs of the bushmeat commodity chain on urban markets, information was collated from a number of case studies. This allowed six specific classes of expenditure to be identified:

- Game is bought from rural hunters, at an average price of €2.3/kg.
- The ways in which bushmeat is collected by middlemen in the rural areas of Cameroon are relatively uniform (Ellis 2000): on average, middlemen travel once or twice a week to meet hunters and collect several dozen kg before coming back to town (Bahuchet 2000). Traders combine public transport and local transport—taxi, “clando”, motorcycles—to reach the transport hubs from the villages (Ngoufo *et al.* 2006, CEW 2008). The average transportation cost is estimated at €18.3 per trip on the basis of the current prices of public and informal transport in Cameroon (Fiaila 2011, MacDonald *et al.* 2012). It was assumed that half of the transport cost covers the purchase of fuel, which is submitted to a value added tax of 19.25%.
- Costs for accommodation, food and communication were estimated at €7.6 per day for a trader (Zouya Mimbang 1998), half of them—notably the hotel and telephone communication—being subject to value added tax. Under the assumptions that a trader collects 60 kg of bushmeat before returning to town and that he collects 15 kg of bushmeat a day, the average duration of a collecting trip is four days, in line with what Bahuchet (2000) described.

- Waste of game—either because of the deterioration of the condition of the meat before it reaches urban markets, or because of formal or informal seizure by the administration—increases the cost to the trader. Due to a lack of empirical information on such waste, a 10% increase in the total operating cost was assumed.
- The assumption was made that the bushmeat is not processed. Therefore, this estimate does not cover the catering sector.
- Game traders work on their own behalf: their income comes from their profit and not from the payment of a salary.

Table 6 shows the overall estimate of the annual net financial benefit of urban trade of bushmeat.

When extrapolated to all game sold annually to consumers in the cities of southern Cameroon, the global net financial benefit of the bushmeat urban trade was estimated at €12.7 million per year.

Step 4—Estimating the financial benefits of the bushmeat sector from exports

Estimation of the gross financial benefit of bushmeat exports

Some of the game hunted in Cameroon is exported to meet the demands of the African diaspora (Bahuchet 2000). As these exports are not declared to Customs, it is difficult to estimate their volume. Chaber *et al.* (2010) conducted a two-week survey on informal imports of bushmeat at Charles de Gaulle airport in Paris. They estimated that 3.67 tons of game meat arrived in Paris per week from Cameroon. A majority of exported game species consists of small monkeys (*Cercopithecus sp.*). In Paris, this type of monkey—with an average weight of 5 kg—costs about €80 (Chaber *et al.* 2010), three times the price offered on Cameroonian urban markets.

Based on these assumptions, the turnover of bushmeat exports was estimated at around €3 million per year, which is

TABLE 6 *Evaluation of the net financial benefit of bushmeat trade on urban markets (€/yr)*

	€/kg	Total for southern Cameroon cities (10 950 t)	Including VAT
Gross financial benefit	4.58	50 152 672	
Operational costs			
Purchase of bushmeat	2.29	25 076 336	
Transportation	0.31	3 343 511	257 450
Food and lodging	0.51	5 572 519	429 084
Remuneration	0.00	0	
Processing	0.00	0	
Spoilage in transit (10% of the operational cost)	0.31	3 399 237	
<i>Total operational cost</i>	<i>3.41</i>	<i>37 391 603</i>	
Net financial benefit	1.17	12 761 069	

a conservative estimate because it is limited to the game arriving in Paris, while similar flows have been observed elsewhere, such as London (Bowens-Jones *et al.* 2003) or in the United States of America (Bair-Brake *et al.* 2013).

Estimation of the net financial benefit of bushmeat exports

Without prior assessment of the costs of bushmeat exports, the estimation of the expenses related to the informal export of bushmeat was based on the following assumptions:

- The purchase of the game is made on urban markets in Cameroon, at a price of €4.58/kg.
- According to Bahuchet (2000), informal exports of bushmeat are a speculative activity and constitute for the conveyors a means of funding their stays abroad. However, there is no information about the financial arrangements between the conveyors and their customers. Therefore, the assumption was made that the conveyor is paid €9/kg, i.e. double the domestic price in Cameroon and 55% of the price on the Paris market.
- Exporting of game does not appear in the statistics of the Customs services (Nkou and Eba'a Atyi 2013), which suggests that no formal tax is paid.
- It was assumed that 10% of the game is seized by the exporting or importing countries' Customs services, which increases the average operating cost by 10%.

These assumptions were used to calculate a net benefit estimate from the sale of bushmeat on overseas markets (Table 7).

Even with an attractive profit rate of 37%, this volume of trade is marginal, due to weak demand on foreign markets.

Step 5—Overall financial and economic assessments of the bushmeat commodity chain

Table 8 summarizes the sub-sector estimates to reveal the full impact of bushmeat extraction and trade on the economy of Cameroon.

Due to strong demand and high prices, most sales and profits are made on the urban markets. However, the gross financial benefit is only a third of the gross economic benefit, indicating the major importance of bushmeat in the nutrition of rural households. The main users of bushmeat are the rural people and their harvesting and consumption patterns remain relatively insensitive to market-type regulation.

Both the production and the consumption of bushmeat are poorly integrated in the public accounting system. In 2010, public accounts assessed the production of the hunting sector at €61.8 million (Nkou and Eba'a Atyi 2013), i.e. 36% under our appraisal. Even worse, the final consumption of bushmeat was estimated at €44.3 million in the public accounts, 69% below the self-consumption level assessed in Table 8. These discrepancies demonstrate the difficulties in analysing the financial and economic importance of informal commodity chains with the current public accountancy procedures. On the basis of the existing literature, the added value of the bushmeat chain appears to amount to €41.1 million or 0.17% of Cameroon's GDP (non-oil) for 2013. It is equivalent to the contribution of the mining sector to Cameroon's GDP (Nkou and Eba'a Atyi 2013).

TABLE 7 *Evaluation of the net financial benefit of bushmeat on foreign markets (€/yr)*

	€/kg	Total Export (190 t)
Gross financial benefit	16	3 053 440
Operational costs		
Purchase of bushmeat	4.58	874 076
Remuneration of the conveyor	4.58	874 076
Taxes	0.00	0
Spoilage in transit (10% of the operational cost)	0.92	174 815
<i>Total operational cost</i>	<i>10.08</i>	<i>1 922 968</i>
Net financial benefit	5.92	1 130 472

TABLE 8 *Financial and economic appraisals of the bushmeat sector in Cameroon (€/yr)*

€/yr	Rural areas	Urban areas	Export	Total
Gross financial benefits	44 160 000	50 152 672	3 053 440	97 366 112
Net financial benefits	10 023 206	12 761 069	1 130 472	23 914 747
<i>Profit margin</i>	<i>23%</i>	<i>25%</i>	<i>37%</i>	
Gross economic benefits	142 671 756			142 671 756
Net economic benefits	23 982 290			23 982 290

DISCUSSION

The macro-economic assessment of the bushmeat commodity chain in Cameroon suggests three areas of interest for public policy:

- (1) Food security in rural areas, since bushmeat consumption is the major economic benefit of the sector.
- (2) Poverty alleviation in rural areas by maintaining or increasing revenues from hunting.
- (3) Nutrition of urban populations, since a fair share of the bushmeat trade is intended for city dwellers.

In rural areas, the challenge is to maintain the contribution made by bushmeat harvesting and trade to local livelihoods, through the provision of both protein and revenues. In urban areas, where food security may be ensured through access to other sources of proteins, the policy goal should be to limit the consumption of vulnerable species by the upper class, while guaranteeing that bushmeat provides irreplaceable nutrients to consumers of the middle and lower classes.

Maintaining bushmeat consumption in rural areas: a food security issue

Bushmeat remains a major element in the diet of the rural population in Cameroon, and hunting provides between 30 and 80% of the protein consumed by forest-dwelling families in the Congo Basin (Wilkie and Carpenter 1999). Seventy per cent of the mammal species hunted in Central Africa do not appear on the list of threatened species (Nasi *et al.* 2011, van Vliet *et al.* 2012). Current hunting practices may cover most of the consumption of rural populations and supply trade flows to urban centres, without relying on unsustainable exploitation of such species (Brown and Williams 2003, van Vliet *et al.* 2011).

It appears difficult to reduce the dependence of rural populations on bushmeat due to a lack of alternatives sources of proteins: the attempts at captive breeding of game in forest areas, as well as the attempts to supply rural villages with “imported” meat or fish, have met with little success in Central Africa (Brown and Williams 2003, Wilkie and Carpenter 1999).

The major challenge to sustaining bushmeat consumption by rural households is therefore to improve local management of the wildlife resource. However, decentralizing game meat management has often failed in Central Africa. The approach tends to be based on a simplistic vision of customary hunting and imposes complex and expensive technical procedures on the communities, out of keeping with their capacities and the potential of the trade (Bowen-Jones *et al.* 2003, Fargeot 2014). An alternative approach would be to set out some principles for sustainable hunting—for example, excluding vulnerable species and certain hunting techniques, and controlling the periods of access to the resource—and then allow communities to establish and enforce their own rules of access and use (Karsenty 1998, Larson and Pulhin 2012, Wright and Priston 2010). Such principles would be more

easily understood by the populations and more easily controlled by the public authorities.

The longer-term trend: anticipating a decrease in the contribution of hunting to rural incomes

Hunting is a significant source of cash for rural populations, but it remains a secondary source of income in rural areas. According to Lescuyer (2010) and Levang *et al.* (2015) for five sites in Cameroon, the share of hunting income in the annual budget of rural households varies between 2 and 13%. However, this contribution is highly dependent on the socio-economic conditions of the area (market access, presence of a logging company, etc.) and the wealth and status of the household (Brashares *et al.* 2011, Fargeot 2005).

Two long-term trends will probably threaten the current level of income from hunting by local people. Firstly, the probable scarcity of large mammals due to forest fragmentation and to the pressures from commercial hunters will negatively impact on the volume of hunted game and the value of this trade (Fa *et al.* 2003, 2006, Nasi *et al.* 2008). It seems unlikely that repressive actions—such as a harvesting quota per species that would be controlled along transport routes (Edderai and Dame 2006, MacDonald *et al.* 2012)—could ever be enough to stop or slow the “defaunation” of forest ecosystems, given the weak governance of the sector.

Secondly, subsistence and commercial farming constitutes a financially attractive activity for rural populations, due to rising demand and a significant increase in prices for some agricultural commodities, such as cocoa and palm oil (Lescuyer *et al.* 2014). Without being as flexible as hunting, agriculture offers two advantages: for most local people, it is a low entry cost activity that may provide high and sustained income, and agriculture is also a socially valued activity (Carrière 2003, Robiglio 2008). In the years to come, it could provide an attractive livelihood option for the rural poor that might deter young individuals from commercial hunting or, at least, reduce the time they devote to it.

Breaking down the urban market for bushmeat

Bushmeat consumption remains significant in the cities of Cameroon, both physically and financially, but few studies have focused on the specific demands for bushmeat (Wilkie and Carpenter 1999). Urban consumption of bushmeat can be categorized into at least two sub-sectors (Bowen-Jones *et al.* 2003). On the one hand, for the vast majority of urban consumers, bushmeat is a necessary staple that is financially affordable because supplied by fast-reproducing and unthreatened species. In comparison to other sources of protein, bushmeat has a positive cultural connotation (Fargeot 2005, van Vliet *et al.* 2011) and provides valuable nutrients. Although elements of the commodity chain seem socially, ecologically and economically sustainable, this activity remains illegal. There is a need to revise regulatory frameworks to secure harvesting practices and trade channels (Brown and Williams 2003, Wilkie *et al.* 2006).

On the other hand, some bushmeat species—usually prestigious large-size mammals—constitute luxury items, which are bought by rich elites. This specific consumption is a major source of defaunation and cannot be justified on food security grounds. The challenge is therefore to reduce this specific urban demand. Two approaches commend themselves: (1) a quota system with checks and tax payment along the roads (Wilkie and Carpenter 1999) and/or on the urban markets (Nasi *et al.* 2011); (2) environmental education, in which the Ebola virus can contribute to changing these consumers' patterns (Auzel 1997, Wilkie and Carpenter 1999).

CONCLUSION

The need for a public policy to promote the sustainable use of wildlife is still not widely accepted in Cameroon for at least three reasons. Firstly, it is a matter of stakeholders' perceptions. In all Congo Basin countries, hunting and bushmeat consumption benefit from strong social legitimacy for all segments of the population. This broad social acceptance is an obstacle to the application of formal instruments to control and sanction 'illegal' hunting practices (Wilkie and Carpenter 1999). In parallel, the international community remains reluctant to support the rational exploitation of wildlife resources, rather than viewing the issue in terms of poaching and species disappearance, which are topics that have greater traction among western publics (Brown and Williams 2003, Davies 2002). The socio-economic benefits of this sector, its impact on rural poverty and the complexity of its operating modes are largely neglected in the national and international arenas.

Secondly, the development pathway chosen by Cameroon is likely to increase access to forest areas in the next twenty years. In such a context, it is difficult to design a policy of sustainable use of game, while also ensuring the conservation of the population of large and threatened mammals. To date, there have been no convincing measures that have curbed such "defaunation" and the increase in rural and urban populations is not conducive to the emergence of innovative solutions to maintain the population of large animals in natural forests. Although the disappearance of the megafauna is worrying for the functioning of forest ecosystems (Abernethy *et al.* 2013), its economic and financial impact is less of a concern, since local hunting depends primarily on species that are less vulnerable and could supply most rural and urban demands. While seeking to reduce the rate of disappearance of large mammal species, the public policy should primarily be directed at the sustainable management of small/medium animal species, which make up the bulk of the consumed and traded volume of bushmeat.

Lastly, the lack of information on the operation and governance of the bushmeat commodity chain constitutes an obstacle to the development of effective tools for implementation of a sustainable game management policy. Unlike local hunting practices in rural areas, which are well documented in the scientific and technical literature, there is very little

information on the intermediary and final phases of the bushmeat commodity chain in Cameroon. However, the successful monitoring and management of bushmeat extraction and trade is likely to necessitate a multi-actor approach that encompasses most or all actor groups (Cowlshaw *et al.* 2005). It requires the development of specific combined measures of sustainable wildlife management in order to take into account the linkages between the different groups along the commodity chain (Bowen-Jones *et al.* 2003). These are still important unexplored areas of research for the social and political sciences, as they would significantly contribute to the successful implementation of such a public policy.

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