



Scoping the feasibility of potential alternatives to bushmeat hunting in Equatorial Guinea: a literature review and key informant perspectives

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EXECUTIVE SUMMARY

Introduction

In the Congo Basin 1-3 million tonnes of bushmeat are taken from the forests each year (Fa et al., 2003; Wilkie & Carpenter, 1999), and hunting rates, driven by a growing and increasingly accessible urban market, are increasingly rapidly (Nasi et al., 2008). At a regional level, the trade is deemed to be highly unsustainable, with bushmeat production levels predicted to decline rapidly, severely compromising food security (Fa et al., 2003), and in the process, negatively affecting biodiversity through local extinctions (Oates et al., 2000; Roldan & Simonetti, 2001) and the loss of ecosystem services (Vanthomme et al, 2010). Critically, the bushmeat trade underpins many livelihoods and, in the case of forest dependent communities, commonly acts as a safety net in times of hardship, in terms of protein and income (de Merode et al., 2004; Nasi et al., 2008; Allebone-Webb, 2009).

In light of this, conservation organisations have increasingly invested in projects which include components focused on generating alternative sources of income and/or protein to local communities as a means of achieving conservation-related goals. However, to date the few such projects implemented in the region have tended to apply a time-limited, 'top-down' approach with insufficient monitoring and evaluation of impacts, and as a result they have largely failed to demonstrate local buy-in and long-term positive benefits

The Zoological Society of London (ZSL) recently started a project in Equatorial Guinea investigating the feasibility of various alternatives to bushmeat hunting and consumption. In addition to initiating socioeconomic research on the ground, a desk-based literature review combined with key informant interviews has also been undertaken to evaluate prospective alternative livelihoods and other possible mechanisms to manage the bushmeat trade in terms of their feasibility, cost and likely social and environmental impacts. Options reviewed include: regulating the bushmeat trade, improving marketing and sourcing of non-animal protein, domestication of wild species, improved production of fresh fish, domestic meat or non timber forest products (NTFPs), and improved or alternative methods of forest management. A wide number of projects were reviewed in countries across Africa and further afield.

Below we summarise the lessons learned from our research, discuss options for project implementation and provide general recommendations for donors and government. It should be noted that our recommendations are preliminary and made largely in the context of Equatorial Guinea, and are thus not necessarily applicable to other countries or regions. We welcome comments or feedback on the contents of this report, which is still a work in progress, and would be pleased to hear about other case studies relevant to this topic (please email noelle.kumpel@zsl.org). Finally, we thank the individuals and organisations listed in Annex 1 for valuable insights and information, and we gratefully acknowledge the support of the Rufford Foundation and the US Fish and Wildlife Service in preparing this review.

Lessons learned from other projects

- The success and uptake of alternative food products to bushmeat will depend in the short term on whether they are relevant to existing preferences and consumption patterns of target groups. Novel products can be introduced but must be accompanied by extensive social marketing campaigns.
- Attempting to turn traditional activities into money-making schemes should be investigated rather than developing new alternative livelihoods.
- Where an alternative livelihood is novel to a community, social marketing, education and appealing to religious paradigms are essential. Training local organisations in methods leading to social and behavioural change is essential if livelihoods are to be adopted.
- If alternative livelihoods are to be adopted by target populations, training and materials have to be provided at low or no cost to participants, as bushmeat hunting is virtually a costless activity. However, some form of community commitment is required if long-term interest is to be maintained. This can be promoted through motivating local entrepreneurs to actively participate in the supply chain.
- Creating benefit-sharing systems and cooperatives within communities has proven beneficial.
- Engaging the education system with issues related to bushmeat hunting can be an effective means to promote long-term social change and achieve sustained projects impacts. The effects of such campaigns on the perceptions and behaviours of target audiences should be monitored.
- Collaboration between organisations from different sectors is an effective means to tackle the controversial issue of bushmeat hunting on different fronts by relating it to other issues such as food security, human health, education, etc.

Options for project implementation

- *Bushmeat hunting and trade regulation:* Bushmeat harvest and trade regulations are better implemented by government entities. NGOs can be part of the process through advising policy, providing monitoring information and through facilitating acceptance of the regulation by local communities.
- *Marketing:* Marketing is an essential first step before introducing a new product, although awareness-raising in isolation is not effective at changing behaviour. There is some evidence for 'Westernisation' of tastes among wealthier, young, urban groups reducing preferences for bushmeat. The impact of awareness

- campaigns linking bushmeat handling and consumption to emerging infectious diseases also has potential for decreasing bushmeat consumption.
- *Aquaculture*: Micro- and small-scale aquaculture does not appear to be a sustainable livelihood alternative in Equatorial Guinea at present. Viable aquaculture projects rely on expensive modern technologies and extension services, requiring constant donor funding to meet operational costs and long-term technical assistance.
 - *Livestock rearing*: Free-range poultry rearing coupled with vaccination campaigns and improved housing for predator control could be a viable alternative for small farmers but is unlikely to meet the total demand for meat. In general, intensive livestock rearing is hard to introduce because of the high start-up and maintenance costs, lack of extension services and, in Equatorial Guinea, lack of experience/tradition of domestication.
 - *Bushmeat rearing*: Snail farming needs to be carried out on a large scale to ensure an adequate income but is cheaper and simpler than other forms of bushmeat farming. Grasscutter farming also seems to be technically feasible although may not be adopted by communities where they are more easily hunted in nearby fields. The same husbandry issues apply as for livestock rearing.
 - *NTFPs*: Plant-based NTFP harvesting involving public-private partnerships could generate income and have minimal environmental impacts if managed sustainably. Developing new supply chains for NTFPs would necessitate detailed information on the harvest of the species involved, whilst investment in services which facilitate the storage and distribution of these products would be required. Beekeeping offers a low-cost and highly feasible alternative. The regional and international market for honey and bee products is expanding although there is currently no beekeeping sector in Equatorial Guinea. Initial investment in training from neighbouring countries, such as Cameroon, would be required.
 - *Sustainable forest management*: Community forest management may provide local incentives to reduce bushmeat hunting, but to be successful, would need to include income-generating activities or protein replacement for the communities involved. Long-term finance could be generated from REDD+ credits although there is no evidence that this will be implemented in Equatorial Guinea within the immediate future.

General recommendations for donors and the Equatoguinean government

- Bushmeat hunting regulations should be developed that allow a legitimate channel for the trade in order to develop participatory management of the resource. This could be achieved through the implementation of quotas or taxes. These regulations would need to be monitored and enforced regularly to ensure they are sustainable and effective. Coupling regulation with attempts to explicitly measure the value of bushmeat to the national economy would highlight the need for sustainability.
- Local communities require incentives to invest in the future of the resource. They should thus be included as an integral part of hunting and trade planning and management.
- Capacity and incentives for law enforcement and monitoring of enforcement activities should be developed, such as confiscating excess bushmeat through

- roadblocks or random market raids.
- A national campaign to raise public awareness regarding unsustainable and illegal bushmeat hunting and trading should be developed. Appropriate messages should be constructed by local authorities and NGOs to target different demographics whilst the media skills of industry professionals should be harnessed.
 - Conducive investment policies to attract increased private sector participation could fund the development of large-scale livestock rearing initiatives, potentially easing demand for bushmeat. High-priority sites for the development of these industries should be identified in areas of low conservation value, and environmental impact assessments should be conducted.
 - Funding extension services (training, veterinary and technical support) is necessary for the development of agriculture, livestock and aquaculture in Equatorial Guinea. Training in marketing, business and entrepreneurship is necessary more generally to ensure the long-term viability of projects.
 - Facilitating access to credit for local enterprises (such as low interest loan schemes) would facilitate higher participation in market supply chains. At least part of the credit provided must be conditional based on the performance of the enterprise.
 - An analysis of existing market supply chains should be undertaken in order to identify under-developed markets for products derived from rural areas and this information should be shared with potential entrepreneurs and relevant government ministries.
 - Regulating the harvesting of wild NTFPs should include evaluating and controlling harvesting permits to avoid overexploitation. Overseas trade must adhere to CITES requirements. Species domestication should be promoted when possible.
 - Options to create community-managed forests with controlled hunting zones should be explored, and coordinated with existing plans for protected area management. Like other NTFPs, methods to measure and control bushmeat harvests would need to be implemented.
 - Timber certification could support improved bushmeat management and could be promoted by engaging with some of the timber companies present in Equatorial Guinea and by active law enforcement (specifically anti-poaching). However, this needs further evaluation as it may not be a feasible option given the relatively small size and mature nature of timber concessions in Equatorial Guinea. The potential for improved forest governance and law enforcement via FLEGT (an EU initiative on Forest Law Enforcement and Governance in Trade) should also be explored.
 - A framework for monitoring of wildlife and sustainable bushmeat offtake should be developed, to enable local-level monitoring by communities, protected area authorities and concessionaires. Appropriate audits should be undertaken by third party experts.
 - Baseline information on abundance and distribution of bushmeat species and other NTFPs is needed. Guidelines on how to manage resources in the wild and harvest them sustainably should be developed. There is a need to build capacity amongst young scientists to undertake these inventories and develop key indicators to monitor biodiversity change.

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A. Introduction

In the Congo Basin 1-3 million tonnes of bushmeat are taken from the forests each year (Fa et al., 2003; Wilkie & Carpenter, 1999). This mass extraction of fauna is leading to population decline and local extinctions (Oates et al., 2000; Roldan & Simonetti, 2001), which in the process has an impact on ecosystem function through the loss of ecosystem services (Vanthomme et al., 2010). Hunting rates have increased rapidly over the last 10 years, fuelled by a growing and increasingly accessible urban market (Nasi et al., 2008) and a decreasing supply of domestic livestock and fish alternatives across the region (Kümpel, 2006). Solutions to this problem proposed by conservationists include improving the management of bushmeat hunting and trade alongside identifying suitable alternative foods and livelihoods to bushmeat.

Unfortunately, solving this issue is problematic, as the bushmeat trade underpins many livelihoods and, in the case of forest dependent communities, commonly acts as a safety net, in terms of protein and income, in times of hardship (de Merode et al., 2004; Nasi et al., 2008; Allebone-Webb, 2009). The commercial bushmeat trade increasingly acts as an important source of income for rural hunters which typically sell their harvest if they can buy cheaper frozen foods and make a net profit (Kümpel, 2006; Nasi et al., 2008; Allebone-Webb, 2009). In contrast, urban populations often consider bushmeat a luxury item, and its consumption is determined by a combination of taste/cultural preference, availability and price (East, 2003).

Different actors are involved in different stages of the bushmeat commodity chain as women typically assume the role of traders while men carry out the hunting (Cowlshaw et al., 2005; Kümpel, 2006). Young men tend to hunt at the highest intensity and thus have the greatest impact on wildlife (Kümpel et al., 2009). In Equatorial Guinea, hunting is however seen by young men as a fall-back activity to alternative livelihoods such as paid employment, which they would switch to when available (Kümpel et al., 2009; Kümpel et al., 2010b).

Managing bushmeat harvesting will require an in-depth understanding of the economic, political and socio-cultural factors that underpin the demand for, and supply of, bushmeat, and any initiative considered needs to be placed within that framework. The Zoological Society of London (ZSL) recently started a project to identify and develop acceptable and feasible initiatives that could reduce bushmeat hunting in Equatorial Guinea. This following analysis explores the following options: Regulation, improved marketing and sourcing of non-animal protein, domestication of wild species, improved production of fresh fish, domestic meat or non timber forest products (NTFPs), and sustainable forest management.

B. Overview of research approach

Desk-based research by the first author investigating the feasibility of various approaches with the potential to reduce bushmeat hunting and trade in Equatorial Guinea was undertaken between November 2010 and February 2011. This work expands on and adapts essays examining bushmeat alternatives compiled in November 2009 by students of the Imperial College London MSc Conservation Science course. It also reviews other relevant peer-reviewed published scientific articles, grey literature

reports found via the internet and details of initiatives or projects carried out by NGOs and other organisations in different countries relevant to the creation of alternative livelihoods in the context of Equatorial Guinea. When possible, representatives of these organisations were contacted by phone or email to gain a first hand account of their activities, issues encountered, lessons learned and budget necessary to set up the projects or initiatives. A list of the people contacted is available in Annex 1.

C. Results

Reducing bushmeat hunting and trade through regulation, improved marketing and sourcing of non-animal protein, domestication of wild species, production of fresh fish, domestic meat or non timber forest products (NTFPs), and forest management, are discussed hereafter in terms of feasibility, cost, and likely social and environmental impacts in the context of Equatorial Guinea. It should be noted that results presented from case studies presented are specific to their local context and are difficult to quantify. They are thus not necessarily applicable to all other scenarios but instead provide meaningful recommendations for future initiatives in terms of the lessons learned from past projects.

1. Regulation of bushmeat hunting or trade

Bushmeat hunting and trading in Africa is rarely actively regulated or managed. In the few countries that have transcribed some sort of regulation into law, it remains unenforced due to a lack of capacity (ODI, 2003). In Equatorial Guinea, hunting is banned in protected areas and of certain nationally protected species (Decree 8/2008). Primates are the most protected taxa and bans are in place for hunting, trade, possession and consumption of all primates regardless of whether the area is protected or not (Decree 72/2007). However, the lack of government control and enforcement leaves the trade virtually open, regardless of species' legal status, and primates are still traded openly at urban bushmeat markets (Gill, 2010).

Dickson (2003) argues that as bushmeat hunting is such a common practice, a legitimate channel for the trade in Africa is a necessary precursor for its regulation. He states that deeming bushmeat directly illegal does not offer the possibility of developing "participatory management models or to broaden the governance reform", and is also likely to render the trade inconspicuous and encourage the bribery of monitoring officials (Egbe, 2000). Experience also shows that "improved law enforcement can drive the hunting and trade further underground if local people have no available alternative sources of protein" (Ngono, 2010 pers. comm.). Governments should therefore invite the local communities impacted by bushmeat trading policies to be an integral part of the trade management, thus providing them with an incentive to maintain the future condition of this resource (Brown et al., 2002). In Cameroon, for example, the creation of 'community managed forests', where locals have the exploitation rights, has led to better management of NTFP resources, though in Equatorial Guinea the implementation of these schemes would likely be hampered by imprecise and conflicting laws related to land tenure (CARPE, 2000) (see section 7).

One way of creating a legitimate channel for bushmeat would be to allow restricted hunting and/or trade through quotas. This would in theory lead to a reduction of bushmeat consumption, as a contraction in supply would lead to higher prices, making bushmeat unaffordable to many households (and potentially leading to a change in cultural preferences). Individual transferable quotas (ITQs) have been used successfully to regulate sea fisheries (Inamdar et al., 1989, in ODI, 2003). They have provided clarity regarding the access to and legitimacy of resources and offered incentives to monitor and self-regulate harvests. From this perspective ITQs could be applied to bushmeat hunting. Excess quotas could be regulated by confiscation, through roadblocks and random market raids. These interventions would require substantial finances in order to guarantee high salaries for the law enforcers and thus limit corruption or the emergence of alternative distribution and marketing systems (Wilkie & Carpenter, 1999). Furthermore, quotas would have to be applied carefully due to the reliance of households on bushmeat for nutritional purposes, and may be unrealistic in cases where monitoring costs are high and alternative livelihoods unavailable. There is also a risk that rural communities would see such enforcement as a “national infringement on traditional resources” which could lead to increased hunting and poaching through retaliation (Wilkie & Carpenter, 1999).

Regulation could also focus on certain aspects of the trade. For example, a ban on gun-hunting or on the hunting or commercial trade of certain predominately gun-hunted species such as apes, mandrill and black colobus could reduce the impact on these more vulnerable species. Moreover, primate meat is one of the least preferred bushmeat types in Equatorial Guinea, (Kümpel et al., 2008), and the ban of its trade would have a minor (but admittedly increasing) impact on the overall scale of the trade in Equatorial Guinea, as the majority of offtake is comprised of trapped species such as rodents and duikers. Furthermore, impact on livelihoods of the rural poor would also be limited, as gun-hunting households tend to be wealthier than trapping households (Kümpel et al., 2010b; Damania et al., 2005), so less vulnerable to any loss of income incurred.

Alternatively, supply and demand of bushmeat could be curbed, while giving it a legitimate status, through setting a bushmeat tax per kilo (Steel, 1994). For this, the market price of bushmeat would have to be monitored regularly to maintain high enough levels of taxation to reduce consumer demand. Resultant tax revenues could be used by the national and local authorities to pay for law enforcement or social services (Wilkie et al., 2006). In Equatorial Guinea, bushmeat trade is legitimised in some way (counteracting the hunting ban) through a tax that is applied to sell products on the market. A yearly fee is paid by the traders to delegates in Bata and the districts from which they source the bushmeat (around 5000CFA yearly plus a daily cost of 300-500CFA), and an extra 5000CFA is taxed for trading bushmeat sourced outside Equatorial Guinea (Gill, 2010, pers. comm.). Adapting the current system of taxation in place could provide policy makers with an important tool for regulating a sustainable bushmeat trade in Equatorial Guinea.

2. Improved marketing and sourcing of frozen and non-animal protein (Adapted from Fernandez-Secades, 2009)

It has been suggested that providing alternative protein sources such as plant-based proteins and imported frozen food at a cost lower than bushmeat could reduce hunting rates (Bowen-Jones et al., 2002). Imported frozen goods are widely available in Bata and other towns across the country at substantially lower prices than fresh foods, and they are the most consumed food types (East et al., 2005). However, when asked, Equatoguineans tend to prefer fresh meat and fish, with fish rated highest in the continental capital city of Bata and in the village of Sendje, in the same province (Kümpel, 2006; East et al., 2005). Reasons for eating bushmeat can be divided into two categories: the rural poor often consume it because it is an affordable and an easily available protein source, whereas in urban areas bushmeat is often considered a luxury item, with people willing to pay a higher price for it (Schenck et al., 2006; East, 2003).

If an alternative is to be successful, consumers are a key group to address and their cultural preference needs to be recognised and taken into consideration (Rusthon et al., 2005). Tradition, education and habit all affect this process, and preferences are not necessarily fixed (Kümpel, 2006). For example, in Gabon, many older people who have migrated from rural areas to Libreville still buy bushmeat if and when they can afford it, because it reminds them of life in the village, but younger, second generation urbanites, who were not brought up on bushmeat, are more likely to spurn it in favour of 'modern' domestic alternatives (Starkey, 2004), and these same findings were also voiced at a recent national workshop held in Equatorial Guinea (D.Gill, 2011, pers.comm.). Two of the major ethnic groups in Equatorial Guinea (the Fang and the Bubi, the latter predominately on Bioko island) show different consumption patterns and preferences (Fa et al., 2002), as do Equatoguineans compared to other nationalities, with availability the main determinant of preferences for individual bushmeat species once cost was no longer a factor (East et al., 2005). There is therefore a need to address specific group characteristics and their particular circumstances.

Social marketing, education and appealing to religious paradigms are the most common approaches suggested for the promotion of alternative food sources (Rose, 2001; Milner-Gulland, 2001). International and local food manufacturers might play an important role in stimulating and converting the purchasing power of people into effective demand for specific products. It is however difficult to find case studies addressing this issue, particularly in Africa. Southern Asia, especially India, could be a useful region from which to extrapolate a baseline model for Africa. Rural markets in India show large similarities with West-Central African ones. They are defined by a growing population with an increasing purchasing capacity, coupled with a low standard of living (with a majority of income from agriculture and hunting) and a lack of infrastructure. Some well-known international companies have developed new marketing methods to enter the rural market in India. Changes had to be developed to meet 'the four A's' criteria: acceptability, affordability, availability and awareness of the product (Vikram, 2010).

Some NGOs have also been known to use private sector marketing techniques to sell social change to local communities. An example of this is Rare's 'Pride Campaign' programme, which aims to train local leaders to change the way their communities relate to nature through introducing alternatives to usual behaviour. The tactics used during these campaigns include audience segmentation, focus group testing of highly targeted messages, use of multiple media vehicle outlets to reinforce messages over a sustained period of time, and measurement of product adoption. Rare does not directly implement the campaigns, but trains local organisations with a better understanding of local culture and norms in methods leading to social and behavioural change. This bottom-up approach has been used by Rare to promote species conservation in China (Rare, 2010; Box 1).

BOX 1: Innovative project - Campaign for species preservation in Hunchun Nature Reserve, China

This campaign from Rare and the Wildlife Conservation Society (WCS) aimed to protect the Siberian Tigers living in the reserve. The campaign targeted community members to stop hunting wild game, the tiger's primary food source, which is the greatest threat to the species survival.

The three main audiences targeted were: local villagers (enlisted through the campaign to form voluntary patrols to remove snares), government officials (after public appeals to stop consuming illegally hunted game) and restaurant owners serving illegal game.

The campaign progressed through different initiatives. Firstly, it conducted demonstration projects to introduce new sustainable businesses, such as beekeeping and cattle production, in order to offer an alternative meat source and supplement income lost by farmers who stop hunting and selling bushmeat. Secondly, it recruited more volunteer patrol teams and finally, it launched marketing material targeting local restaurants and consumers to persuade them to reduce their consumption of illegally hunted meat.

(<http://www.rareconservation.org/article/hunchun-nature-reserve-china>)

Following the same strategy, some countries (supported by NGOs) have developed national campaigns to raise public awareness regarding the bushmeat trade: particularly well known are the cases of Ghana (Conservation International; see Box 2) and Liberia (Zoological Society of Philadelphia). Their campaigns created different posters, booklets and other information materials in English and various major local languages, aimed at different target groups. Broad media coverage was a key point, with the most cost-effective medium being radio (Conservation International, 2004). Traditional beliefs were appealed to within the campaign. In Ghana, leaders from the ten major regions were persuaded to stand against the trade of certain sacred totem species amongst rural communities. In cities, where the educational level is higher, school groups and individuals were addressed by cultural performances and academic talks (Conservation International, 2004).

BOX 2: Lessons learned from the field - Increasing public awareness of the threat of the bushmeat trade to wildlife in the Upper Guinean forest.

This project was carried out by Conservation International (CI) in Ghana from January 2001 to April 2004, and the final project completion report deems it successful in increasing public awareness of the crisis created by the bushmeat trade for biodiversity conservation in the country. The project established a National Stakeholder Taskforce, which mobilised communities, NGOs, government officials and development organisations that adopted the Bushmeat Extinction Declaration, and encouraged the government to enforce existing regulations. The launch of a national media campaign alerted the public to the health

implications of consuming bushmeat caught with pesticides, which resulted in the closing down of 85% of all the bushmeat road markets from Accra to Cape Coast and Kumasi.

An unwanted impact from the project was the increase in crop raiding around several of the protected areas in Ghana, which have been attributed to the rise in wildlife populations resulting from the bushmeat campaign, leading to food insecurity and increased poverty. CI thus worked on a project with the Wildlife Division and the FAO to develop deterrents to crop raiding.

Lessons learned through this project were the value of collaboration as the National Stakeholders Taskforce allowed the project to tackle the controversial issue of bushmeat hunting in relation to other issues such as food security, human health, education, etc; and the usefulness of engaging the education system which allowed impacts to be maintained after the end of the project.

(*Conservation International, 2004*)

Marketing campaigns such as those described in Box 1 and Box 2 could be used in Equatorial Guinea to promote the demand for alternative proteins alongside targeted awareness-raising of the consequences of purchasing threatened or flagship bushmeat species. Marketing and outreach material would have to be published in Spanish, and through oratory means in Fang, Kombé and Bubi, the languages spoken by the main tribes. It also would have to be adapted to each tribes hunting and food preferences, while ensuring that no local taboos are broken in the process. However, such campaigns will ultimately only be successful when the adoption of these alternatives proteins provides tangible benefits to the producers and consumers targeted. When successful campaigns lead to a reduction in bushmeat hunting, the resultant impacts of increased crop raiding on the verge of protected areas, particularly, in the case of Equatorial Guinea, from elephants, (H.Ruffler 2011, pers. comm.), should be monitored and mechanisms to either reduce human-animal conflict levels or compensate the communities affected should be considered.

3. Production of fresh fish

(adapted from Le Courtois, 2009 and Ghoddousi, 2009)

In Equatorial Guinea the top five most preferred foods in the city of Bata and village of Sendje in the continental region were found to be fresh fish or bushmeat species, with red snapper (*Lutjanus campechanus*) the most preferred food. Conversely, the top five most consumed foods were all frozen, with frozen mackerel (*Scomberomorus spp.*) scoring most frequently (Kümpel et al., 2005). However, fisheries sectors in Equatorial Guinea are highly underdeveloped and most of the fish consumed in Equatorial Guinea is imported (FAO, 2003; Kümpel, 2006). The following section evaluates the opportunities for developing aquaculture and fishery projects in Equatorial Guinea, as an alternative to bushmeat hunting.

- **Aquaculture**

In Equatorial Guinea, there is insufficient information describing the hydrological and biophysical status of the country from an aquaculture development point of view (FAO, 2011b). Mariculture projects are inexistent and freshwater aquaculture is limited to some micro-scale projects (FAO, 2009). The President's first lady and another private operator have been running aquaculture projects in the Mongomo area since 2006, although their success needs to be verified (D.Gill 2011, Pers. Comm.). Common

issues that limit the development of the aquaculture sector are the requirements for high levels of expertise (training, veterinary and technical support) and the level of investment needed, which is only affordable for major donors, governments or foreign companies (for large and medium-sized projects). Taking these limitations into account, this research will focus on the development of small- or micro-scale freshwater pond aquaculture.

In Africa, aquaculture is estimated as being 95% small-scale, with fishponds integrated into the mosaic of agricultural activities. Mean yield is approximated as 500kg/ha/yr, although the range is wide (Machena & Moehl, 2001). The main species farmed are tilapia (*Oreochromis niloticus*) and African clarias catfish (*Ciarias gariepinus*) (Machena & Moehl, 2001). Most farmers have polyculture tilapia in association with catfish and/or kanga (*Heterotis niloticus*) (Brummett et al., 2004). The fertiliser used is livestock manure, which is occasionally supplemented with composted agricultural waste. This has led NGOs to create projects combining aquaculture and livestock breeding (see Box 3 and 4). Feeds are generally supplementary (high energy, low protein) and include various combinations of brewery waste, wheat or rice bran, palm nut meal and cottonseed meal (Brummett et al., 2004).

BOX 3: Innovative project - Combining aquaculture and rabbit breeding

The Akazi Kanoze project seeks to combine aquaculture and rabbit breeding to offer a more balanced livelihood alternative to 58 people in the Gasabo district of Kigali, Rwanda.

The project started with US\$500, 30kg of Tilapia and North African catfish fish eggs given by the Ministry of Agriculture (MINAGRI) and 10 rabbits. The pond was already present and adjacent to a small stream, an underground pipeline was installed to channel water from the stream in order to increase oxygen levels in the pond. A natural drainage point was constructed to maintain balanced water levels. The pond was drained and cleaned, and gravel and sand was added at the bottom of the pond to avoid bacteria and manure from building up. Suspended wire bottom cages were constructed to accommodate rabbits and allow the manure to drop straight from the cages into the pond to feed the fish. This combination is useful as rabbits are fast breeders (females start breeding at 6-7months, give birth after a month and can produce 6-9kits per birth) so income generating can start in a short period of time by selling mature rabbits.

(<http://appropriateprojects.com/node/409>)

In practice, however, even small- or micro-scale aquaculture projects are very labour-intensive, time-consuming, require considerable financing and capacity building and bear a risk of releasing invasive species into the environment (Kümpel, 2006). Fish growth is often stunted due to lack of oxygen and incorrect pond management (RIPPLE Africa, pers. comm.; Corey, Vandenbor & Brummett, 2010). Growth stunting also occurs when fingerlings are obtained from other fish farmers or from surplus stock obtained as a result of excess reproduction from grow-out ponds, a practice commonly undertaken in Africa. In order to obtain this surplus, male and female fish are often raised in the same ponds, instead of in separation, meaning their energy is spent breeding rather than growing (Brummett et al., 2004; Vandenbor, 2010 pers. comm.). To ensure single-sex fishponds (males are usually preferred), fingerlings need to be produced in hatcheries, which are expensive to build. In order to be viable grow-out sites should contain at least 10 hatcheries (Corey & Vandenbor, 2010 pers. comm.). More generally, the limited availability of high quality fingerlings and feeds has been identified as one of the factors constraining further development of aquaculture in Cameroon (Pouomogne, 2008). This is also the case in Equatorial Guinea where little

hatchery infrastructure exists. The development of small- and micro-scale aquaculture in Africa appears to be extremely challenging and in most cases it has not been recommended (RIPPLE Africa, Box 4; Corey, Vandenbor & Brummett, 2010).

BOX 4: Lessons learned from the field – RIPPLE Africa aquaculture project in Malawi

This project sponsored the development of 8 integrated fishponds managed by the local community, in order to improve food security. Four fishponds were managed by men and four by women, with the two groups in competition with each other to make the most money.

Each pond measured 20mx20mx1-1.5m deep and operated on an integrated basis, including goats, ducks and chicken as the means to provide manure to fertilise the plankton on which the fish fed. Banana and other fruit trees were planted to provide shade whilst Katope, chivumu and mlewezi trees, renowned for their ability to retain soil water and regulate water levels in the pond were also planted as fence lines. Vegetables were grown in the area irrigated by the water outlets from the ponds.

The total funding for this project was £6,000 for the 8 integrated ponds, with £1,600 for construction costs, £900 for equipment and stores, £300 for livestock shelters, £250 for livestock, £750 for initial fish stocking, £900 for fish feed, £100 for chicken feed and £1,200 for the salary of a manager/watchman for the year. Based on an assessment of the demand and potential future prices of fish that can be sold, the aim was for the project to be sustainable within two years.

However, this aim was not achieved, due to low fish production and stunted fish growth due to low oxygen levels. Small fish earned low revenues and as a result the project never became self-sustainable and was abandoned after three years. Issues included high levels of evaporation and a lack of effective drainage. Furthermore, snakes and other predators took some of the fish and livestock. RIPPLE Africa does not recommend investment in similar projects, as they incur high start-up costs and are not sustainable.

(www.rippleafrica.org, and pers. comm.)

Furthermore, aquaculture is commonly associated with ecological problems, such as habitat loss, release of particulate and chemical wastes, diseases transmission into to the wild, release of antibiotics resulting in the emergence of resistant bacteria and genetic impacts on wild populations if farmed stock is accidentally released (Davenport et al., 2003). As tilapia and African clarias catfish are non-indigenous species, this leads to the added concern that they might displace indigenous species if released in the wild, especially as they are extremely resilient and are invasive in other areas (Lever, 1996). Furthermore, low buying power in rural communities due to the inability of the fish seller to either store the fish or get it to alternative markets means the commercialisation of fish is extremely difficult (Brummett et al., 2010).

A system of fish production that could contain ecological issues is 'aquaponics' (a combination of a circulating aquaculture system and a hydroponic vegetable production system). Both fish and vegetables are produced efficiently in a closed environment that uses limited resources and prevents the release of contaminants such as waste products, chemicals or invasive fish species to the ecosystem. The water and waste products issued from the fish tanks are diverted to irrigate and fertilise connected plant beds that in turn filter and purify the water to be returned to the fish tanks. Using aquaponics to farm low trophic feeders such as tilapia would limit the need to purchase feeds and thus reduce expenditure, while growing plants with a market value would increase financial gains. However, aquaponics requires a high initial capital investment, depend on a constant supply of water and electricity and the system may take considerable time to reach an equilibrium state (for example, the

Leka Gape Organisation aquaponics project in South Africa was not in balance after two years of production) (Ruffler, 2007).

The production of ornamental fish for international trade can also provide an alternative source of income for local communities. Globally, the ornamental fish trade is worth US\$1.8million per ton compared to US\$2,700 per ton for food fish (FAO, 2000), whilst retail prices (up to US\$50 per freight on board) vastly outstrip wholesale prices at their port of departure (US\$0.50 to US\$3.00) (Brummett et al., 2005). Potential ornamental fish species are abundant in the Lower Guinean rainforest and have been exploited for international trade in Cameroon (see Box 5). Small-scale initiatives which capture and rear these fishes may indeed be more feasible than large commercial breeding programmes as these species do not reach sexual maturity outside of their complex rainforest ecosystem (Brummett, 2005).

BOX 5: Innovative project – Sustainable ornamental fish exploitation in the Cameroonian rainforest

This project was set-up in 2002 by the WorldFish Center and OPED, a local NGO in the Kribi area. The aim of the project was to reorganize and revitalize the Cameroonian ornamental fish industry through: adapting the best capture and holding practices to local materials and environments in order to improve survival rates, assisting local fishers to organize themselves and negotiate better prices from buyers, and developing a sustainable management plan for the rainforest rivers where most fish are collected.

In the target area, 63 villages with a population of 7,200 are involved in or affected by ornamental fishing, although four villages each with around 25 fishers were specifically targeted by the project. Typically in each village one or two representatives coordinate the fishing and serve as a contact point for the buyers, whilst access to the sites and the prohibited use of certain fish, catching methods and the collection of fish eggs during spawning season is regulated by village leaders. The majority of the fishers are children between 9 and 14 who receive compensation in the form of food, shelter, school fees and health care.

The project provided training courses in gentle fish handling, diet, transport and handling. Holding stations for the fish were constructed in each river basin, in order to reduce transport-induced fish mortality, and to encourage natural reproduction. A project office was established with aquariums to display and hold the fishes prior to shipment. This allowed buyers to order and collect fish in one instance.

Previously, isolated fishers had negotiated individual deals with various buyers resulting in low prices (average US\$0.10 per fish). Fishers were organized into a collective (GICA) which was legalized in 2006 granting them with collective bargaining power. All orders are now channeled through GICA according to a pricing schedule agreed by the members. Moreover, GICA established a community development fund that channels a percentage of earnings to village projects.

However, the price rise associated with GICA resulted in a reduction of local buyers, whilst overseas orders required more species than were available in Kribi. Although, a public-private partnership was negotiated with a local entrepreneur, the existing number of shipments (10 boxes per month) is far below the level of export required for the project to be profitable (a minimum of three shipments of 10 boxes per month). The establishment of a local market for ornamental fishes would allow higher margins. The success of the collective was also hampered by non-GICA members selling fish to market at a lower price.

(Brummett et al., 2005)

Suitable ornamental fish species will likely be present within parts of the Lower Guinean forests that stretch into Equatorial Guinea. Local presence will be determined by stream width, depth, current velocity and substrate type. Typically, the tributaries from which most ornamental fish are extracted are <5m wide, <50cm deep, with a

current velocity rarely exceeding 0.5m/sec, 25-100% canopy cover and a substrate of leaf-covered sand or gravel (Brummett et al., 2005). The management of a sustainable ornamental fish harvest would require baseline studies in order to determine quotas and adequate holding facilities would have to be built. Moreover, as no ornamental fish market exists in Equatorial Guinea, fishes would have to be exported, and while production could be linked with the Cameroonian market; it is likely that current demand levels are insufficient to make this financially sustainable.

- **Fisheries**

The fishing sector is vastly under-developed in Equatorial Guinea, mainly because of a collapse of the industry in the 1970's due to political unrest (Allebone-Webb, 2009). It has had competition from the EU which has historically fished off the coast of West Africa through agreements, and subsequently resulted in the depletion of higher value fish species in the Gulf of Guinea (Watson and Brashares, 2004; Atta-Mills et al., 2004). Recently, the 1984 bilateral treaty granting the EU fishing access to the EEZ (Exclusive Economic Zone) of Equatorial Guinea was ended and new Fishing Licence Agreements are in place; however these have not been accompanied by a decrease in fishing pressure due (Bene, 2008). Equatorial Guinea, as well as other countries in the region, exports a large proportion of its catch to the EU and the Far East (Bene, 2008), and imports frozen fish instead (Watson and Brashares, 2004). Fortunately, Equatoguinean waters are still considered to be some of the richest in the world due to the fact that small fish species (such as sardinellas and mackerels), which are not targeted by foreign commercial fleets, are thought to be under-harvested (Watson and Brashares, 2004). However, the actual state of the waters off Equatorial Guinea remains unclear and under-studied. A good understanding of fishing pressure, sustainable rates and the state of fish stocks is greatly needed to avoid overharvesting resources vital for meeting future protein demand.

Production could be increased without actually increasing fishing pressure, by avoiding by-catch and spoilage. Pirate vessels, common in the region, target high-value species yet 70-90% of their catch is by-product which is then dumped back into the sea (FAO, 2002). Furthermore, over 25% of fish destined for consumption in Africa is spoiled before reaching consumers during transportation or handling. Fish is very perishable, and infrastructure is needed to preserve such as cold storage and rapid refrigerated transport (FAO, 2008). It is estimated that if processing was improved, this could cut post-harvest losses by 50% (WorldFish Center, 2009). Preservation methods to reduce fish spoilage can also be more traditional, such as screens to keep off mosquitoes, improved smoking techniques (e.g. Mali: WorldFish Center 2009), elevating the fish while it dries (Uganda: WorldFish Center, 2009) or traditional smoking (Congo: FAO, 2003). It is thus likely that traditional methods would be considered preferable by development organisations for reducing fish spoilage over complex refrigeration routes.

Small-scale fisheries can also be improved through shifting emphasis on artisanal fishing by restricting access, co-management and regional harmonisation:

- Restriction of access: Reserved fishing zones and exclusion of large-scale fleets can favour small-scale fishers, as was the case in Java in the 1980s when the government imposed a trawl ban in the Java Sea fisheries (FAO, 2008). The presence of such zones

requires surveillance and enforcement, but projects in Guinea-Conakry have shown that involvement of local fishers in surveillance, using radios to warn patrol boats of the presence of illegal fishers, can be very effective (Cotula et al., 2002; FAO, 2003).

- Decentralised management in the form of local organisations or committees has been identified as a key element in the success of small-scale fisheries. Instead of concepts coming from experts and consultants, problems and solutions can be identified by the people themselves, increasing their stake in the success of the project (FAO 2003; Cotula et al. 2002). In Congo, lobby groups were created during the FAO Sustainable Fisheries Livelihoods programme. Not only do those organisations give weight to the fishmongers and power to negotiate with their governments, they also give them an identity and a structure for investments such as the purchase of ovens or bulk-buying salt (FAO, 2003).

- Regional harmonisation: Fishing occurs across national boundaries, and so coordination between countries is needed. For example, it has been shown that Nigerian fishers in Gabon will occasionally fish in Equatoguinean waters (Westlund et al., 2008). In 1984 the COREP (Regional Fisheries Committee for the Gulf of Guinea) was created and a Code of Conduct for responsible fishing was voted unanimously at the 1995 FAO conference. COREP aims to harmonise regulations and attitudes to fishing in member countries. However, Equatorial Guinea is not a signatory state (only four countries in the region are members) and COREP is yet to come into force (FAO, 2009b). In addition, the need for coordination will have to go hand in hand with improving institutional capacities, which are currently very weak (FAO, 2008).

The outcomes of this research are that the development of small- and micro-scale aquaculture or ornamental fish production in Equatorial Guinea is currently not recommended. Medium and large-scale aquaculture seems to be the most successful in Africa along with the promotion of artisanal fisheries (Vandenbor & Brummett, 2010 pers. comm.; Pouomogne & Pemsil, 2008). The potential for the expansion of the aquaculture sector at this scale in Equatorial Guinea is considerable, but requires several enabling factors: a positive perception of aquaculture; sound policies at the national level; strong public institutions; access to market; availability of nutrient and fingerling inputs; conducive investment policies to attract increased private-sector participation; and access to credit for commercial-scale enterprises (such as low-interest loan schemes). High priority sites should be identified and environmental impact assessments should be carried out. With thorough training and participatory field trials, recent and prospective fish farmers could learn current, practical techniques for aquaculture (Smith, 2007).

4. Production of fresh domestic meat

(adapted from Swart, 2009)

Livestock rearing could decrease the harvest of bushmeat by replacing it with domestic meat as a protein source (Robinson & Bennett, 2000; Loibooki et al., 2002), as well as creating an alternative livelihood and a source of income. This has been demonstrated in communities in Tanzania where a positive relationship between small

stock ownership, such as goats and sheep, and reduced bushmeat hunting exists (Loibooki et al., 2002).

Africa has gone from being a net exporter in the 1970s to a net importer of beef, and Central Africa has also experienced a decline in beef productivity over this period (Tambi and Maina, 2003). Livestock production is currently low in Equatorial Guinea (Kümpel, pers. comm.). However, during the colonial period, Equatorial Guinea had an established livestock system, which suggests that biological factors alone are not a barrier to livestock farming. Indeed, before independence, Bioko island produced sufficient quantities of domestic meat (100,000 kg/yr) to be self-sufficient in beef and other dairy products (Fa, 2000). Livestock rearing declined severely in the 1970s due to political factors. In 1983 a FAO mission visited Equatorial Guinea with plans to develop cattle and goat production (FAO, 1983); but this project never obtained funding. The government has since attempted to expand the livestock industry in Equatorial Guinea by passing agricultural reforms in 1990, but this has had little influence (East, 2003), leaving goats, sheep, pigs and poultry to be reared in 'backyard' systems in Bata with no fixed livestock management (Kümpel, 2006). The DABAC project (*Développement d'Alternatives au Braconnage en Afrique Centrale*), financed by the European Development Fund, has tried to stimulate the rearing of domestic animals for meat production in areas where hunting is common. They concentrated on species with a short production cycle (DABAC, 2003). For the purpose of this study, the rearing of poultry and cattle was researched as livelihood alternatives to bushmeat hunting.

- **Poultry**

Poultry is by far the most popular livestock reared in Equatorial Guinea (Allebone-Webb, 2009; Keylock, 2002), and generally in Africa where it is particularly common amongst poorer families (CTA, 2004).

There are two main ways of rearing poultry. The first comprises 'free range', backyard systems where birds scavenge for food during the day and are usually housed at night. More than 80% of Africa's poultry population is raised in backyard systems (Guèye, 2000). The second is 'intensive rearing' which involves keeping livestock in specially built houses with controlled supplies of feed and water. Feed is the biggest input cost for commercial poultry production, ranging from 60 to 80% of total costs. Coupled with labour and housing costs, only higher income-earning families would have access to this method of livestock rearing, as small-holders could simply not afford the start up and maintenance costs (Fa & Brown, 2009).

Poultry management requires the producer to manage disease and predators. Disease outbreaks can cause large losses of poultry. In Tanzania, 43% of chicken mortality is the result of disease (Mwalusanya et al., 2000). The most common diseases include Newcastle disease, which kills 70-80% of unvaccinated village chickens/year in developing countries (CTA, 2004), as well as, fowl typhoid, fowl pox, fowl cholera, helminthoses and ectoparasites. Chickens, most vulnerable throughout the first ten weeks life, face mortality rates of 40% at this age as a direct result of disease and predation (Mwalusanva et al., 2000). Therefore, it is important to monitor and prevent disease outbreaks and vaccines should be routinely administered (FAO, 1992). Unfortunately, currently 35-79% of resource-poor poultry farmers in Africa rely on ethno-veterinary medicine, which is ineffective, and education is vital to address this (Guèye, 2000). Vaccination campaigns for village chickens have proven difficult

and expensive to organise not only because of the practice of traditional medicine but because poultry owners are widely distributed and often hard to reach (CTA, 2004). Furthermore, the productivity of small-scale poultry farming could be improved by predator control. This could be achieved through improved housing, e.g. raising coops and shelters above ground (CTA, 2004). In intensive production systems applying the 'all in, all out' system, whereby the whole flock is sold and the poultry house cleaned and disinfected before a new flock is introduced, could contribute significantly to productivity (CTA, 2004).

- **Cattle and goats**

Cattle are kept for meat, milk, ploughing, pulling carts or as a sign of wealth. The lack of cattle husbandry in Equatorial Guinea is attributed to the presence of tsetse flies (Kümpel, 2006), which infects 50 million cattle each year in Africa (Teale, 2003). Resistant strains of cattle have however been developed, such as dwarf cattle, which were once farmed in Equatorial Guinea and therefore could be investigated for possible reintroduction. They were imported from Nigeria and Cameroon between 1949 and 1955, but not allowed in low-lying areas to prevent the spread of sleeping-sickness. Dwarf livestock is generally tailored to small and landless farmers' capabilities (Branckaert, 1995). However, cattle rearing in the tropics (especially on a large scale), is environmentally problematic as it encourages the destruction of forests (Fa, 2000). The challenges of rearing cattle apply largely to sheep and goats too. However, in Equatorial Guinea, there is the belief that goats are more resistant (Gill, 2010 pers. comm.). Goat rearing projects have successfully been established in rural communities before, as demonstrated by FARM-Africa (see Box 6).

BOX 6: Lessons learned from the field – FARM-Africa dairy goat project in Ethiopia

The dairy goat development project was launched in 1988 with the aim to improve family welfare through generating increased income and milk production. This was done by improving the productivity of local goats managed by women, through a combination of better management techniques and genetic improvements. The project targeted communities where women traditionally kept small livestock, encouraged them to improve feeding and donated two goats to women that the community had identified as being the poorest. It provided veterinary support and essential equipment.

The project resulted in improvement in family welfare and in the creation of local women's groups to manage goat credit and establish joint saving schemes. Some goat loans were repaid in kind which broadened the impact and appeal of the project within the community. Generally, households involved managed to get steady annual income from goat sales. The high success of the project is attributed to the high level of community participation in the design and implementation of the project. In parallel to the project a small-scale backyard poultry programme was set up.

(Ayele and Peacock, 2003)

Livestock rearing is commonly challenging to introduce due to the high start up costs and the lack of extension services (e.g. vets, vaccines) which have traditionally excluded rural smallholders (Allebone-Webb, 2009; Brown & Williams, 2003; ODI, 2004). It appears that free-range poultry rearing could be most cost-effective for small farmers but is unlikely to meet the demand for meat (Guèye, 2000), nor provide significant income for rural farmers in Equatorial Guinea who generally prefer to retain poultry for traditional ceremonies rather than sell it to market. Furthermore, domestic meat currently scores low in terms of preference compared to bushmeat and fish

(Kümpel et al., 2007; Davies & Brown, 2007). However, limited exposure to domestic meat does not allow taste to develop, so increased consumer access to domestic meat could create familiarity, which could in turn increase demand (Milner-Gulland et al., 2003; East et al., 2005). High livestock meat price is one of the factors shown to reduce its popularity. Thus rearing domestic livestock is currently only appealing in areas where wildlife has been depleted and where there is no cheaper alternative (Kümpel, 2006). Alternatively, reducing the price of livestock meat could be done by improved management, which would increase productivity, coupled with decreased running costs and price/profit margins (Milner-Gulland et al., 2003). Intensive poultry farming represents an excellent option in this regard. However, for any progress to be made on a significant scale and to ensure a constant livestock meat supply, technical policies must be defined by the government. Livestock development programmes should combine breeding, pasture development, use of non-conventional animals, veterinary programmes, improved farming systems, transport and economic policies, financial production incentives and marketing structure (SWAC-OECD/ECOWAS 2008). From a social perspective, livestock husbandry should be promoted as it can distribute wealth to women (SWAC-OECD/ECOWAS, 2008), who are often viewed as second-class citizens in Equatorial Guinea (AEO, 2009), although involvement of men – particularly young male hunters who have greatest impact on wildlife (Kümpel et al., 2009) - would be necessary to reduce hunting pressure.

5. Bushmeat rearing/farming

(adapted from Tiller 2009)

Different species of wild animals have been reared (or attempted to be reared) in parts of West and Central Africa. Candidate species for farming must breed quickly and be culturally acceptable. Rearing wild species may seem a better strategy than raising domestic livestock as they are already adapted to local diseases and consumers may have taste preferences for some of them (although they may not adapt so quickly to captivity). Nonetheless, investing in micro-ranches for bushmeat rearing is more expensive than setting snares, which will often be favoured by local communities. To address this issue, animals and training have to be provided at low or no cost to participants (BCTF, 2009). For the purpose of this study, the rearing of snails, grasscutters, duikers and brush-tailed porcupines has been researched.

- **Snails (*Archachatina marginata*)**

The consumption of snails has been growing in popularity (Etchu & Mbonteh, 2006) and as a result has increasingly contributed to household nutrition (Hardouin et al., 2003). This has prompted interest from conservation and development organisations in snail farming as a means of generating income for individuals. A study carried out by Kalmbach et al. (2009) looked into the feasibility of snail farming in Mount Cameroon, and found it to be a suitable source of income. Snail farming is simpler and cheaper (due to low veterinarian fees and maintenance costs) than livestock rearing, as the materials needed to sustain the farm are minimal, locally available and free. However, the returns will be determined by snail reproduction and growth rate, and Annex 2 shows that it may take around 10 years to recover the initial investment.

The results from Kalmbach et al. (2009) highlight that snail farming only generate adequate income when production is carried out at large-scale levels, whilst, there is evidence that small-scale snail farming projects are encountering issues (see Box 7). Reports from Cameroon show that some households depend on snails as a major source of income, making as much as US\$100/day from their harvest. However, this seems to be dependent on a market for snails being already developed in Cameroon and neighbouring Nigeria where they are considered a delicacy (CREE, 2010).

BOX 7: Lessons learned from the field - CREE snail farming project in Mount Cameroon

This was a very small project, which started with less than US\$1000 and 5 households. The village is situated in an area where there is a large demand for snails as they are exported to Nigeria and Equatorial Guinea. Each participating household had an individual pen, as shared pens are normally not cared for. The households contributed material and labour worth about 20% or less of the total cost. They were also in charge of feeding the snails and taking care of the pens. The cost of the pens for a household was US\$40 (including material and snails).

The first phase of the project, in 2009, did not yield any tangible positive results. The snails were sold for a very negligible amount and a lot of them died due to the dry season (as the village didn't have water access), ant attacks and to the fact that people didn't take the project seriously (the selection of village was possibly an issue as they were dubbed the 'lazy people'). This led to evaluation meetings with households to assess what went wrong and regular monitoring of the project was established. The project is ongoing and aims to produce enough snails to invite buyers to the village (rather than having to go to the main market).

(Asaha, Project Manager, pers. comm., 2010)

Provided there is long-term commitment, careful project design and adequate financial support, it appears snail farming could potentially be successful in Equatorial Guinea. It could be an industry providing a high source of protein for both rural and urban households with negligible input. However, demand for snails needs to be ascertained as they don't make up a significant proportion of the bushmeat market and did not feature in consumer preference lists (East et al., 2005; Kümpel 2006).

- **Grasscutter** (*Thryonomys swinderianus*)

In West and Central Africa, grasscutter (or cane rat) meat is highly desirable and preferred over domestic meat in many places (Baptist & Mensah, 1986). Grasscutter meat is an expensive dish in restaurants in urban areas; in Gabon for example, it is 3-4 times more expensive than beef (Steel, 1994). It is also accepted as a better source of protein (22% compared to 20% for chicken) (Jori et al., 1995; Hoffman, 2008).

The 'Projet Promotion de l'Élevage d'Aulacodes' (PPEA), which was set up in Benin and supported by GTZ, carried out initial intensive research into grasscutter production in 1983. In 1994, animals were placed in pilot farms. The pilot farmers underwent training and gradually became advisers who trained other farmers – leading to an increase in the number of farms. From 1994-2000 VSF (*Vétérinaires Sans Frontières*) was also responsible for a bushmeat rearing trial project in Gabon, where grasscutters proved to be the most successful species (see Box 8).

BOX 8: Lessons learned from the field – VSF 'Élevage de petit gibier' (grasscutter) project in Gabon

The project focused on grasscutter farming at small and medium scale in urban and peri-urban areas where wildlife is scarce, prices for bushmeat are higher and transport costs are limited. The farmers contributed to the project by building the rearing facilities themselves, while the project contributed the animals.

No negative environmental and social problems were identified. One issue that can arise is finding breeds of grasscutters adapted to captivity, as in such settings, wild-captured animals face high levels of mortality. The project thus chose to import animals that were already raised in captivity from other areas such as Cameroon or Benin.

This project model can be replicated anywhere with a good market access (i.e. peri-urban areas). Although Gabon has not had the greatest success compared to other countries in terms of grasscutter farming, as people were not inclined to take on agricultural work, it is worth noting that the best farmers on the project were from Equatorial Guinea and were very talented in animal husbandry. In rural areas, hunting management of wild grasscutters shows more promise than farming as they are abundant, and their capture reduces predation on and damage to food crops.

(Jori 2010, Project Manager, pers. comm.)

The DABAC project has been active for the last 10 years in Gabon, Cameroon and Congo, and aims to farm bushmeat in order to satisfy demand. The results of this project show that grasscutters are the most convenient bushmeat species to farm. This project however further demonstrates that rearing bushmeat is not viable close to hunting zones as sale price is low and farming is more time consuming than hunting; furthermore grasscutters are too common in rural areas for hunters to be motivated to farm them (DABAC, 2003).

Grasscutter rearing could potentially be introduced in Equatorial Guinea as initial research carried out in countries such as Ghana, Benin and Nigeria, has demonstrated an increasing demand for grasscutter meat (Annex 3.), although all of these countries have support from programmes such as GTZ, Action Aid, FAO and Heifer International (Archer et al., 2003). A grasscutter rearing project was instigated in Equatorial Guinea under the ECOFAC project in the 1990s but failed due to a lack of funds, local interest and technical support (Bizzarri, pers. comm.). Cane rat farming in rural conditions seems to be technically feasible and best practice is described in a number of publications on the subject coming from different countries has increasing recently (Jori & Chardonnet, 2002). Indeed, reproduction is sufficiently understood to allow the reproductive success of 95% of mated females (Edderai & Houben, 2001) and animals achieve commercial weight at 3.5kg, between 8 and 12 months (Edderai & Ntsame Nguema, 2000). If start-up assistance is given, poor households can also enter into grasscutter farming. Examples of start-up costs are 235 Euros in Benin (75 Euros for a four-animal breeding group, 60 Euros for three weeks training and 100 Euros for the cages) and 500 Euros in Ghana. However, costs can be reduced with the use of local materials (Nill & Bohnert, 2006).

A World Bank study showed that small-scale grasscutter farming with a yearly stock of 260 animals (40 reproductive females) was the most profitable system, and several authors in different African countries seem to agree that it is the most profitable scale of production for that species (Fantodji & Mensah, 2000; Dabogrogo, 2000). In Gabon, a farm of this size could reach a profitability threshold of between US\$350 and US\$400/year with the sale of 14 to 20 animals for meat at US\$5/kg. It is said that in Benin “one grasscutter sold is enough to buy food for a week”, and a report by Niesen (2004) found that there is a domestic return of 20-40% on animals for slaughter with prices around 3 Euros/kg live weight. Thus grasscutter rearing could provide a viable source of income.

Previous experiences indicate that difficulties in promoting grasscutter farming are social rather than technical: the level of success and technical appropriation varies

according to the individual and the farming tradition of the country. If carried out, such projects could have an impact on female employment as, for example, in 2002 women made up 20% of livestock owners in Ghana and 12% in Benin (Nill & Bohnert, 2006).

- **Other species**

Duikers (*Cephalophus spp.*) account for a large percent (up to 70%) of the bushmeat trade in West/Central (Auzel & Wilkie, 2000). Duikers are easily hunted and have a substantial quantity of meat on them making them highly profitable. There has been limited research conducted to investigate the potential of duiker farming in Central and West Africa. However, it appears that although experiments at the Chipangali Duiker Research and Breeding Centre in Zimbabwe show that the common, blue, Maxwell's and yellow-backed duikers can be successfully bred in captivity (Mainka & Trivedi, 2002), duikers are difficult to raise due to their aggressive and nervous tendencies, low reproductive rate, high quality food demand and high practical costs (a maximum of two animals can be kept in the same enclosure) (Hofmann et al., 1999). Without more research, the rearing of duikers remains questionable and does not appear to be a viable option due to the costs involved and the characteristics of the species. Duikers produce on average 1.8 young/female/year, which equates to 6-12kg of meat per year, an amount inferior to that extracted through hunting or from rearing grasscutters.

The **African brush-tailed porcupine** (*Atherurus africanus*) is another popular source of meat that is heavily relied upon in Equatorial Guinea (Fa et al., 1995; Kümpel et al., 2010a). Given the prevalence of this species and its high market value, it appears to be a good candidate for rearing. However, information on the biology of this species is scarce and very few trials have been undertaken so far to investigate its potential in captivity (Jori et al., 1998). Most of the research has been conducted in Gabon, during the VSF project mentioned previously. There, brush-tailed porcupines adapted well to captivity and bred successfully. However, females only tend to produce one offspring per birth and obtaining more than two pregnancies per/year proved difficult (Weir, 1974; Edderaï & Houben, 2000), making it unprofitable. With such low reproductive performance and low success of polygamous groups, the cost of feeding and construction of concrete facilities represents respectively 73% and 10% of total annual costs. The income generated by the farming of nine females with a production turnover of two young/yr compensated for just 24% of production costs (Edderaï & Houben, 2000). This confirms the low capacity of brush-tailed porcupine as a meat-producing animal..

Rearing wildlife as an alternative to bushmeat will not itself eradicate the problem. Fundamentally, the cost of farming wildlife and the level of investment required are far higher in comparison to hunting. The low productivity rates of the species researched indicates that farming could not promote food security (Mockrin et al., 2005), further reducing any incentive to farm. For very poor households, wildlife farming will only be viable when an investment is made in training, animals and materials are provided by an external donor such as, Heifer International (Archer et al., 2003). Further incentive schemes should be installed to ensure buy-in from local people for wildlife rearing projects (Mockrin et al., 2005).

Finally, problems associated with rearing bushmeat species are exacerbated by a lack of research into the biology of many potential species (Jori et al., 1995). Social behaviour, energy requirements, reproductive rates, growth rates, space requirements and nutritional benefits have to be considered for wild species that are reared. Grasscutters are one such species that has been intensively studied farming and the practice has proved successful in Ghana, Benin and Nigeria, although it still needs to be reared on a larger scale to cover the national demand. In Equatorial Guinea, the practice could be complemented by snail rearing which can provide household nutrition and, on a large scale, can be profitable, as shown in Cameroon. If more funding and research are provided, a combination of bushmeat rearing practices could therefore provide an alternative livelihood for local people and help to reduce bushmeat hunting.

6. NTFP production

(adapted from Jamsranjav, 2009)

Non-timber forest products (NTFPs) from the humid forests of Central Africa play an important role in the livelihoods of African households, providing a source of food, medicine, services and income. For poor families, NTFPs are an essential dietary and economic safety net, and can be used to improve household income if they are commercialised (Arnold & Perez, 2001). Bushmeat itself is considered a NTFP, hence, this section will focus on the role of plant-based non-timber forest products (PBNTFPs), beekeeping and butterfly farming, while improved management of hunting is discussed in section 7.

- **PBNTFP**

Harvesting plant-based non-timber forest products (PBNTFPs) is a common activity in Central Africa, and in some cases has been commercialised. The bark of the **African cherry tree** (*Prunus africana*), a tree found in Afromontane forests including Cameroon, Equatorial Guinea, DRC and Madagascar, is a traditional medicine in Africa, used to treat chest pain, malaria and fevers (Cunningham and Mbenkum 1993) and used in Western pharmaceuticals to treat an enlarged prostate. Commercial exploitation started in 1971 and the international over-the-counter retail trade (mainly to Europe and the US) is estimated at US\$220 million or 3,600 tonnes annually (Cunningham et al., 1997). However it is very common for NTFPs to be overexploited and for this to lead to negative environmental impacts if commercial demand is too high.

An example of this is in the Mount Cameroon area, where the Mapanja Prunus Harvesters Union was created by local communities as a benefit-sharing system to manage the harvesting and commercialisation of *Prunus africana* to European markets. Farmers involved with the union received greater development, conservation and financial benefits, causing CIFOR (Centre for International Forestry Research), the World Agroforestry Centre, CARPE (Central African Regional Program for the Environment) and other partners to work jointly to replicate the initiative in other parts of Cameroon (Ndoye, 1997). Following an increase in global demand and concerns about unsustainable extraction, *Prunus africana* was listed under CITES

(Convention on International Trade in Endangered Species) in 1995. Subsequently, in 2000, Plantecam, the largest *Prunus africana* bark exporter in Africa, closed its extraction factory in the Mount Cameroon area, due to complex ecological, social and economic factors, including losing its monopoly when the government licensed other harvesters who did not follow sustainable harvesting guidelines and violated local taboos (Cunningham & Mbenkum, 1993; Fisiy 1994). In addition, an increased demand from Cameroon, due to the 50% devaluation of the Cameroonian Franc, led to a surge in illegal harvesting (Ewusi et al., 1996; Sunderland & Nkefor, 1996).

After Cameroon, Equatorial Guinea is one of the major exporters of *Prunus africana* bark. Since its inclusion in CITES, the Equatoguinean government has attempted to ensure the sustainable exploitation of *Prunus africana* bark and other high value forest products through creating the 1997 Appendix to the 1995 Forestry Law of Equatorial Guinea (*Reglamento de Aplicacion de la Ley Sobre el Uso y Manejo de los Bosques EQG/96/002*), which directly references the sustainable management of commercially exploited NTFPs. However, this has been stalled by the lack of availability of baseline information on the biology of the species, such as abundance and distribution, as well as a lack of knowledge on how to manage and exploit the resource in the wild. There is currently no minimum diameter size for harvest, so the exploitation of young trees (<20cm) is commonplace, and annual export quotas were arbitrarily set at 500 tonnes of bark per annum (in consultation with CITES) without being based on a population inventory. Furthermore, although harvesting permits are issued, no harvesting controls are implemented, similarly to Cameroon (Sunderland & Tanyi Tako, 1999).

Two other PBNTFP species present in Equatorial Guinea have been identified as important (Allebone-Webb, 2009). These are the bush mango, *Irvingia gabonensis* (known locally as 'chocolate'), eaten for its fruit and kernel which is made into a sticky brown sauce for meat/fish dishes, and the African plum, *Dacryodes edulis*, which is cooked and eaten with cassava. Farmers in Cameroon intercrop these species with cocoa and coffee, using them to generate income when market commodity prices are low, and in 1997 the national African plum market was worth US\$7.5 million (Awono et al. 2002), with 75% of the profits going back to farmers (Allebone-Webb, 2009). In Equatorial Guinea these species are widely harvested, but not farmed or traded to any great extent, although the African plum and bush mango trees found in relative abundance around some villages in Río Muni may be a legacy of forgotten Spanish plantations (Allebone-Webb, 2009).

In order to avoid overexploitation issues linked to the unregulated harvesting of wild species, some scientific organisations have opted for the domestication of wild species. This has been the case with **Allanblackia** (*Allanblackia spp.*) a tree whose nuts are used in the food and cosmetic industry (Atangana et al., 2006; see Box 9).

BOX 9: Innovative project – 'Project Novella' Allanblackia domestication initiative in Africa

This initiative from Unilever and the World Agroforestry Center aims to develop a sustainable international supply chain for Allanblackia. The development of this supply chain faced a series of challenges.

Firstly, Allanblackia grows in the wild in dense tropical forests, which caused high transaction costs for the collection of seeds. To remediate this and to avoid over-harvesting of the wild trees, the domestication of Allanblackia trees is being promoted in order to increase production by breeding 'superior trees' with regular fruiting, large fruits and vigorous growth, and through the trees being planted closer to the communities.

Secondly, because this was a new supply chain, intense information provision, communication and education were required in project areas. In order to boost community interest in the project, it aimed to motivate local entrepreneurs to participate actively in the supply chain, setting up businesses around collection, storage and transporting of the nuts to Unilever processing centers. This should encourage more people to participate in the collection of the seeds and bring real income into the communities. The project also chose to target the empowerment of women in order to stabilise family income and thus lead to improved livelihoods.

Thirdly, all partners recognised that pricing was a critical issue to the success of the project. The price/kg fixed by Unilever was not high enough to motivate the collectors. Through open discussions with the partners, it was agreed that the Unilever pricing formula would be re-assessed.

The Novella project started in 2008 in Tanzania and Ghana with 100,000 seedlings with the hope of planting 1 million seedlings in these two countries each year, and expanding activities to Liberia and Nigeria. It has generated enough interest amongst the partners to continue with the project and all partners have renewed their commitment for the next phase with planned activities to improve performance.

(www.allanblackia.info)

Domesticating wild NTFPs in order to reduce environmental impacts and ease the collection burden of communities appears in itself a smart solution, especially if it involves a public-private partnership. Allanblackia is present in the wild in Equatorial Guinea (Artanga et al., 2006; van Rompey, 2003), so creating such partnerships for its exploitation would be possible.

There is certainly potential for improved PBNTFP harvesting in Equatorial Guinea, with the most popular PBNTFPs seeming to be the African plum tree and the bush mango (Allebone-Webb, 2009). Sunderland et al. (1999) reported that bush mango kernels were sold more widely than any other species, with a reported high market value (Ndoye & Ruiz Pérez, 1999). In terms of PBNTFP commercialisation however, there are several pre-requisites that would have to be addressed before promoting the harvest of wild species as an alternative livelihood. Firstly, knowledge of sustainable harvest levels is needed (Stewart, 2003). Unfortunately, the information required, such as growth and reproductive characteristics, and practices that allow reproduction or regeneration, is missing (Clark & Sunderland, 2004). Hence inventories and resource assessments would be needed before promoting further harvest of these species. Secondly, there is a need to ensure that there are no large gaps in price paid between the initial product and the commercialised one as this encourages illegal and unsustainable harvesting (Stewart, 2003), even forcing some species to become locally extinct (Clark & Sunderland, 2004). Finally, harvesting regulations would have to be set to minimise forest degradation and ensure equitable access. This should be coupled with extensive training of harvesters to ensure that they don't damage or kill the plants (Stewart, 2003). Training PBNTFP traders has also been shown to be a successful initiative. For example, in 2000, CIFOR started training traders in Cameroon using information collected during market surveys four years prior. Training included information on market trends, product specialisation, storage and availability of raw material, to help guide the expertise and decision-making process of traders. This information increased the traders' revenues by an average of 55% (CIFOR, 2003).

- **Beekeeping**

Beekeeping is one of the community-based conservation approaches to reduce bushmeat hunting that has been proposed and piloted. Beekeeping appears to be a good income-generating activity for resource-poor people. Furthermore, it is environmentally friendly and sustainable with no outside resources required; and in most African countries there is already a market for honey with an increasing number of export markets being developed (www.apitradeafrica.org). Many small-scale beekeeping projects have been instigated across Africa (see Box 10), some of which have a specific conservation focus (see Box 11).

BOX 10: Lessons learned from the field – RIPPLE Africa beekeeping project in Malawi

This project created small community organisations for beekeeping, providing a loan (with a two-year repayment period) to get them started, after which they would operate a beekeeping business on an ongoing sustainable basis. As well as the provision of a high-energy food source for the communities, the honey also provided an additional source of income. The total funding required for a project of 10 beehives was £300, with £80 for training and £220 for the materials. RIPPLE Africa found this project to be sustainable. (www.rippleafrica.org, and pers. comm.)

BOX 11: Lessons learned from the field – Lebialem Hunters' Beekeeping Initiative (LHBI) in Cameroon

This initiative was launched in Lebialem in south-west Cameroon in November 2007 to investigate the potential of beekeeping as an alternative to bushmeat hunting. The general objectives for the project are (1) to train bushmeat hunters in beekeeping and supply them with the equipment and technical support necessary; (2) to set up a beekeeping association in Lebialem; (3) to implement a conservation education programme; and finally (4) to evaluate the effectiveness of beekeeping as a bushmeat hunting reduction strategy.

The pilot phase of the project trained two hunters in beekeeping. During that time market opportunities for selling honey and beeswax were also explored. The second phase of the project, in 2008-2009, resulted in the training of 139 hunters from seven villages. Staff wages for training came to £1281. Participants were provided with the materials, equipment and instructions necessary to construct a top-bar hive. The hives were manufactured locally to reduce cost; all other construction materials and harvesting equipment was sourced within the communities. A disabled women's group was trained to make the harvesting suits and gloves. Common Initiative Groups (CIGs) were established in each village and start-up packages of equipment were given to each group. The cost of the equipment came to £1598.

It takes 2-3 years for beekeepers to become established, so most of the trainees are not yet receiving significant financial benefits. A positive example however, is that one of the assistant trainers for LHBI, who has 5 colonised hives and is also employed to manage other hives, has made enough income to stop bushmeat hunting. Another benefit is the conservation education that the hunters received in parallel with the training, which connected the external assistance received with primate conservation efforts. All the hunters were required to sign a pledge to reduce their hunting of primates. An indirect benefit was the relationship built between the project team and the hunters, which encouraged them to be open about the levels of bushmeat hunting.

(Wright, 2009)

Presently there is no evidence of beekeeping in Equatorial Guinea; however the successful development of beekeeping industries in neighbouring countries suggests that it has potential. Beekeeping is an inclusive activity with various aspects that can be done by women as well as men, including the management of hives, making of bee-suits and processing of bee products. Common issues encountered by organisations promoting beekeeping include lack of cultural acceptability, the promotion of inappropriate technologies including modern hives if provided without sufficient

training and follow-up support, providing the material for free without ensuring the commitment of the community towards the activity, failing to get the hives occupied and inadequate market development (Apiconsult, 2009 and www.beesfordevelopment.org).

- **Butterfly farming**

There are two types of markets for butterflies, dried specimen dealers and live butterfly exhibits. The latter appears the most promising market as the lifespan of most butterflies does not exceed 2-3 weeks, so these exhibits demand regular shipments. Pupae export packages are highly time-sensitive as they can hatch within a week to 12 days – delays in postage are responsible for a 15% loss in earnings. The price paid per pupae in the European and American market ranges from US\$1.00–3.00 depending on the commonness of the species, and the standard order is between 250 and 300 butterflies. Such an initiative thus has the potential to generate significant income to rural populations (TFCG, 2003). An example of this is the Kipepeo butterfly farming project in Kenya which has had cumulative community earnings of over US\$130,000 from 1994 to 2001, becoming self sustaining from 1999. It has had positive effects on livelihoods and attitudes towards conservation, and is thought to have had no negative effects on wild butterfly populations (Gordon and Ayiemba, 2003). This model has been successfully replicated in Tanzania with the Amani Butterfly Project (See Box 12) and the Zanzibar Butterfly Centre.

BOX 12: Lessons learned from the field – Amani butterfly project in Tanzania

The Amani Butterfly Project is a NGO set up by the Tanzanian Forest Conservation Group (TFCG) that helps 6 villages (400 people) in the East Usambara Mountains to farm and market native butterflies. This project was quickly established due to the low initial infrastructural investment required.

An elected board of 12 volunteers set up project prices, policies and the village development fund. The fund is composed of 10% of the butterfly farmers' earnings and goes towards projects that benefit the community as a whole. Membership is controlled, new members only being allowed to join if there is a need for production, and a licensing fee of US\$1.70 is charged. Farmers receive 70% of the project's sales, the rest covering staff salaries and operating costs. Butterfly farming is a secondary activity for most households involved, but they have still seen a 25% increase in income since the start of the project. After receiving start-up donor funding, the project is now financially sustainable, however it does not have administrative self-sufficiency, hence TFCG continue to support the project.

The main lesson learned from the project was that butterfly production by groups was not feasible, due to differences in motivation and work ethics. 10 illiterate women in the group were mistreated by their male leader, who was free-riding and giving himself a higher share of the profits. This resulted in the women lowering or abandoning the production. A mechanism was thus set up to ensure individual accountability.

The project achieved its aim to reduce poverty through providing employment (especially to poor and landless farmers due to the low levels of land and capital required), raising household income and creating social capital for enterprise.

(Scurrah-Ehrhart and Blomley, 2006)

Butterfly farming could thus be a suitable option for development in Equatorial Guinea provided there is sustained initial investment, professional training and support to local institutions to provide ongoing technical assistance. It provides farmers with a source of income that has little environmental impact (Scurrah-Ehrhart and Blomley, 2006). A female butterfly lays between 250 and 500 eggs in her lifetime thus few

butterflies are required to set up a captive population and pupae are retained at each generation preventing the need to catch more. However, some male butterflies will have to be captured from the wild to maintain genetic diversity. In addition, each butterfly species uses a different host plant to lay eggs, so seeds will have to be collected at the start of the project to set up a nursery. Butterflies are less costly and easier to produce in their natural environment, and with demand exceeding supply there is potential for expansion within the African butterfly export market (TFCG, 2004).

7. Agroforestry

• Agroforestry

Traditionally, Equatorial Guinea's main export crop has been cocoa (in colonial times the country was once the world's largest producer of cocoa), which is grown from the beach zone up to a height of 400m above sea level. The cocoa is of the '*Forastero*' type, known as golden melon (CAMASA, 2011). Cocoa production played a large part in the economy of Equatorial Guinea until President Macias Nguema, the country's first president, expelled the Spanish and Nigerian expatriates that were leading the cocoa production industry (McSherry, 2010). This was also influenced by the drop in world prices of cocoa (World Bank, 2002). Globally, smallholder cocoa is usually farmed in agroforests in combination with other cash crops (such as fruit or timber trees). Furthermore, shade-grown cocoa agroforestry systems are very efficient in protecting biodiversity and safeguarding ecosystem functions. Unlike many slash-and-burn food crop systems, cocoa agroforests require only single partial clearing of the forest, which is better for soil health and allows longer-term cropping cycles. Cocoa plantations can be used to partially reforest degraded agricultural lands, stabilise and provide livelihoods within buffer zones around protected areas and improve habitat connectivity for wildlife (WWF, 2006). This opens the possibility to restore cocoa farming as an alternative to bushmeat hunting in Equatorial Guinea.

The World Bank set up a Cocoa Rehabilitation Project in Equatorial Guinea that ended in 2002. Its aim was to 'alleviate the constraints impeding the increased production of cocoa', while establishing the necessary infrastructure and improving production. However, the performance of the project was deemed unsatisfactory due to an overestimation of the profitability of the plantations (linked to the drop in the price of cocoa) and the lack of participating farmers (World Bank, 2002). There is nonetheless an Equatoguinean company, CAMASA, focusing on agricultural development in Bioko, and concentrating on cocoa. They manage large plantations up to the stage of drying cacao in artificial dryers, provide services to a large number of farmers in the villages of the island, and maintain small plantations of pepper, nutmeg, cinnamon, pineapple and papaya (CAMASA, 2011). Further development of these already existing industries would be highly feasible, especially as knowledge regarding cultivation of this species already exists. The current President Obiang of Equatorial Guinea even made a public appeal to assist the country in the promotion of cocoa production in order to diversify the country's economy (Channel Two Communications, 2010).

Smallholder farming has been successfully restored before by the Wasmoeth

Wildlife Foundation project in the Bondo-Bili region of the DRC. In this case, former coffee farmers were encouraged to resume the practice by providing them a guaranteed above-market price for fixed quantities of coffee beans, in exchange for the commitment that they will not hunt, wildlife (especially elephants and primates), with sanctions for those that did not comply. The coffee was organically grown and destined for the European market, while attempts were made to develop a local market. Monitoring showed this approach to be effective in reducing primate hunting. Unfortunately this project was stopped in February 2008 due to the opening of a gold mine in the region (TWWF, 2008).

Regenerating the country's cocoa industry, through smallholder agroforestry, would seem to be a sound method to generate alternative livelihoods (albeit more feasible for Bioko island than Río Muni). However, labour costs on smallholder agroforestry plantations can be higher than those on large plantations and technical and financial assistance would be needed. The government can take an active role in this through agricultural zoning, land-use planning and licensing or land allocation regulations to promote better practices (WWF, 2006).

8. Forest-management

Sustainable forest management can be achieved using a variety of measures. Protected area management, controlling access to forests, community-managed forests, forest certification and payments for carbon conservation via REDD (reducing emissions from deforestation and forest degradation) or the voluntary carbon market all have potential to support a reduction in bushmeat hunting.

• Protected area management

Effective management of protected areas has generally been compromised in Africa, and Equatorial Guinea is no exception. The main issue appears to be inadequate funding, government support and technical resources (Struhsaker et al., 2005; Mugnier & Martinez-Plaza, 2008).

Natural resource management in Equatorial Guinea is subject to many laws, in particular Decree 1/1997 – Forest Use and Management Act – and its directives from Decree 97/1997. The monitoring of natural resources falls under the dual jurisdiction of the Ministry of Fisheries and Environment and the Ministry of Agriculture and Forestry, which potentially leads to conflicts of jurisdiction. There are two other bodies dedicated to protecting the environment in Equatorial Guinea: INDEFOR-AP (the National Institute for Forestry Development and Management of Protected Areas / *Instituto Nacional de Desarrollo Forestal y de Gestión de Áreas Protegidas*), which was established to provide scientific and technical resources and created by Decree 60/2002 and includes 15 technicians trained during the CUREF project (Conservation and Rational Utilisation of Forest Ecosystems in Equatorial Guinea / *Proyecto Racional Utilización y Conservación de los Ecosistemas Forestales de Guinea Ecuatorial*) between 1996 and 2002; and INCOMA (National Institute for Environment and Nature Conservation / *Instituto Nacional de Conservación del Medio Ambiente*), which aims to protect the environment and was created by the Environmental Act (Decree 7/2003) but is not yet operational. Unfortunately, there are few decentralised technical

administrations, and as a result the impacts of these policies on the ground are limited, especially due to lack of capacity (e.g. one vehicle per local office; Mugnier & Martinez-Plaza, 2008).

There are 13 protected areas in Equatorial Guinea, under the conservation status of scientific reserves, national parks, natural monuments and nature reserves (see Annex 4). As mentioned previously, INDEFOR-AP has legal jurisdiction for protected areas. However it has little acceptance or influence within the government, and received no operating budget for two years, until April 2011. As a result INDEFOR-AP has been unable to implement existing management plans, establish a management presence in the landscape or engage with local communities (CI, undated). To date, only five management plans have been produced for the following areas: (i) Caldera de Luba Scientific Reserve, by the Spanish Cooperation and the NGO *Amigos de Doñana*; (ii) Monte Alén National Park by ECOFAC (*Programme de Conservation et Utilisation Rationnelle des Ecosystèmes Forestiers en Afrique Centrale*), an EU-funded project and Groupement BRL; and (iii) Altos de Nsork National Park, (iv) Río Campo Nature Reserve and (v) Estuario de Río Muni Nature Reserve by the local NGO ANDEGE (*Amigos de la Naturaleza y el Desarrollo de Guinea Ecuatorial*) and Conservation International, with financial support from USAID-funded CARPE (Central African Regional Program for the Environment) (Mugnier & Martinez-Plaza, 2008; CI, undated; CI, 2010).

Protected area management must take into account limits in capacity in terms of human resources and finances (Nasi et al., 2008). In Equatorial Guinea, Blom (2004) estimated that the recurring expenditure necessary for protected area management in Equatorial Guinea is US\$58/yr/km² for minimum management and US\$212/yr/km² for effective management and proposed projects should take these values into account. Bloom suggests that the creation of 'Environmental Trust Funds' for specific areas could provide a stable source of revenue and provide opportunities for greater accountability than present funding mechanisms. These funds could come from government or from donors in the private sector through corporation taxation, voluntary contribution or corporate sponsoring.

A recently approved UNDP-GEF (United Nations Development Programme-Global Environment Facility) proposal submitted by Conservation International and managed by the Ministry of Environment and Fisheries aims to reduce policy, legal, capacity and socioeconomic barriers to effective protected area management in Equatorial Guinea. This ambitious project aims to strengthen a network of five protected areas including, on Bioko island, Pico Basile National Park and Caldera de Luba Scientific Reserve, and on the continental region, Monte Alén National Park, Estuario de Río Muni Nature Reserve and Río Campo Nature Reserve.

Other components of the proposal include the development of studies for ecotourism and benefit-sharing with local communities (CI, 2010). Tourism is however currently very limited in Equatorial Guinea. The ECOFAC project facilitated the opening of a 10-room lodge on the edge of Monte Alén National Park as a means to develop this sector and contribute to local employment. The enterprise is still very small, recently employing only four guides and welcoming just 45 tourists in 2007 (Mugnier & Martinez-Plaza, 2008). However, a study by Struhsaker et al. (2005) demonstrated that the success of protected areas was not directly correlated with employment benefits for the neighbouring community or with the presence of development programmes. Indeed, Struhsaker et al. (2005) identified the most important short-term strategy to

be the improvement of law enforcement, the most important medium-term strategy to be long-term funding and monitoring and the most important long-term strategy to be changing people attitudes towards conservation.

However, there is growing belief that limiting conservation activities to protected areas will not be sufficient in order to conserve wide-ranging species which move outside of park boundaries. In 2001 the Wildlife Conservation Society (WCS) attempted to address this shortcoming by establishing PROGEPP (Project for the Management of Ecosystems Adjacent to the Nouabalé-Ndoki National Park / *Projet Gestion des Ecosystèmes Périphériques au Parc National Nouabalé-Ndoki*) in the Republic of Congo in collaboration with the Congolese government, the timber company CIB (*Congolaise Industrielle du Bois*) and the local community. The aim was to “protect critical habitat, minimise hunting and provide safe passage for wildlife through logging areas” (WCS, 2010a). CIB instigated rules on hunting, only allowing local bushmeat consumption and restricting hunting methods. Unfortunately, hunting levels recently increased in the area after hundreds of workers were made redundant, and as a result anti-poaching strategy have been revised (with an increase in patrol and law enforcement effort; WCS, 2010b). More recently, ZSL’s Wildlife Wood Project started with the aim of improving wildlife management in timber concessions (currently managed by Pallisco and Rougier-SFID timber companies in south-east Cameroon), training and advising company biomonitoring teams, advising on bushmeat hunting and trade controls and working with communities to evaluate the potential of community hunting zones in the periphery of the concessions.

- **Community-managed forests**

Community resource management has been commonly discussed as a means to facilitate sustainable bushmeat harvesting (Kiss, 1990; Hannah, 1992; Wells et al., 1992; Bissonette & Krausman, 1995). Its principals are based on the joint development of forest management plans by communities and local authorities, which are in turn implemented by the communities on land that remains under public ownership. Communities are then allowed to use the forest resources in a sustainable way. Most of the central African states are pursuing legislation along these lines, but so far only Cameroon, and to some extent Equatorial Guinea, have clear laws allowing community involvement in the management of forest resources (Brown et al., 2003; Cobb & Gale, 2008). Existing legislation in Equatorial Guinea however is often conflicting and confusing (IUCN, 2000). Indeed, although Fundamental Law recognising the ‘peaceful occupation’ by peasants of ancestral lands and the Forest Act recognises the rights of communities to ‘use’ parcels of land for agriculture, livestock rearing or timber exploitation, these rights do not extend to tenure and in practice most reserves are processed for large-scale commercial purposes (IUCN, 2000).

Communally managed hunting zones have been extensively tested in Cameroon. Following consultations with communities, hunting zones where villagers monitored animal populations were delimited and quotas for the number of animals hunted were set. This was effective in certain areas where villagers reported on each other and were actively engaged in discussions. Progress was undermined by outside poachers who did not respect community forest rules and even harmed villagers. Logging companies and the government forest service worked together to curb poaching by staffing roadblocks and financing patrols. The funds were provided by the companies,

whereas the rights to investigate and arrest remained with the forest services. The necessity for external funding is a major weakness of such an approach (Wanders, 2010).

FARM-Africa is an NGO with considerable experience developing community-managed forests in Ethiopia and Tanzania. As a first step, they recommend identifying ways to reduce the community's dependence on forest resources. This can include turning traditional activities such as beekeeping and furniture-making into moneymaking enterprises (FARM-Africa, 2010). The Tanzanian Forest Conservation Group (TFCG) has also worked within this field and has been successful in developing site-specific management plans for previously open-access forest (see Box 13).

BOX 13: Lessons learned from the field – TFCG participatory forest management in the Eastern Arc and Coastal Forests of Tanzania

TFCG participatory forest management actions at the village level have proved successful, in that communities are willing to manage local forests through a legal usage status. However, enforcing joint management between communities and local authorities has proven more difficult.

Little money has been generated directly through participatory forest management. Thus, in order to increase the income of these communities, TFCG have supported them in developing other skills through on-the-job learning and exchange visits.

Lessons learned show that giving support to the local area conservation networks proved to be an important internal motivation tool for the communities. Local conflicts, when they happened, were best resolved through village reconciliation committees as opposed to involving local authorities who seemed to accentuate issues. However, local authorities were an asset in resolving conflicts between the communities and outsiders.

Participatory forest management was shown to have a positive impact on biodiversity conservation, reducing illegal timber harvesting, fire incidences and forest encroachment. In terms of livelihoods, participatory forest management did not contribute to any direct improvement. However, when combined with income-generating activities it has the potential to contribute to poverty alleviation. Challenges identified include changing people's attitudes or forest usage and creating markets for alternative products.

(Woodcock et al. 2006; for complete lessons learned see Annex 5)

This example highlights the potential for community forests to reduce bushmeat hunting. However, the conservation potential of this form of management will only be realised when communities are relatively small and stable, and able to defend their resources from encroachment. Furthermore there is no guarantee that forest-dwelling communities would adopt this form of management until they noticed a significant reduction in bushmeat availability (Becker & Ostrom, 1995). Unfortunately, in practice community forest legislation is not always adapted to the management of bushmeat hunting. For example, in Cameroon community forests must be located in non-permanent forest estates and are limited to a maximum size of 5000ha, much smaller than the area required to produce sufficient meat for hunters (ODI, 2003). Finally, if community forests are to reduce bushmeat hunting, additional incentives need to be provided in the form of alternative income-generating initiatives (Woodcock et al., 2006). Long-term benefits for local communities could also be ensured through a 'conservation agreements' approach. This mechanism would involve a legal agreement between a community and a donor, with the former committing to conservation action in exchange for benefits provided by the latter in order to offset any income lost due to this choice (CI, 2010). The approach would need to be linked to a sustainable

finance mechanism such as REDD (see below) or through the development of trust funds by private, corporate or government donors.

- **Forest certification**

Forest concessions in the Congo Basin have been linked to the escalation of unsustainable levels of bushmeat hunting, by opening roads to remote forests, facilitating access to market and attracting a large number of people to previously isolated areas (Poulsen et al., 2010). A study by Laporte et al. (2007) estimates that “29% of forested areas in central Africa are likely to have increased wildlife hunting pressures due to the access and market opportunities provided by new logging towns”.

Recently, bushmeat-related provisions have been included in the most widely used forestry certification schemes, the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC), which appears a promising incentive to reduce bushmeat hunting in concessions.

- The **FSC principles and criteria** relevant to bushmeat hunting are: respect of national laws and international agreements (principle 1), the protection of endangered species and the control of inappropriate hunting (principle 6, criterion 6.2), monitoring of changes in fauna (principle 8, criterion 8.2), the maintenance of high conservation value forests (principle 9, criterion 9.3) (FSC, 2002). Furthermore, the FSC Draft Congo Basin Sub-Regional Standard addresses bushmeat hunting more stringently by requiring the management of illegal hunting and prohibiting staff in certified concessions from hunting or transporting bushmeat in company vehicles (FSC, 2009). FSC also developed ‘Small and Low Intensity Managed Forests Standards’ (SLIMF) targeted to certify community forests.
- The **PEFC** has a membership of 35 independent national forest certification systems ‘based on international processes for promoting sustainable forest management’ (PEFC, 2010). It requires that national certification schemes in countries covered by the African Timber Organization (ATO) be compatible with the joint ATO and International Tropical Timber Organization (ITTO) principles, criteria and indicators for the sustainable forest management of African natural tropical forests. These include measures related to bushmeat hunting such as closing unnecessary roads after harvest, forbidding non-selective hunting methods and forbidding the use of forest concession vehicles for bushmeat hunting, livelihood diversification and the provision of alternative food sources to bushmeat (ATO/ITTO, 2003). However, Equatorial Guinea is not a member of the PEFC or ITTO, only of the ATO, where criterion III.2 (whereby negative impacts of various interventions on biodiversity are minimised) is the sole one applicable to bushmeat hunting, citing as an indicator that “NTFPs in high demand are to be the object of conservation and domestication trials” (Anon., 1998).

Forest certification has the potential to contribute to the conservation and sustainable management of bushmeat. Some examples from the field support this by showing that certified concessions result in reduced hunting pressures thereby providing better living conditions for great apes compared to non-certified concessions (van Kreveld & Roerhorst, 2009). Additionally, certified forest concessions can add

significant value to protected areas, which alone are often too small, fragmented or ineffectively managed to support biodiversity (Aviram et al., 2003; Bass et al., 2003). However, a study by van Kuijk et al. (2009) concludes that more data are required in order to establish their impact on bushmeat hunting on a larger scale. One of the aims of ZSL's Wildlife Wood Project is to develop indicators to ensure that wildlife is sustainably managed and monitored within the framework of forest certification schemes such as FSC (www.zsl.org/wildlifewoodproject).

On the sideline of forestry concessions, an initiative in Cameroon from WWF, WorldFish Center, EDC (Electricity Development Corporation), GTZ (*Deutsche Gesellschaft fuer Technische Zusammenarbeit*), World Agroforestry Center, IRAD (Institute of Agricultural Research and Development) and MINFOF (Ministry of Forests and Wildlife) aims to generate income and create sustainable jobs for poor families as well as reducing the major negative impacts on biodiversity associated with industrial forestry development projects (see Box 14).

BOX 14: Innovative project – Sustainable agriculture, economic growth and rainforest conservation in Cameroon (concept under consideration by the World Bank)

This pilot project is set to be in Campo-Ma'an National Park Buffer Zone in southern Cameroon. Rather than attempting to support dispersed human populations to improve their livelihoods and resist development, communities in the vicinity of large-scale projects would be targeted for assistance. Commercially viable, environmentally sustainable small- and medium-scale agro-businesses serving the market created by the project would be supported through infrastructure, technical assistance and financial services to produce high-quality food for communities created by industrial projects, reducing incentives for poaching, generating incomes and creating jobs. In practice, a suite of environmentally friendly, productive and profitable food production technologies based on modern science would be implemented. Designated 'agricultural parks' would be subsidised in targeted towns within the Campo-Ma'an Buffer Zone, where subsidies would be counted as support to both small and medium enterprises (SME) focused on commercial agriculture and wildlife conservation, and might include such interventions as an irrigation system, warehouse, cold store, paved roads and electricity. Initial funding would come from a consortium including conservation donors and industrial development companies. The subsidies are not intended to create long-term dependency, but rather to allow farmers to begin producing before the market is fully developed.

(Brummett 2010, Senior Aquaculture Specialist with the World Bank, pers. comm.)

- **REDD+**

Conservation and monitoring of forest biodiversity in protected areas is often restricted due to a lack of funding and trained staff. However, long-term funding for conservation activities could potentially be secured through an international mechanism which aims to reduce emissions from deforestation and forest degradation in developing countries (REDD or REDD+). Although this mechanism focuses on the conservation of carbon stocks, standards are being developed to ensure that biodiversity can be more explicitly included too (Entenmann, 2010). REDD+ projects will mainly be funded through the sale of verified emissions reductions (VERs); in this context, avoided emissions from deforestation and land degradation. VERs from projects certified through the current 'Climate, Community and Biodiversity Alliance' (CCBA) standard, which monitors socio-economic and ecological impacts of projects, fetch a premium price on the current voluntary carbon market. A CCBA standard is now being developed for the new REDD+ framework. Thus managing and monitoring

biodiversity is important for the financial viability of these projects (CCBA, 2008; Ecoresources, 2010). Under the CCBA standard, bushmeat hunting is considered a threat to biodiversity, thus the provision of alternative livelihood strategies (such as employment of rural communities as project managers) has the potential to be promoted through carbon/REDD+ projects (Entenmann, 2010; CCBA, 2008).

Equatorial Guinea may be an appropriate candidate for the implementation of REDD+ schemes. According to the FAO, the deforestation rate has increased substantially, from 58.2km² per year in 1990 to 120km² per year over the period 2000-2010. This corresponds to a deforestation rate of 0.7 %. For the period 2000-2010, the forest cover in Equatorial Guinea was reduced by 120,000ha due to agricultural development and intense logging, resulting in 15Mt CO² emissions (FAO, 2011). This brings the potential earning from a national REDD+ scheme in Equatorial Guinea to US\$45 million for the period of 2000-2010 (for a carbon price of US\$3/tCO²e; FAO, 2011). Equatorial Guinea has a network of 11 protected areas, covering 16.8% of the country's area (WRI, 2003), that could serve as a basis for a REDD+ programme. Conservation International has been initiating REDD+ activities in the country as part of a regional REDD readiness initiative for the Congo Basin with WWF and WCS, funded by the French Development Agency, through providing training and support to prepare the Equatoguinean government to develop a REDD+ framework which can contribute to local livelihoods.

Forest management methods leading to a reduction of bushmeat hunting appear to be a viable option, however, even including REDD+, income-generating alternatives need to be developed for local communities for a true change in hunting pressure to occur. Moreover, the long-term success of the various measures will only be achieved if they are linked to sustainable sources of finance.

D. Lessons learned

This research presents a wide variety of policy options and initiatives with potential to reduce bushmeat hunting. From first-hand information gathered and the literature available it has been possible to summarise the lessons learned so far from projects on the ground alongside options for project implementation general and recommendations for the Equatoguinean government and donors.

Lessons learned

- Consumers are key people to address while attempting to implement livelihood alternatives. The success and uptake of alternative food products will in part depend on whether they apply to the different preferences and consumption patterns of various target groups in Equatorial Guinea.
- Projects need to ensure they are socially acceptable and do not break local taboos or traditions. Attempting to turn traditional activities into money-making schemes should be investigated initially.
- Where implemented livelihoods are novel to a community, social marketing, education and appealing to religious paradigms are essential. Training local organisations in methods leading to social and behavioural change are important precursors to the subsequent adoption of alternatives by the

communities.

- For alternatives to be sustainable and attractive for target populations, training and materials have to be provided at low or no cost to participants, as bushmeat hunting is virtually a costless activity. However, some form of community commitment is required if long term interest is to be maintained. This can be promoted through motivating local entrepreneurs to actively participate in the supply chain.
- Collaboration between organisations from different sectors has proven useful in tackling the controversial issue of bushmeat hunting on different fronts by relating it to other issues such as food security, human health, education, etc.
- Creating benefit-sharing systems and cooperatives within communities has proven beneficial.
- Engaging the education system with issues related to bushmeat hunting can be an effective means to promote long-term social change and achieve sustained projects impacts. The effects of such campaigns on the perceptions and behaviours of target audiences should be monitored.
- Ideally, various income generating measures should be combined within communities in order to reduce risk factors related to disease epidemics, loss of crops to elephants, the loss of traders or reductions in market price.

Options for project implementation

- *Bushmeat hunting and trade regulation:* Bushmeat harvest and trade regulations are better implemented by government entities. NGOs can be part of the process through advising policy, providing monitoring information and through facilitating acceptance of the regulation by local communities.
- *Marketing:* Audience segmentation, focus group testing, highly targeted messages and the use of multiple media vehicles should be used to market a new alternative or to create a market for a new product. This is an essential step to include in any livelihood alternative promoted. There is some evidence for 'Westernisation' of tastes among wealthier, young, urban groups reducing preferences for bushmeat. The impact of awareness campaigns linking bushmeat handling and consumption to emerging infectious diseases also has potential for decreasing bushmeat consumption.
- *Aquaculture:* Micro- and small-scale aquaculture does not appear to be a sustainable livelihood alternative in Equatorial Guinea at present. Viable aquaculture projects rely on expensive modern technologies and extension services, requiring constant donor funding to meet operational costs.
- *Livestock rearing:* Free-range poultry rearing coupled with vaccination campaigns and improved housing for predator control could be a viable alternative for small farmers but is unlikely to meet the total demand for meat. Generally livestock rearing is hard to introduce because of the high start-up and upkeep costs and lack of extension services.
- *Bushmeat rearing:* Snail farming needs to be carried out on a large scale to ensure an adequate income but is cheaper and simpler than other forms of bushmeat farming. Grasscutter farming also seems to be technically feasible and has been extensively tried and tested.
- *NTFPs:* Plant-based NTFP harvesting involving public-private partnerships could

generate income and have minimal environmental impacts if managed sustainably. Developing new supply chains for NTFPs would necessitate detailed information on the harvest of the species involved, whilst investment in services which facilitate the storage and distribution of these products would be required. Beekeeping offers a low-cost and highly feasible alternative. The regional and international market for honey and bee products is expanding although there is currently no beekeeping sector in Equatorial Guinea. Initial investment in training from neighbouring countries, such as Cameroon, would be required.

- *Sustainable forest management*: Community forest management may provide local incentives to reduce bushmeat hunting, but to be successful, would need to include income-generating activities for the communities involved. Long-term finance could be generated from REDD+ credits although there is no evidence that this will be implemented in Equatorial Guinea within the immediate future.

General recommendations for donors and the Equatoguinean government

- Ensuring coherence of potentially conflicting policies, such as Equatorial Guinea's primate hunting ban and the bushmeat trading tax (which is indiscriminate to the sale of primates), or ensuring that policies are very specific and clearly worded to avoid conflicting understanding, would be a useful first step in ensuring they are followed.
- Developing bushmeat hunting and trade regulations that allow a legitimate channel for the trade in order to develop participatory management of the resource would be advised. This could be achieved through the implementation of quotas or taxes. These regulations would need to be monitored and enforced regularly to ensure they are sustainable and effective. For example, regulation could be coupled with attempts to measure the value of bushmeat to the economy – to make explicit what bushmeat is actually worth to the country and why it needs to be sustained
- Local communities impacted by bushmeat hunting and trading policies should be invited to be an integral part of hunting and trade management, in order to provide an incentive for them to invest in the future of the resource and ensure that the limitations fixed by policies can realistically be adhered to.
- Capacity for law enforcement and monitoring of enforcement activities should be developed, such as confiscating excess bushmeat through roadblocks or random market raids.
- A national campaign to raise public awareness regarding bushmeat hunting and trading should be developed. Appropriate messages should be constructed by local authorities and NGOs to target different demographics whilst the media skills of industry professionals should be harnessed.
- Developing conducive investment policies to attract increased private sector participation could fund the development of large-scale livestock rearing initiatives, potentially easing demand for bushmeat. Long-term viability of this sector will require significant investment in the veterinary services, and agricultural technicians should receive additional support in terms of training and equipment. High-priority sites for the development of these industries

should be identified in areas of low conservation value, and environmental impact assessments should be conducted.

- Facilitating access to credit for local enterprises (such as low interest loan schemes) would facilitate higher participation in market supply chains. At least part of the credit provided must be conditional based on the performance of the enterprise.
- An analysis of existing market supply chains should be undertaken in order to identify under-developed markets for various products derived from rural areas and this information should be shared with potential entrepreneurs and relevant government ministries.
- Regulating the harvesting of wild NTFPs should include evaluating and controlling harvesting permits to avoid overexploitation. Overseas trade must adhere to CITES requirements. Species domestication should be promoted when possible.
- Options to create community-managed forests with controlled hunting zones should be explored, and coordinated with existing plans for protected area management. Like other NTFP, methods to measure and control harvests need to be implemented.
- FSC certification could be promoted by engaging with some of the timber companies present in Equatorial Guinea by active law enforcement (specifically anti-poaching). The Equatoguinean government should complement this by joining the ITTO and PEFC. However, this needs further evaluation as it may not be a feasible option given the relatively small size and mature nature of timber concessions in Equatorial Guinea. The potential for improved forest governance and law enforcement via FLEGT (an EU initiative on Forest Law Enforcement and Governance in Trade) should also be explored.
- A framework for monitoring of wildlife and sustainable bushmeat offtake should be developed, to enable local-level monitoring by communities, protected area authorities and concessionaires with appropriate audits undertaken by third party experts.
- Funding extension services (training, veterinary and technical support) is necessary for the development of agriculture, livestock and aquaculture in Equatorial Guinea. Training in marketing, business and entrepreneurship is necessary more generally to ensure the long-term viability of projects.
- Baseline information on abundance and distribution of bushmeat species and other NTFPs is needed. Guidelines on how to manage resources in the wild and harvest them sustainably should be developed. There is a need to build capacity amongst young scientists to undertake these inventories and develop key indicators to monitor biodiversity change.

Conclusion

The bushmeat trade involves a number of different actors who each vary in their level of dependence on the resource and in their ability to positively or negatively influence its long term sustainability. Ensuring that the majority of these actors have a genuine incentive to reduce their use of this resource will not be attained through one policy measure alone, but instead requires a range of coordinated measures to ensure

that benefits gained from reducing bushmeat use outweigh any costs incurred. Indeed, the appropriateness of the above recommended policy options will depend on local contexts, as sites within Equatorial Guinea vary in market access, forest quality, geography etc. However, many of the wider recommendations are appropriate across a much broader context. Indeed it is unlikely that any of the income generating strategies reviewed here could provide tangible benefits for communities without considerable investment in training, support for entrepreneurs and marketing of the derived products. Conservationists should engage with government ministries responsible to support such changes and collaborate with them to ensure that impacts on bushmeat hunting are measured.

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Annex 1

List of people and organisations contacted.

Organization	Name	Email	Topic	Project
CREE (Center for Rural Empowerment and the Environment)	Mike Skuja Stella Asaha	mike.skuja@conservationforpeople.org stellaasaha@yahoo.com	Snail farming	Snail Farming in Mount Cameroon (on-going)
VSF (Veterinaires Sans Frontiers)	General	http://www.avsf.org/	Grasscutter farming	'Projet d'élevage de petit gibier' in Gabon (1995)
CIRAD	Ferran Jori	ferran.jori@cirad.fr	Grasscutter farming	Project manager of the VSF project (see above)
Lebialm Hunters Beekeeping Initiative	Juliet Wright	juliet@bees4bushmeat.org	Beekeeping	Project Manager
African Center for Community	Ivo-Emmanuel Array	ivo@africancentreforcommunity.com	Grasscutter farming	
IRAD	Victor Pouomogne	pouomognev@yahoo.fr	Aquaculture	Sarnissa project, www.sarnissa.org
University of Malawi	Emmanuel Kaunda	ekaunda@yahoo.com	Aquaculture	Sarnissa project, www.sarnissa.org
University of Stirling	William Leschen	wl2@stir.ac.uk	Aquaculture	Sarnissa project, www.sarnissa.org
CIRAD	Olivier Mikolasek	olivier.mikolasek@cirad.fr	Aquaculture	Sarnissa project, www.sarnissa.org
World Bank	Randall Brummett	rbrummett@worldbank.org	Aquaculture	Sarnissa project, www.sarnissa.org
RIPPLE Africa	General	info@rippleafrica.org +44(0)1525216346	Aquaculture Beekeeping	UK charity with projects in Malawi (on-going)
Fish for Thought	Julie Vandenbor	julievandenbor@hotmail.com	Aquaculture	Canadian ngo offering advice on aquaculture development in Africa – experience in East Africa
Fish for Hope	Peter Corey	peter.corey@ns.symqtico.ca	Aquaculture	Project manager of a aquaculture demonstration/training site in Mozambique, funded through a Canadian ngo
Conservation International	Johanna Donovan	jdonovan@conservation.org	Social Change	Project manager of the Ghana awareness campaign
CIFOR	Terry Sunderland	t.sunderland@cgiar.org	NTFPs	NTFPs in Cameroon
US Forest Services	Laurie Clark	Lclack9069@aol.com	NTFPs	NTFPs in Cameroon with WWF CARPE

Rare	General	rare@rareconservation.org	Social Change	Pride Campaigns in Africa
ICRAF	Zac Tchoundjeu	z.tchoudjeu@cgiar.org	NTFPs	Allanblackia in Cameroon
IUCN	Cléto Ndikumagenge	Cleto.ndikumagenge@iucn.org	NTFPs	Allanblackia in Cameroon
IUCN	Martin Nganje	Martin.ngange@iucn.org	NTFPs	Allanblackia in Liberia
ICCO	Gemma Boetekees	Gemma.Boetekees@ICCOenKerkinActie.nl	NTFPs	Allanblackia in Liberia
Amani Butterfly Project	Theron Morgan-Brown	kimbiaje@ufl.edu	Butterflies	Technical advisor
Berkeley University	Dale McCulla	mcculla@nature.berkeley.edu	Controlled hunting zones	Scientist

Annex 2

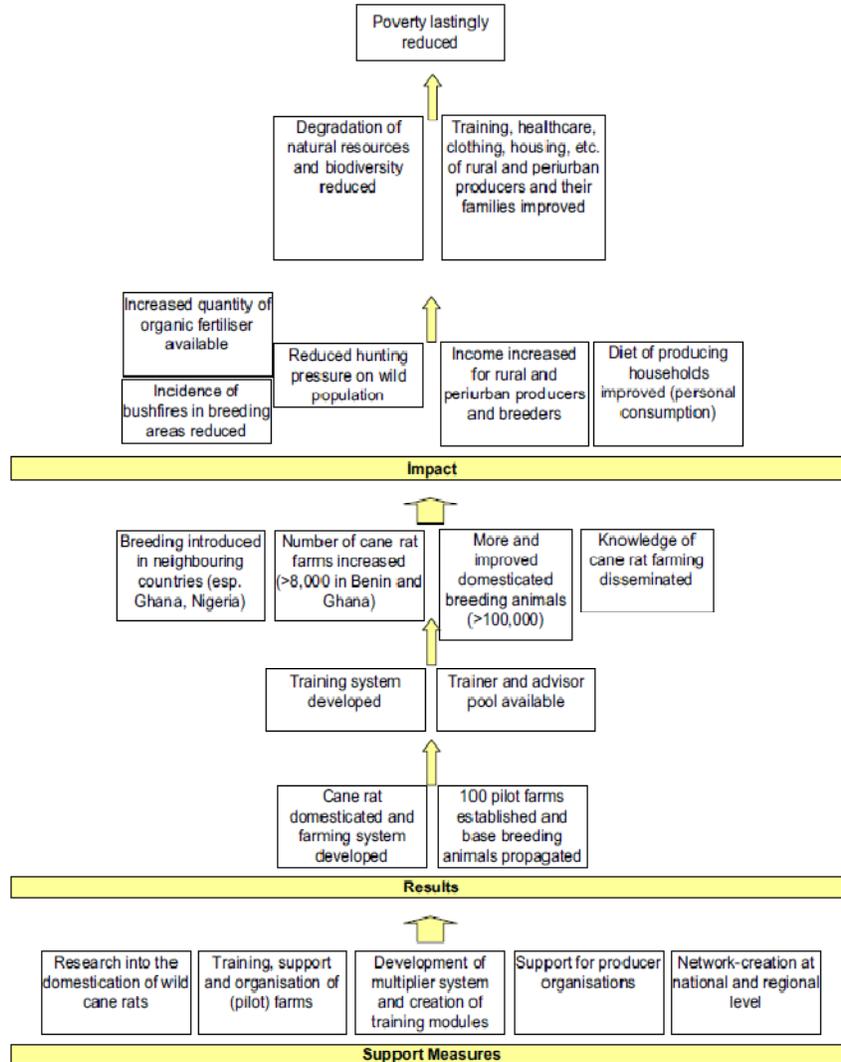
Costs of producing one bucket of snails (400 snails) per month for one year (Kalmbach et al., 2009).

Snails			<i>FCFA</i>
Output needed	400 snails per month, 12 months a year	4800 mature snails	<i>na</i>
Eggs needed	assuming 10% hatching failure and 10% death rate during growth	5800 eggs	<i>na</i>
Parents needed	Assuming 15 eggs laid per parent	400 reproducing snails	- 5000
Space			
Mature and growing snails	400 parents plus 5300 growing snails; assume 1sqm per 100 snails needed, counting walls and ceiling as snails mostly climb	58 sqm (e.g. pen of 2m height, 14.5 sqm ground space)	-341000*
Eggs	Incubator needed for 480 eggs per month	1 sqm soft soil (e.g. high-rise wood pen size 1x1x0.5m)	- 23000
Husbandry			
Snail feed	Assumed to be locally available for free, e.g. papaya and banana leaves and fruits, cassava leaves, etc.		0
Labour	husbandry four times a week 1.5 hours for two people; 2 hours per week maintenance 1 person	14 hours per week	0
Materials			
Initial (other than pen construction)	2 watering cans (4000), 2 buckets (3000), 1 wheelbarrow (16000), rake for the ground (3000), 2 20l water containers (3000)	33000 FCFA	- 33000
Replacement	1 watering can (2000), 1 bucket (1500), 2 hinges (2000), 1 padlock (2000)	7500 FCFA	- 7500
Income			
Rainy season	One bucket sells at 2500 FCFA; rainy season prices for 8 months (March – October)	20000 FCFA	20000
Dry season	One bucket sells at 4500 FCFA; dry season prices for 4 months (November – February)	18000 FCFA	18000
Cost-benefit			
	Net income after one year, including all initial investment		-371500
	Net income after one year, excluding initial investment		30500

*Costing for a 4x4x2m paddock made of wood with cement foundations, wire mesh and thatch roofing (in FCFA): 3 bags cement = 18000, stones = 10000, supporting beams for roof = 21000, beams from the ground = 21000, wire mesh = 30000, nylon mesh = 5000, thatch roofing = 7000, others = 5000, 68 planks for walls = 204000, door = 20000.

Annex 3

1. Results and impact of support measures in grasscutter production (Nill & Bohnert, 2006)



2. Parameters in grasscutter production (Jori et al, 1995)

Gestation	154 days
Random litter size	4
Sex ratio	1:1
Random weight	135.9g
Annual random abortion rate	2%
Annual random stillborn rate	3.4%
Random daily weight gain	12g
Consumption index (food/weight gain)	4.5:1

Annex 4

Protected Areas in Equatorial Guinea in 2008 (Mugnier & Martinez-Plaza, 2008).

Protected area	Type	Area (ha)	Year of creation	Staff	Location
Caldeira de Luba	Scientific Reserve	51,000	2000	14 guards and 4 technical officers	Bioko Island
Playa Nendji	Scientific Reserve	500	2000		
Monte Alén	National Park	200,000	1997	26 guards and 4 technical officers*	Monte Alén – Monts de Cristal
Altos de Nsork	National Park	70,000	2000	4 guards and 4 technical officers*	Monte Alén – Monts de Cristal
Pico Basilé	National Park	33,000	2000		Bioko island
Piedras Nzas	Natural Monument	19,000	2000	2 guards	Monte Alén – Monts de Cristal
Piedra Bere	Natural Monument	20,000	2000		
Rio Campo	Nature Reserve	33,000	2000	5 guards and 1 technical officer*	
Monte Temelón	Nature Reserve	23,000	2000		
Estuario del Río Muni	Nature Reserve	60,000	2000	2 guards and 1 technical officer	Monte Alén – Monts de Cristal
Punta Liende	Nature Reserve	5,455	2000	2 guards	
Corisco y Elobeyes	Nature Reserve	53,000	2000	2 guards and 1 technical officer	Corisco and Elobeyes islands
Annobon	Nature Reserve	23,000	2000		Annobon Island
Total		590,955		57 guards and 15 technical officers	

Annex 5

The lessons that have been learnt from TFCG's experience in facilitating participatory forest management (PMF) can be translated into a series of recommendations for other facilitators of participatory forest management. These can be summarised as follows (Woodcock et al., 2006):

Facilitating PFM

- Clearly identify and include all stakeholders in PFM from inception to prevent unnecessary conflict between groups;
- Ensure that roles of the VEC and VC are clearly identified and negotiated;
- Raise awareness widely amongst the communities involved in PFM;
- Advise communities that all sub-villages should be represented in VECs in order to be involved in decision-making aspects of management.
- Advise communities that only those sub-villages utilising or in close proximity to forest should be expected to participate in the practical labour of management.
- Advise communities to fully involve people with farms in or adjacent to forest in surveying, clearing and marking forest boundaries.
- Be aware of changes in policy and District by-laws that may affect village by-laws and management plans, and assist villagers to adjust plans accordingly.
- Provide support in setting up and monitoring systems that maintain the role of forest as a social asset in times of seasonal and environmental strain;
- Facilitate negotiation of roles between FBD and village forest managers in forests under JFM.
- Fully involve members of the VECs in activities such as PFRAs, marking of the VFMA and mapping.
- Facilitate PFM in the order of steps suggested in the CBFM guidelines.
- Take time to facilitate the development of trusting relationships between stakeholders (For instance, District and Village) by arranging frequent formal and informal meetings.
- Ensure that VCs and VECs have copies of documents related to the PFM process, in particular, the maps, management plans and participatory forest resource assessment reports.
- Assist communities to review PFM activities yearly.

Livelihoods

- Focus specifically on supporting poorer households and specific forest user groups who are initially negatively impacted by PFM, to be involved in IGAs, and in particular those that provide alternatives to forest products and services;
- Link support for IGAs and the provision of transfer payments directly to the management of the forest; and
- Seek partnerships with projects, which develop innovative sustainable forest-based products, or alternatives to forest products, and the markets for those products.

Participation

- Support the representation of men and women in VECs, through: direct advice, and extension visits, radio broadcasts and video that promote male and female representation.
- Where women may be unconfident in contributing to meetings, the facilitators should be careful to have focus group discussions with men and women separately. Bringing the groups together at the end once their ideas are formulated has proven to empower women to contribute more in meetings.
- Continue to advise communities that all sub-villages should be represented in VECs in order to be involved in decision-making aspects of management.
- Clearly link support for IGAs and transfer payments to the management of the forest. Make it clear that support in these areas will be removed if there is failure to manage forest as stated in the management plans.

Money and Information Handling: Transparency and Accountability

- Avoid creating high hopes for making money through tourism in areas where tourism is unlikely.
- Invest in training in record keeping. Procedures for revenue collections need to be transparent and VECs need to be held accountable for keeping records that can be viewed by insiders and outsiders alike. Make basic record keeping a prerequisite for continued support.
- Support communities in ensuring, that basic forest rules and maximum fines are known by the whole community, whether through sign-boards or further awareness raising.
- Advise communities to develop a sliding scale of penalties for those not adhering to forest rules, from monetary fines to communal work.
- Investigate alternative systems of reporting information gained by individuals who have been on extension visits to a wider section of the community through e.g. environmental choirs.

Skills and Capability: Learning and Motivation

- Be prepared to provide long term support for capacity building.
- Follow up quickly on assisting communities to extend or manage other forest areas.
- Continue to support the development of Local Area Conservation Networks whose members can act as advisers, facilitators and watchdogs in PFM. These networks are important for the future spread and sustainability of PFM to other villages and areas.

Conflict Anticipation and Management: Appropriateness and Effectiveness

- Encourage the use of local mediators in managing conflicts in a timely and firm fashion, only using Ward and District Officials and the police as a last resort.
- Use video, radio broadcasts and extension visits to highlight the lessons learnt from conflicts faced by those communities involved in PFM. Assist communities in identifying potential conflicts and developing village by-laws to prevent anticipated conflicts.
- Facilitate a negotiation of roles around patrolling and the support the FBD can offer in areas where village forest managers must contend with outside armed traders.