

Institution: University of Stirling		
Unit of Assessment: 14. Geography and Environmental Studies		
Title of case study: Sustainable wildmeat harvests and rural food security in Gabon		
Period when the underpinning research was undertaken: 2000 - 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Katharine Abernethy	Professor	03/1995 - Present
Robin Whytock	Post-doctoral Research Asst.	03/2020 - Present
Daniel Ingram	Post-doctoral Research Asst.	08/2019 - Present
Period when the claimed impact occurred: 2015 - 2020		
Is this case study continued from a case study submitted in 2014? No		

1. Summary of the impact

Unregulated harvesting of wildmeat (bushmeat) undermines rural food security and devastates wildlife and ecosystem function in the tropics. Stirling research has underpinned extensive reform of wildmeat harvest and trade to improve sustainability in Gabon, a high biodiversity country, home to the world’s largest remaining populations of forest elephants, giant pangolins, and mandrills.

Impact 1. Stirling research led to **new laws** in Gabon that allow subsistence use of resilient game species, enhancing the livelihoods of the entire rural population of 250,000 reliant on wildmeat, and reducing biodiversity loss. Stirling expertise allowed the government to test regulation of local trade in pilot areas from 2018. The **food security of 8%** of rural people has already been improved through the new practices, extending to the entire population of Gabon (2,200,000) by 2024.

Impact 2. Acting on research showing dramatic wildlife losses to unregulated hunting, **new wildlife protection regulations** significantly increased protection for 11 endangered species considered overexploited (e.g. pangolins, elephants), and improved **wildlife monitoring** is now mandatory for >50% of the country’s area. Pangolin hunting has declined and elephant numbers are increasing in some protected areas. Research also prompted the introduction of a new Penal Code **increasing penalties for wildlife crimes**, particularly those impacting sustainability.

Impact 3. Stirling research showed, for the first time, that species with high risk of zoonotic disease transmission (bats, pangolins, primates) were living in close proximity in the wild. Trade in these species has now been **banned** in Gabon, leading to further **wildlife protection** and a **reduced direct human-health risk** for over 1,000,000 wildmeat consumers, and ultimately the entire population.

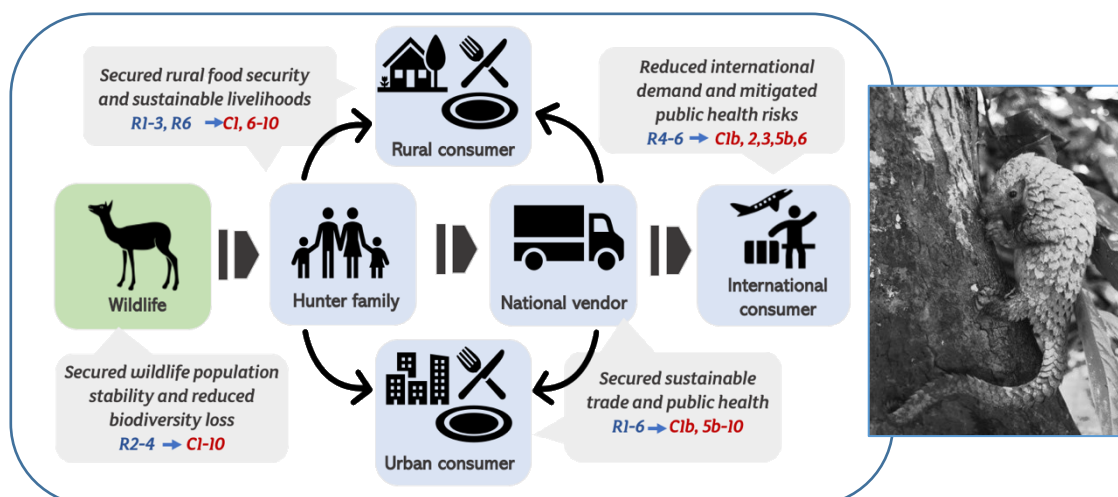


Figure 1. Left: The wildmeat use and trade system, illustrating Stirling research impacts on all wildlife and stakeholders along the trade chain. Right: Common pangolin; previously unsustainably hunted pangolins now benefit from increased protection.

2. Underpinning research

In 2003 Stirling participated in novel research showing that subsistence hunting had become unsustainable across the tropics, driving declines in wildlife, particularly populations of large,

endangered species, and jeopardising rural food security ([DOI:10.1038/nature01566](https://doi.org/10.1038/nature01566) and [10.1016/S0169-5347\(03\)00123-X](https://doi.org/10.1016/S0169-5347(03)00123-X)). To support the government of Gabon to address these problems, Stirling researchers went on to lead novel, large-scale research on consumption and use of wildlife and to elucidate the socio-economic drivers of hunting and trade. This was done through a repeated national survey of consumption in >1000 households, trade in 16 markets over 6 years and long-term hunter follows in 12 villages (R1, R2). Results showed, for the first time, that the largest volumes of hunted meat are destined for urban wealthy, not food-insecure rural people (R1) and that revenues from hunting sales are important in >70% of rural livelihoods (R1, R2). Continued overhunting causes eventual wildlife collapse followed by local economic failure and exodus, leading to profound social change in rural communities (R2 and <http://hdl.handle.net/1893/28635>). Prior to wildlife collapse, families who hunt the most are the biggest short-term losers under rural trade regulation (R2) and resist such measures. Rich families, able to afford high prices, are undeterred by low penalties and perpetuate the trade via underground sales. Solutions are therefore socially intractable. A comprehensive 2015 International Union for the Conservation of Nature (IUCN) report citing previous Stirling research (<https://doi.org/10.2305/IUCN.CH.2015.01.en>) concluded that alternative livelihood provisions had largely failed.

To support innovation in management strategies, in 2015 Stirling researchers built and populated the first accessible evidence-base for informed management across Central Africa (R3). This went on to become the online WILDMEAT database used to provide assessments of the effects on wildlife of prolonged or changing hunting pressure (R4). Following researcher presentations to national consultations on hunting management and Stirling research briefs submitted to the CITES Head of Delegation (2016) and the Minister responsible for Wildlife, rapid legal and policy reforms were enacted for species endangered by illegal use [C1-8]. Stirling also provided direct evidence to government on the contribution of hunting and trade incomes to families across the country (R1, R2). This enabled modelling of how different regulatory scenarios may affect stakeholders for the optimisation of management strategies (R5). A systematic review and analysis of the wildmeat sector, commissioned by the Convention on Biological Diversity (CBD) following Decision XIII/8 (C9a,b) brought Stirling researchers together with other leaders in the field to author new guidance and theories of change for use in governance strategies (i.e. R5). The CBD Secretariat encourages all 193 Parties to use this 2019 Guidance document to support policies to improve sustainable wildlife use (C9b).

Stirling's most recent research, funded by the 2019-2024 UKRI GCRF Trade, Development and the Environment Hub, responds to public demand to identify (R6) and manage the risk of zoonotic disease transmission in the light of the recent global zoonotic pandemic. Stirling research considers how economic shock can affect sustainable wildlife use in Africa and offers mitigation scenarios to policy-makers (R5). This research was used in Gabon in the 2020 pandemic-response decision to ban the hunting and use of some species deemed high-risk for zoonotic disease emergence (C1b).

All research outputs are delivered to decision-makers via carefully planned pathways to impact, developed over the past 20 years and curated to remain relevant and persuasive (i.e. C5, C8a,b, C9 a-f). Abernethy is a member of the Gabon Expert Group of the National Strategy for Bushmeat Management, sits on the Advisory Board for the Wildlife Conservation Society's Urban Bushmeat Initiative, is an advisor to the Gabon National Parks Agency Science Unit, and provides technical advice on assessment of use of wildlife resources to the EU Sustainable Wildlife Management project, the US Fish and Wildlife Service, and the African Conservation Development Group.

3. References to the research

R1. Wilkie, D.S., et al. (2005). Role of prices and wealth in consumer demand for bushmeat in Gabon, Central Africa. *Conservation Biology* 19, 1–7. [DOI: 10.1111/j.1523-](https://doi.org/10.1111/j.1523-)

[1739.2005.00372.x](#) **Stirling author: Abernethy**

R2. Coad, L., et al. (2013). Social and Ecological Change over a Decade in a Village Hunting System, Central Gabon. *Conservation Biology* 27, 270–280. [DOI:10.1111/cobi.12012](#).

Stirling author: Abernethy

R3. Taylor, G., et al. (2015). Synthesising bushmeat research effort in West and Central Africa: A new regional database. *Biological Conservation* 181, 199–205.

[DOI:10.1016/j.biocon.2014.11.001](#). **Stirling author: Abernethy**

R4. Ingram, D.J., et al. (2017). Assessing Africa-Wide Pangolin Exploitation by Scaling Local Data: Assessing African pangolin exploitation. *Conservation Letters* 11, e12389.

[DOI:10.1111/conl.12389](#). **Stirling author: Abernethy**

R5. McNamara, J., et al. (2020) COVID-19, Systemic Crisis, and Possible Implications for the Wild Meat Trade in Sub-Saharan Africa. *Environmental and Resource Economics*. [DOI:](#)

[10.1007/s10640-020-00474-5](#). **Stirling author: Abernethy**

R6. Lehmann, D., et al. (2020) Pangolins and Bats Living Together in Underground Burrows in Lopé National Park, Gabon. *African Journal of Ecology* 58, 540-542. [DOI:](#)

[10.1111/aje.12759](#). **Stirling author: Whytock**

Funding

R1 DEFRA Darwin Initiative project (162/12/002 & 162/12/002-F), GBP194,087 and International Medical Research Centre Franceville (00045), GBP781,000

R2-R4 International Medical Research Centre Franceville (00045), GBP781,000, Gabon National Parks Agency (399677), GBP124,802

R5, R6: UKRI GCRF Trade, Development and the Environment Hub (ES/S008160/1) GBP20,400,000 (GBP400,518 to Stirling)

4. Details of the impact

University of Stirling research has been vital in understanding the unsustainability of the wildmeat trade in Gabon and proposing solutions that have been carried through into policy and practice. Trade of hunted wildlife generates much-needed subsistence income for >70% of Gabon's rural families (approximately 250,000 people; R1, R2). However, many hunted species, including endangered species such as elephants and pangolins, are now in serious decline (i.e. R4). Economic growth has increased demand from wealthy urban centres driving severe overhunting that threatens rural livelihoods, food security, and social stability. Ebola, SARS, and COVID-19 outbreaks have exposed the urgent need to control the risk of zoonotic diseases emerging from the wildmeat trade. Gabon faces a societal problem of balancing economic development, rural food security, public safety, and the conservation of globally endangered wildlife. Stirling research has helped Gabon to tackle these challenges and to secure environmentally and socially sustainable outcomes. National Geographic now lists Gabon as one of the [top 8 most sustainable destinations in the world in 2020](#).

Pathway to Impact: Following initial research which framed the problem, Stirling and the Gabon Ministry of Forests' Wildlife Department secured Darwin Initiative funding (2003-2009) for joint research. This led to training of 15 research-active staff, joint publications (R1 and [others](#)) and the development of a first national database which gave stakeholders a research evidence-base (R3). The project organised a cross-government workshop in 2007 to examine the adequacy of hunting laws for sustaining subsistence food security. This resulted in a Minister of Forests' declaration to the Cabinet on the need for legal reform and better governance. Following this call, the Director of Forests commissioned a full report on the wildmeat sector, co-authored by Stirling and citing 10 Stirling research papers. This report was then used at inter-ministerial level to initiate development of a National Strategy for Bushmeat Management. In 2008 the Convention on Biodiversity also commissioned a first Technical Report questioning the sustainability of wildlife hunting in the tropics, co-authored by Stirling and citing 2 Stirling papers in evidence of unsustainability.

Impact 1: Improved food security for around 250,000 people in subsistence livelihoods

The research-led approach pioneered by Stirling's collaboration with the Gabonese government for improved hunting management (R1-3, R6, C2c, C5-8) led, in 2018, to Gabon testing new regulatory approaches in the field (C6a) with funding from the European Union 'Sustainable Wildlife Management' programme (C6b). The stated objective of the EUR44,000,000 global programme is to 'Contribute to wildlife conservation and the protection of ecosystem services alongside amelioration of the quality of life and food security of the populations who depend on these resources', exactly mirroring the National Strategy set out in the 2010 technical report co-produced by the Gabon Ministry and University of Stirling (C8b) upon which Gabon's political approach to wild meat management is now based (C6a, C8a).

Using Stirling research methods for measuring consumption (R1-3), pilot sustainable bushmeat management programmes were put into effect in 2019 to **monitor the food security of 8% of Gabon's rural population** (approximately 20,000 people). In 2020, the pilot project reported the proportion of rural families' protein consumption that was wildmeat was a maximum of 22% in the most remote villages; a drop of approximately 15% from previous figures (R1, C6a): Evidence of a reduced reliance on wildlife and improved access to other proteins that has improved overall food security. By 2024, evidence-based reforms built from this initiative will affect the wildlife use of the entire population of Gabon; approximately 2,200,000 people (C6a).

The research designs and methods for monitoring used in the pilot programmes are housed in the Stirling co-created online open-access [WILDMEAT database](#) (C10). The data will ultimately be openly available here also. The Government research agency in Gabon now collaborates with Stirling to monitor consumption in a further 1,000 households, with direct funding from UKRI GCRF Trade, Development and the Environment Hub. Gabon's Environment Minister states "*Stirling's research has been key to our strategies for sustainable hunting. To balance food security and wildlife conservation is complex and requires robust evidence for decision-making. Their research showing the scale of urban demand [...] changed the way we think about management. Stirling are our primary research partner in building and monitoring sustainable harvesting policies*" (C6a).

Impact 2: New national and international protection for endangered wildlife species

Stirling research on the scale of hunting impacts on wildlife (R2-4) stimulated a national wildlife monitoring programme (C4). Biomonitoring using Stirling methodologies is now deployed in the Gabon National Parks which cover 3 million ha (11%) of the country (C5) and becomes obligatory in timber concessions covering a further 14 million ha (52%), in 2021. Mr Christian Tchemambela, Head of the National Parks Agency, confirms that no other African rainforest country has such a programme and that Stirling research has been critical in Gabon's programme: "*Stirling showed us the impacts of hunting on all biodiversity and the need for a wildlife monitoring system to improve our management strategies. Thanks to their biomonitoring methods, we have been able to improve our wildlife monitoring in the parks and therefore increase protection. We can demonstrate an increase in wildlife populations in some parks*" (C5). Responding to Stirling research evidence on the detriment to rural societies of heavy biodiversity loss (R2 and others), the new 2019 Penal Code has significantly increased punishments for crimes reducing wildlife sustainability (C3, p136, C6a). Organised wildlife poaching now carries a sentence of 15 years imprisonment and penalties for hunting endangered species have increased from 6-month to 10-year maximum sentences. Using Stirling research (R4, [DOI:10.1111/aje.12507](https://doi.org/10.1111/aje.12507)), on pangolins, which are particularly heavily hunted, Gabon's delegation co-led the 2016 Convention on the International Trade in Endangered Species (CITES) 17th Conference of Parties (CoP17) Decision 17.239 to **include all African pangolins in Appendix I** (which lists the most endangered species) (C2, C7). This listing **prohibits international trade in all 4 African pangolins**; now crucial as African pangolins represent the largest source for the international market, which has already

driven Asian species to critical endangerment (see [UNODC, Wildlife Crime: Pangolin scales, 2020](#)). Dr Koumba Pambo, head of the Gabon CITES Scientific Authority, qualifies that Stirling research is “*driving our agenda on combatting wildlife overhunting, particularly their work showing how international trade is implicated. Our approach to pangolin conservation is now widely acclaimed*” (C7).

Impact 3: New laws to reduce public health risk from novel zoonotic disease transmission

New Stirling research in 2020 showed that high-risk species contact each other in the wild (R6), that these species are regularly hunted and consumed (R1, R2, R4) and that the COVID economic shock could increase contact between wildlife and humans (R5). This evidence underpinned **Gabon’s 2020 decision to prohibit domestic trade in pangolins, bats, and primates** (C6a, C1b) and to include public health concerns in the 2020 Protected Species by-laws (C1a,b), legally binding the country to better safeguards against zoonotic disease emergence from the wildlife trade. This legislation reduced pangolin consumption (C1c) and directly benefits public health in the whole population of 2,200,000 people.

5. Sources to corroborate the impact

- C1 a)** 2020 By-law (*Arrêté*) 0041/PR/MEFMEPPCODDPAT of 04/11/2020 with changes to hunting seasons to promote subsistence food security, and **b)** 2020 by-law for public health 0024/PR/MEFMEPPCODDPAT of 31/03/2020 banning pangolin and bat consumption, and **c)** press article highlighting the decline in pangolin sales following this ban. In French.
- C2 a)** 2016 CITES Notification to Parties of new listing of African Pangolins on Appendix I, and **b)** CITES report on implementation of Decisions 17.239 and 17.240, citing Stirling Research (R4), **c)** Pangolin Conservation Strategy, proposed by Stirling to Gabon National Parks Agency, following new joint research (including R3 and R4-and citations therein). Adopted in 2017.
- C3** 2019 Gabon Penal Code, Law n°042/2018 of the 5th July 2019, highlighting increased penalties for Wildlife Crimes in Livre 6(1) pp.128-9 and Livre 7(3) pp.136-138. In French.
- C4** 2018 Bylaw 000937/MEFEDD/SG/DGFAP of 11 July 2018. Legal basis for the *Programme de Protection de la Faune* of the Ministry of Water and Forests, which adopted Stirling research in the design of the national wildlife monitoring (Article 6) (see also C6). In French.
- C5** Testimonial from Mr Christian Tchémambela, Head of National Parks Agency, stating the importance of Stirling research in developing wildlife monitoring and protection. In French.
- C6 a)** Testimonial from Professor Lee White, Gabon Minister of Water, Forests, Seas and Environment, stating importance of Stirling research in developing sustainable hunting policies, practices and reforms, the Wildlife Protection Programme (on logging concessions), CITES positions for pangolins and other species, and national policies to mitigate disease risk in wildlife use, and **b)** the EU SWM programme: <https://www.swm-programme.info/gabon>
- C7** Testimonial from Dr Aurelie Flore Koumba Pambo, Head of CITES Science Authority in Gabon, stating importance of the Stirling research in achieving better protection for pangolins.
- C8 a)** Testimonial from Senator Paul Koumba Zaou of the Senate Rural Development and Wildlife Conflict Group detailing the importance of Stirling research in policies to safeguard subsistence livelihoods whilst improving biodiversity outcomes in line with international commitments. In French. and **b)** the 2010 Stirling co-authored report Sen. Koumba Zaou commissioned as Director of Forests. <http://hdl.handle.net/1893/26126>.
- C9 a)** Coad et al., 2019, <https://doi.org/10.17528/cifor/007046> CBD Secretariat Technical Report commissioned in 2018 after Decision XIII/8, paragraph 5(a) and Decision XII/18 paragraph 13. Co-authored by Stirling and citing 15 Stirling research papers, and **b)** CBD papers 2008-2018 demonstrating sustained UN-CBD use of Stirling research: CBD Technical Report 33 (2008), **c)** CBD Decision XII/18 (2014), **d)** CBD/SBSTTA/20/INF/46 (2016), **e)** CBD/SBSTTA/21/INF/6 (2017), **f)** CBD/COP/DEC/14/7 (2018).
- C10** www.wildmeat.org Stirling co-founded online database collating all available empirical evidence of the scale of wildlife hunting and use across the tropics. These data are used to support national planning in Gabon and other countries.