How Could Hunting and Fishing Policies and Practices Influence the Future of the Congo Basin Biodiversity and Ecosystems?

N. van Vliet, J. Semeki, J. Kyale, P. Mafwila, J. M. Mondo, H. Vanthomme, J. Nyumu, J. Muhindo, S. Nziavake, E. Mbangale, D. Mukubi, C. Vermeulen, S. Ratiarison, D. Cornelis, F. Sandrin, E. Sartoretto, H. Boulet, and R. Nasi

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N. van Vliet (✉)
CIFOR-ICRAF, Kenya, Cameroon

J. Semeki
University of Kinshasa, Kinshasa, Democratic Republic of Congo

J. Kyale
Université de Kisangani, Kisangani, Democratic Republic of Congo

P. Mafwila
Université de Kinshasa, Kinshasa, Democratic Republic of Congo

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Abstract

Terrestrial and freshwater wildlife in the Congo Basin provide crucial ecosystem services, food, medicine, and income, for millions of rural and urban communities. However, unsustainable hunting and fishing have caused significant ecological disruptions, including population declines and altered species composition, threatening biodiversity and livelihoods. Despite political and scientific efforts, overharvesting continues, driven largely by persistent poverty, limited protein and income alternatives, and rising demand fueled by population growth, urbanization, and migration. Modern technology and improved transport have shifted practices from subsistence to commercial exploitation, increasing pressure on wildlife. Traditional resource governance, weakened since colonial times, struggles to regulate use, while conflicts exacerbate wildlife exploitation through displacement and increased firearm availability. Meanwhile, deforestation, habitat fragmentation, and mining pollution further degrade ecosystems and complicate sustainable management.

In response, Congo Basin countries have made strides toward more sustainable wildlife management. There is a clear shift from exclusionary, militarized conservation to community-based wildlife management (CBWM), empowering Indigenous Peoples and local communities by integrating traditional knowledge with modern practices. Efforts have evolved from expert-driven solutions to community-focused, nature-based businesses, alongside campaigns to reduce wildmeat consumption in urban areas. National recognition of hunting and fisheries' roles in poverty alleviation has increased, prompting policy reforms

J. M. Mondo
Université Evangélique en Afrique, Kinshasa, Democratic Republic of Congo

H. Vanthomme · D. Cornelis
CIRAD, Montpellier, France

J. Nyumu · J. Muhindo · S. Nziavake
SOWILD, Kisangani, France

E. Mbangale
CIFOR-ICRAF, Kisangani, Democratic Republic of Congo

D. Mukubi
Ministère de l Environnement, Kisangani, France

C. Vermeulen
Université de Liège, Gembloux, Belgique

S. Ratiarison
FAO, Libreville, Gabon

F. Sandrin
WCS, Kigali, Rwanda

E. Sartoretto · H. Boulet
FAO, Rome, Italy

R. Nasi
CIFOR-ICRAF, Bogor, Indonesia

to formalize these sectors and improve regulation under initiatives such as the Sustainable Wildlife Management program and the Central African Regional Program for the Environment. Additionally, countries are adopting biodiversity-positive practices in logging and mining sectors through certification schemes and legal reforms, though challenges remain in scaling these measures.

Financially, although some steps have been taken recently, there is a need for a more meaningful transition toward innovative finance mechanisms to support sustainable wildlife management and to explore the development of wildlife-based economies. Initiatives such as the BIOFIN program, the Central Africa Forest Initiative, and the High Integrity Forest Finance Initiative are fostering investment, policy dialogue, and sustainable funding models to ensure wildlife and community well-being in the Congo Basin's future.

Keywords

Drivers of unsustainable use · Community-based wildlife management · Alternative livelihood projects · Behavior change · Enabling policy frameworks · Sustainable finance

Introduction

Terrestrial and freshwater wildlife in the Congo Basin provide essential ecosystem services, including food, medicine, and income for both rural and urban populations. These resources are fundamental to the livelihoods, culture, and well-being of millions of people. However, the unsustainable exploitation of wildlife has already triggered significant ecological shifts, leading to changes in species composition, declines in population sizes, localized depletions, and alterations in population traits in both aquatic and terrestrial ecosystems (Wilkie et al. 2019). Such disruptions have cascading effects, threatening biodiversity, destabilizing ecosystems, and undermining the livelihoods of those who depend on these resources (Abernethy et al. 2013). In the Congo Basin, despite political statements and scientific efforts to address wildlife overharvesting, hunting and fishing continue to drive biodiversity loss and undermine the livelihoods of dependent communities, exacerbating the ongoing biodiversity crisis in tropical regions (Coad et al. 2019).

The main drivers of unsustainable use have not changed significantly since the early 2000s (Ingram et al. 2021). Communities in the Congo Basin rely heavily on wildmeat and fish for food and income due to poverty, few alternatives, and the high cost of other protein sources. Rising demand for wild protein, advances in hunting and fishing technology, along with better preservation and transportation, have transformed these activities from small-scale subsistence to widespread commercial exploitation, increasing pressure on wildlife. Traditional resource management systems struggle to regulate use effectively. Conflicts worsen the situation by causing displacement, insecurity, and wider access to firearms, with some armed groups exploiting wildlife for profit. Meanwhile, deforestation, habitat loss, and pollution,

especially from mining, damage ecosystems and threaten biodiversity and human health, making sustainable management even more challenging.

Despite these challenges, governments are increasingly pressured to provide innovative solutions that can trigger transformative change to balance conservation and human needs, particularly in view of the objectives set aside by the Global Biodiversity Framework from the Convention of Biological Diversity. Over the past two decades, Congo Basin countries have taken significant steps to mitigate unsustainable hunting and fishing through a range of initiatives. These include efforts to officially recognize these informal sectors and build resilient policies that account for the important role that communities and the private sector can play in conservation, the promotion of community-based conservation approaches, and efforts to scale alternative livelihoods for wildlife-dependent communities while promoting more culturally respectful behavior changes (FAO 2021; Coad et al. 2019). Despite these efforts, challenges remain in ensuring effective implementation and long-term success.

This chapter examines the drivers of unsustainable hunting and fishing, explores the obstacles to creating an enabling environment for sustainability, and discusses how existing initiatives can be expanded and integrated into broader conservation and development frameworks. By addressing these issues, we aim to highlight pathways toward a transformational change in hunting and fishing in the Congo Basin for a future where both wildlife and people can thrive sustainably.

Barriers and Challenges to Sustainable Hunting/Fishing

Lack of Alternatives and Poverty

Due to a lack of viable food and income alternatives, communities and wildmeat/fish traders in the Congo Basin are often trapped in a cycle of overhunting and overfishing, driven by the increasing number of actors involved in the trade and the expansion of wildmeat and fish markets at regional and national levels (Coad et al. 2019). Wildmeat and fish trade is primarily fueled by poor socioeconomic conditions, limited employment opportunities, and the high cost of producing alternative protein sources (Nasi et al. 2011). For many rural communities and wildmeat traders, hunting and fishing remain essential for both food and cash income (Abernethy et al. 2016). Wildmeat and fish also serve as critical safety nets during times of crisis, helping households cope with economic shocks, unexpected cash needs, or income shortfalls (Ogunjinmi et al. 2022; Namwira et al. 2024; Emogor et al. 2024). In Cameroon, educators have turned to wildmeat trading to supplement their salaries when teaching wages are delayed, demonstrating the role of this trade in stabilizing household incomes (Randolph et al. 2022). In remote areas where alternative income sources and food supplies are scarce, the sale of hunting and fishing products provides access to essential goods and services, including medicine, energy, and education (Abernethy et al. 2016). In Kisangani, wildmeat was the most affordable and widely consumed source of animal protein during the 2002 conflict. However, as

peace was restored and households were able to invest in livestock production, domestic meats became more available, cheaper, and consequently more commonly consumed (van Vliet et al. 2014, 2017c). This shift demonstrates that improved market access and safer conditions for domestic meat production can reduce reliance on wildmeat by encouraging the transition to alternative protein sources.

Increased Efficiency of Hunting and Fishing Gears

Over historical times, traditional communities have developed diverse hunting practices to meet their nutritional needs, including capturing small and medium-sized mammals for self-consumption (Fargeot 2013; Duda et al. 2017, 2018; Coad et al. 2019; Fongnzossie et al. 2023). Traditional Baaka hunters still use various techniques such as spear hunting, crossbows, traps, and over 176 plant species in hunting practices (Duda et al. 2017; Coad et al. 2019; Fa et al. 2021, 2022; Fongnzossie et al. 2023). In farming communities, hunting methods continue to include collective hunting with spears, dogs, net hunting, and trapping with organic materials (Walters et al. 2015; Dounias 2016; Coad et al. 2019; Fa et al. 2022). However, over the past 40 years, a drastic shift from subsistence to commercial hunting in the Congo Basin has taken place, leading to the specialization of hunting and changes to more efficient hunting gears (Walters et al. 2015; Ziegler et al. 2016; Ichikawa et al. 2017; Van Gils et al. 2019; Martin et al. 2020; Fongnzossie et al. 2023; Taylor et al. 2015; Abernethy et al. 2016; Coad et al. 2019; Fa et al. 2022; Fa and Funk 2024; Kwidja et al. 2023; Ingram et al. 2025). Rural populations, including the Baaka, have adopted modern techniques like wire traps, head lamps, and firearms, leading to the proliferation of night hunting, losses due to the large number of traps set without regular visits, and the possibility to better target arboreal animals (Dounias 2016; Duda et al. 2017; Martin et al. 2020; Fa et al. 2022). Changes to more commercial hunting have also implied the development of more efficient and diversified preservation methods through salting, smoking, and freezing as well as motorized transportation means (outboard canoes, motorbikes, etc.), which provide easier access to remote forests and facilitate loading larger quantities of biomass back to the markets.

A similar trend has been observed in inland fisheries. Traditional fishing practices included weir, poison, net, line, hook, and bail fishing (Gallois and Duda 2016; Fongnzossie et al. 2023). However, most traditional practices have been declining over the last 40 years in favor of individual and industrial methods (hooks, nylon line fishing, cotton, or nylon netting) (Comptour et al. 2016). Currently, most communities practice a variety of fishing methods, adapted to seasonality, including pond, weir, bait, poison, net, barrier, basket trap (woven with rattan vines and raffia palm stems), line, longline, and harpoon fishing (De Graaf and Garibaldi 2015; Comptour et al. 2016). In the DRC, fishermen commonly use mosquito nets, which capture very small fish and pose an immediate threat to population replenishment at spawning grounds along the Congo River and various lakes (Namwira et al. 2024).

Human Population Trends

The Congo Basin is one of the fastest-growing regions in Africa, experiencing significant population expansion (Ongolo and Karsenty 2011; Leridon 2015). For example, the Democratic Republic of Congo (DRC), home to 100 million people, has a fertility rate of six children per woman, with a similar rate recorded in Cameroon (4.8 children per woman) (Véron 2022). At the same time, the region has the world's highest urbanization rate (Megevand 2013), with new urban spaces emerging at an unprecedented pace and scale (Magrin and Ninot 2021). Between 1950 and 2015, Africa's urban population—particularly in sub-Saharan Africa—increased by 2000% (Didier and Simonneau 2022). In the Congo Basin, urban expansion is driven by economic activities, energy, rural exodus, and population growth. In the DRC, armed conflicts and insecurity in rural areas have further accelerated migration to cities (Jacobs and Kyamusugulwa 2018). This rapid urbanization has profound implications for wildlife. Cities are major consumption hubs for fish and game, with urban markets and restaurants offering wildmeat in high volumes (Igugu and Boutinot 2023; Wright et al. 2022; Simo et al. 2024; Fargeot et al. 2017; Mitchell et al. 2025; Bachand et al. 2015). Although per capita consumption of wildmeat may decline in urban areas, the sheer size of the population means overall demand continues to rise (Bauld et al. 2026). This growing demand fuels the overexploitation of wildlife, with wildmeat trade in major city markets reaching hundreds, if not thousands, of tons (Medzey Me Sima et al. 2024). As a result, hunters are increasingly driven to supply urban markets, intensifying hunting pressure on already vulnerable species (Ingram et al. 2025).

Another factor intensifying pressure on wildlife is migration into rural areas in search of better livelihoods. Climate change impacts in Sahelian countries have driven herders to migrate into the Congo Basin (Gemenne et al. 2017), increasing threats to lions and leopards as transhumant Mbororo herders kill them to protect their livestock, often using firearms and fire (Abossolo and Nkans 2022; Binot et al. 2006). Additionally, the movement and settlement of cattle in protected areas, such as the Bili-Uéré Hunting Reserve in the DRC, heightens competition with wild herbivores (Kiéma 2007). Migration linked to industrial activities also contributes to wildlife depletion. The influx of workers, jobseekers, and their families into logging concessions increases pressure on wildlife, as these newly established populations often have limited alternative food sources (Poulsen et al. 2009). Roads built and maintained by logging companies further intensify wildmeat hunting by providing hunters with greater access to previously unexploited wildlife populations and lowering the costs of transporting wildmeat to markets (Wilkie et al. 2008). Similarly, mining areas in the DRC and CAR attract migrants seeking to exploit gold and diamond deposits (Spira et al. 2019). Once settled, these migrants create conditions that facilitate hunting and the wildmeat trade. Beyond mineral resources, wildlife—particularly elephants and rhinoceroses—also attracts poachers and armed groups that take advantage of porous borders to conduct illegal activities (Funk et al. 2022).

Disruption of Customary Governance Systems Perpetuated Since Colonial Times

Historically, interactions between different civilizations have led to a variety of factors that have disrupted customary systems in the Congo Basin (Verweijen and Van Bockhaven 2020). The arrival of Europeans, with their religious influence, forced displacement policies and centralized authority is cited among the most prominent factors having reshaped local governance systems in Central Africa (Ocheni and Nwankwo 2012). Their monotheistic Western religion weakened and altered cosmologies and traditional practices related to resource management (Hickey 2007). This significantly contributed to the desacralization of customary practices in hunting, agriculture, and fishing (Baco et al. 2007; Savadogo et al. 2011; Juhé-Beaulaton and Roussel 2003). In the Bateke region (Gabon), among the Pouvi, before colonial time, the forest surrounding the villages was divided into named hunting zones, belonging to individual lineages and within a lineage they were divided by households. In these zones only members of the household had exclusive access and resource extraction and management rights, and the ownership of these forest zones was strictly enforced (Walters et al. 2015). However, the colonial resettlement that occurred between 1910 and the 1960s forced some ethnic groups to migrate into the customary lands of other groups, causing resource-use conflicts and concomitantly, laws continually evolved, reducing customary controls over time, and centralizing hunting authority at the state level (Walters et al. 2015). Based on evidence from the Republic of Congo, Mavah et al. (2022) argue that outdated institutions and historical exclusionary conservation since colonial times have led to the disempowerment of local people ("empty laws" open-access syndrome) in which neither national nor local controls are working.

Persistence of Conflict

Another significant factor affecting wildlife populations is conflict (Beyers et al. 2011). The accumulated evidence suggests that war in the Congo Basin has exacerbated both intensive hunting and habitat conversion resulting in an increase in forest cover loss (Butsic et al. 2015) and is detrimental for wildlife (Daskin and Pringle 2022). The region has been plagued by different armed groups, from rebel militias controlling lucrative mineral resources to ethnic factions, perpetuating a state of violence and engendering a climate of fear, instability, and uncertainty for civilian populations. The displacement of populations exacerbates poverty and food insecurity (Brinkman and Hendrix 2010). In Lake Tanganyika (DRC), Namwira et al. (2024) showed that the unpredictable nature of the violence in DRC generates insecurity, loss of equipment, and increase in fishing pressure associated with newcomers, who turn to fishing as a safety net. During conflict, firearms and cartridges become more available, which increases the efficiency and scale of hunting (Braga-Pereira et al. 2020). Smallholders fear to invest in livestock and prefer to rely on hunting for primates, rodents, and ungulates for food and income

(van Vliet et al. 2017c). Certain species are exploited by militia for the lucrative international trade in tusks, horns, skins, and other body parts (Pires and Moreto 2016). Retaliatory killing of wildlife species has also been observed in contexts of food insecurity and war, with increased local resentments toward land-grabbing by authorities contributing to the willingness of local people to engage in illegal exploitation of wildlife resources (Yamagiwa 2003).

Deforestation, Forest Degradation, Fragmentation, and Pollution

Historically, deforestation in the region has been relatively low (Megevand 2013). However, while situations vary from country to country, the Congo Basin is generally under increasing pressure particularly from smallholder forest clearing for agriculture both for subsistence and commercial crop farming (such as for cocoa and oil palm) (Kamath et al. 2024; Zeppetello et al. 2020; Molinario et al. 2020; Tyukavina et al. 2018). In 2019, it was estimated that about 30–40% of tropical moist forests in the region were degraded (Vancutsem et al. 2021). Deforestation also affects some protected areas, such as inside the Yangambi Biosphere Reserve, which presents similar degradation rates inside as outside its boundaries (Kipute et al. 2023). Deforestation is also observed in the miombo forests of DRC, inside the Kiziba-Baluba Hunting Domain (KBHD), where forest loss and fragmentation is progressing at fast pace due to charcoal production and agricultural expansion (Muteya et al. 2024). Given projected increased global demand for food products and regional policy objectives to boost agricultural production, the current rate of disturbances is likely to continue over the next decade. In the business-as-usual scenario, the DRC will have lost 22% of its humid forests by 2050 and 33% of its undisturbed rainforests (Eba'a Atyi et al. 2022). Regions that are most at risk of losing wildlife through deforestation in the next decades are west Cameroon and northeastern and eastern edges of DRC, where cocoa expansion is pushing into biodiversity-rich forests (Kamath et al. 2024). In the Congo Basin, unpaved logging roads used by timber firms, as well as paved and unpaved public roads, have expanded by 50% inside logging concessions since 2003 and by 40% outside logging concessions. Logging activities open up remote forest areas by building roads and establishing permanent camps that not only make these regions more accessible to hunters (Wilkie and Carpenter 1999; Kleinschroth et al. 2019; van Vliet and Nasi 2008) but also facilitate the establishment of new agricultural frontiers, except along abandoned unpaved roads inside certified forest concessions (Kleinschroth et al. 2019).

A major factor affecting aquatic wildlife in the Congo Basin is pollution associated to mining activities. Various processes, including deforestation, soil degradation, chemical contamination of aquatic and terrestrial systems, and changes to the turbidity of watercourses, largely affect wildlife, particularly amphibians and freshwater fish (Schure et al. 2011; Dossou Etui et al. 2024). In Lubumbashi (DRC), mining activities for the hydrometallurgical extraction of copper and cobalt have resulted in toxic metal liberation and contamination of the surrounding soil and the

near to surface waters endangering wildlife and human health (Ramazani et al. 2022). Coltan mining and the illicit trade generate major environmental impacts, including on sites of historical heritage and indigenous lands (Ojewale 2022). In Lake Tshangalele, which receives effluents from metallurgical and mining plants in Likasi, high concentrations of cobalt, copper, iron, manganese, zinc, and aluminum were found in fish collected closest to the copper mining plant. Metal contamination from mining activity is of great concern because of potential health risks to the local inhabitants due to the consumption of heavily contaminated fish (Squadrone et al. 2016).

Transformational Changes for Sustainable Wildmeat and Inland Fisheries Sectors in the Congo Basin

From Expert-Driven Alternatives to Bottom-Up Solutions for Livelihood Diversification Among Hunters and Wildmeat Traders

In the Congo Basin, expanding access to alternatives to wildmeat is essential for reducing pressure on wildlife while ensuring food security. Early interventions in the 2000s explored various alternatives, including sustainable agricultural and forestry practices, domestication of wild species, livestock rearing, and aquaculture (van Vliet et al. 2016). Since then, many initiatives have focused on promoting terrestrial animal farming, particularly pig, snail, and cane rat rearing (Willis et al. 2022). However, these projects often lacked the necessary enforcement, long-term monitoring, and impact evaluations, limiting their effectiveness (Wicander and Coad 2018).

Building on past lessons, the CARPE alternative livelihood projects have emphasized the importance of a people-centered approach and the involvement of rural development experts to ensure successful integration within conservation landscapes (Yanggen 2010). Crucially, shifting reliance away from wildmeat and fish requires new food and income sources that offer greater benefits than the environmentally harmful activities they seek to replace (Brown and Williams 2003). In the Democratic Republic of Congo (DRC), research by Nyumu et al. (in press) demonstrated that higher-income alternatives, such as pig farming, can significantly contribute to wildlife conservation, as observed in the Yangambi landscape. Properly designed farm subsidies have the potential to reduce hunting frequency and, thus, volume of wildmeat taken out of forests and to bring down the costs of domestic meat compared to bushmeat in rural areas (Nana et al. 2022). To be effective, alternative livelihoods must be embedded within broader land-use or resource management plans and developed through participatory approaches that strengthen local capacity. Community-based strategies that involve local populations in planning and implementation have been particularly effective in aligning conservation objectives with local needs and cultural values.

Fish farming has long been recognized as a potential solution to food insecurity and the overexploitation of fish resources (Micha 2013). The first aquaculture efforts

in the Congo Basin began in 1946 in Lubumbashi, DRC, with the introduction of tilapia species from Lake Moëro. Initially promising, these efforts expanded under colonial rule but declined following independence due to a lack of public sector support. Today, fish farming in the region remains underdeveloped. Rural fish production is minimal due to poor pond management practices, inadequate access to quality fish feed and seeds, a shortage of training programs for young farmers, and low market integration (Micha 2013). More advanced semi-intensive and intensive fish farming systems are virtually absent, except for a few projects such as the Fish Culture Project in Katanga. The development of aquaculture is hindered by weak policies, uncoordinated interventions by NGOs and international organizations, and the predominance of subsistence-level projects that fail to transition into viable commercial enterprises (Chan et al. 2021). Other major barriers include the lack of fish-feed industries, limited access to capital, and poor control over production technologies (Thiao and Bunting 2022). Without a shift toward viewing aquaculture as a business opportunity rather than a subsistence activity, its full potential will remain unrealized. Policy interventions should promote value-added processing initiatives to prevent post-harvest losses, maintain market value, and improve the profitability and sustainability of fish farming.

From Criminalization to Sustainable Consumption Choices

Efforts to increase the availability of alternative food sources must be accompanied by strategies to shift consumption patterns, particularly regarding wildmeat. Behavior change campaigns aimed at reducing wildmeat demand in urban areas are an emerging field in the Congo Basin, focusing on altering consumer preferences and promoting sustainable alternatives. Effective interventions address both the supply and demand sides by shifting social norms and consumer behavior. Research has shown that wildmeat consumption is driven by accessibility, cultural preferences, and the lack of affordable alternatives (van Vliet and Mbazza 2011). In Brazzaville, Chausson et al. (2019) found that wildmeat is perceived as natural, tasty, and healthy, with cost and availability being the primary barriers to purchase. While locally produced fish, meat, and poultry are generally viewed positively, imported frozen animal proteins are often considered unhealthy and of poor quality. Understanding these socioeconomic and cultural factors is essential for designing successful behavior change campaigns that promote sustainable food choices (van Vliet et al. 2017b). Research has highlighted the importance of audience-specific communication strategies, using messages that resonate emotionally and culturally with local populations. In Southern Cameroon, Simo et al. (2024) found that the lack of awareness regarding health risks associated with wildmeat consumption was a key barrier to shifting consumer behavior, particularly regarding endangered pangolin species. Similarly, Marracoli et al. (2019) suggested that hunter self-monitoring in the Republic of Congo could be a valuable tool for initiating behavior change and tracking resource trends among hunters. A useful framework developed by the Wildlife Conservation Society (WCS) was initially designed for major urban centers

in the Congo Basin and later adapted to rural, protein-poor towns. This approach addressed the entire wildmeat value chain, offering consumers sustainable legal alternatives while engaging stakeholders in other economic activities (Wieland et al. 2022).

However, evidence on the effectiveness of such interventions remains mixed. Some studies have shown positive trends but lacked statistical significance, suggesting the need for caution when scaling these strategies (Chaves et al. 2017; Veríssimo et al. 2018). Moreover, while behavior change approaches can contribute to a more sustainable wildmeat sector, ethical concerns must also be considered to ensure that they are compatible with the values of resource users (Nana et al. 2022). Indeed, interventions must take into consideration the multiple intrinsic (e.g., attitude, moral obligation, perceived legitimacy of rules) and extrinsic (e.g., social pressure, customary laws) social incentives that interact to influence attitudes and the decision to enter and remain in wildmeat trade or consumption (Nana et al. 2022). Guidelines should be established to assess potential risks and ensure that interventions do not disproportionately affect vulnerable communities (van Vliet et al. 2022). Ultimately, behavior change strategies must be part of a broader system that includes community participation, equitable access to conservation benefits, land rights, and viable alternative livelihoods. Addressing wildmeat consumption effectively requires integrated approaches that tackle its multiple drivers, from market dynamics to cultural preferences and economic incentives (Thomas-Walters et al. 2020; van Vliet et al. 2022).

From Exclusionary Conservation to Community-Based Wildlife Management

In the 1990s, conservation models in the Congo Basin largely based on militarized conservation, overlooked the complex values wildlife holds for local people, focusing instead on Western-oriented approaches, which have been described as a form of "cultural imperialism" in addressing the unsustainable uses of wildlife (van Vliet 2018). The limits of fortress conservation in the Congo Basin have become increasingly evident in the twenty-first century, with the realization that highly militarized, top-down approaches cannot sustain long-term conservation goals at scale (Wellsmith 2011; Bennett 2011; Challender and McMillan 2014; Cooney et al. 2017). These approaches have sparked a "cultural backlash," which not only undermines conservation efforts but also exacerbates local conflicts and negatively impacts livelihoods. Anti-poaching units have faced criticism for human rights violations (Pihälä et al. 2016), failing to build institutional capacity within governments (White et al. 2023), and even fueling conflicts rather than resolving them (van Vliet et al. 2017c). Historically, the establishment of protected areas has often meant the forcible displacement of local populations who relied on forests for their livelihoods, creating lasting resentment and conflict (Walters and Wardell 2023). In Virunga National Park, law enforcement efforts have failed to stop poaching, instead fueling armed mobilization and resistance poaching (Marijnen and Verweijen 2016;

Verweijen and Marijnen 2018). Extreme law enforcement tactics can criminalize rural and Indigenous communities, trapping them in cycles of illegality and unsustainable practices that lead to both ecological and cultural losses.

In response, there is now growing recognition that empowering local communities in wildlife management presents a more effective alternative to fortress conservation (Challender and Mc Millan 2014; Inogwabini 2014; Mavah 2015). In Central Africa, Community-based Wildlife Management (CBWM) remained limited until the 1990s, primarily driven by short-term projects with minimal empowerment of local decision-makers (Roe et al. 2000). For decades, CBWM was also hindered by conflicts between customary and national land tenure systems, which disempowered local communities (Tchigio 2007; Walters et al. 2015). However, in recent decades, CBWM has gained new momentum, largely due to the recognition of Indigenous Peoples and Local Communities' (IPLCs) rights to manage the resources they depend on. Programs like the Sustainable Wildlife Management (SWM) initiative, which operates in several Congo Basin countries since 2017, define CBWM as a collaborative process in which rights holders manage wildlife sustainably (FAO 2021). CBWM not only integrates traditional knowledge with modern conservation practices (Pollock and Whitelaw 2005) but also acknowledges the utilitarian relationships rural populations, especially poorer households and women, have with wildlife, often driven by the need to mitigate risks like crop raiding (Rickenbach et al. 2017). Additionally, CBWM recognizes the cultural and spiritual connections to wildlife, such as wildmeat and fish consumption during ceremonies or hunting and fishing as symbols of prestige (van Vliet and Mbazza 2011; Dounias and Ichikawa 2017). Moreover, CBWM addresses the costs of living alongside wildlife, including agricultural damage and livestock loss, which have often been neglected in previous conservation models (Gomez et al. 2022) and empower communities to engage in wildlife monitoring to improve decision-making and enable local populations to benefit from wildlife management (Froese et al. 2022). At the core of CBWM is the promotion of social cohesion and human rights principles such as free, prior, and informed consent (FPIC), equitable benefit-sharing, and conflict resolution (FAO 2021). In this context, community-based monitoring systems present a cost-effective and empowering approach to wildlife data collection. By involving local communities in monitoring wildlife populations, habitat health, and resource use, these systems not only generate valuable ecological data but also strengthen local stewardship and build technical capacities, integrating traditional ecological knowledge (TEK) with modern scientific methods (van Vliet et al. 2017a).

However, CBWM still faces significant challenges in the Congo Basin, including the low capacity of local communities to self-regulate and to exclude outsiders (Ingram et al. 2021). Recent initiatives emphasize the importance of creating policy environments that recognize community rights and ensure decision-making processes are community-driven. At the community level, wildlife management institutions are scarce at present; communal rights to wildlife do not extend to management, ownership, or exclusion; and communities are excluded from formal co-management (Mavah 2015). Laws that disregard customary practices are ineffective because they exclude local populations from decision-making on traditional lands and restrict their ability to regulate wildlife offtakes and benefit from them

(Nana et al. 2022). These legal frameworks often impose complex licensing procedures that exceed the administrative and financial capacities of local communities (van Vliet 2018) and result in tensions between local communities and their governments, exacerbating conservation conflicts (Egbe 2001; Nana et al. 2022). For CBWM to succeed, it must involve substantial power transfers to ensure communities directly benefit from wildlife management and actively participate in decision-making (DeGeorges and Reilly 2009). Addressing these challenges will be key to ensuring the long-term success of community-based approaches to wildlife conservation in the Congo Basin.

From Invisible Sectors to Improved Statutory Recognition and Attention

Hunting and freshwater fisheries form a vital part of the informal economy in the Congo Basin, providing essential food and income for poor communities, thereby contributing to poverty reduction and lowering inequality. Despite their significance, these sectors have not been adequately recognized in formal policy frameworks (Enns et al. 2023). Hunting for wildmeat is often indiscriminately labeled as "illegal," failing to distinguish between subsistence hunting, which definition in legal texts is often blurred and more harmful illegal practices like organized wildlife trafficking (Ingram et al. 2021; Enns et al. 2023). This generalized stigmatization complicates efforts to create clear, fair regulations. National food security databases rarely capture the economic contributions of wild foods like wildmeat or freshwater fish, with even major databases like FAOSTAT failing to fully reflect their role in regional food security (Ziegler 2016). A significant barrier to effective wildlife and fishery management has been the lack of formal policies that reflect the collective views and values of local communities regarding wildlife. The lack of clear regulations around inland fisheries and hunting limits innovation in promoting sustainable practices while also preventing countries from fully adhering to international biodiversity commitments, such as Target 9 of the Convention on Biological Diversity (CBD), which encourages the sustainable use of wildlife. The legal ambiguity and outdated laws across much of Central Africa contribute to confusion and insecurity for subsistence hunters and fishers. These gaps fuel underground markets that are difficult to regulate and dilute accountability for sustainability (van Vliet 2018). In many Central African countries, wildlife laws are outdated and fragmented, creating contradictions and inconsistencies across various legal sectors (Mavah et al. 2022). Key concerns include the unclear recognition of hunting and fishing rights for subsistence or trade, insufficient regulatory tools to implement laws (such as permits and certificates), and the imposition of constraints that are unrealistic given local customs.

While some Congo Basin countries had developed national wildmeat strategies in the early 2000s, these efforts were largely driven by international NGOs with minimal involvement from national governments or local communities. These strategies seldom received official validation from government authorities. Similarly,

while countries like the DRC and the Republic of Congo (RoC) have developed inland fisheries strategies, most countries in the region do not have a specific inland fisheries strategy. Besides, where inland fisheries strategies exist, their implementation is hindered by insufficient infrastructure, lack of expertise, and political instability. Another challenge is the absence of financial mechanisms to support these strategies, which prevents timely mobilization of resources for effective implementation. For instance, a financial plan identifying domestic and international funding needs is often missing, making it difficult to gather necessary resources for implementation.

Nevertheless, over the past decade, Gabon has developed and updated its bushmeat strategy and the DRC is engaged into a similar process. A positive shift is emerging in the region, driven by the need to implement the Kunming-Montreal Global Biodiversity Framework (KM-GBF), adopted at the fifteenth Conference of Parties to the Convention on Biological Diversity (CBD COP 15). Target 5 of the KM-GBF urges countries to ensure that the use, harvesting, and trade of wild species are sustainable, safe, and legal, to prevent overexploitation while target 9 emphasizes sustainable management and use of wild species to provide social, economic, and environmental benefits. This aligns with the ongoing updates to National Biodiversity and Action Plans, a key tool for KM-GBF implementation at the national level. Also, countries in the Congo Basin are increasingly adopting the One Health framework to align conservation and resource management with public health and food security. Given the close links between wildlife, fisheries, and human populations, unsustainable resource use can lead to biodiversity loss, disease spillover, and ecosystem degradation. National strategies for sustainable wildlife management are now integrating this approach, recognizing the interconnectedness of human, animal, and environmental health. As part of these efforts, the multi-year INFORBIO program (INtact and effectively managed FORests and BIOdiversity) aims to implement an early warning system to prevent the spread of infectious diseases. For example, sustainable fisheries management should incorporate disease surveillance in fish populations to prevent outbreaks that could threaten both wildlife and human communities. Similarly, regulating bushmeat trade and promoting alternative protein sources can reduce the risk of zoonotic diseases while ensuring food security. Collaborative efforts between conservationists, public health experts, veterinarians, and policymakers are essential to implementing One Health strategies effectively. By integrating ecosystem health considerations into conservation policies, Central African countries can create resilient management systems that benefit both people and nature.

National efforts to strengthen legal frameworks for wildlife protection are crucial in curbing unsustainable hunting. Recently, Congo Basin countries have updated and enacted new wildlife conservation laws to increase penalties for illegal hunting and trade. For instance, all countries except the Republic of the Congo have passed legislation on community forestry, granting forest management decision-making rights to local communities (Trefon 2017). In Cameroon, securing tenure rights for local communities has also improved compliance with wildlife and forest regulations (Tegegne et al. 2022). The DRC and Gabon have introduced stricter penalties for

poaching and illegal wildlife trade and updated their protected species lists, which has led to a reduction in illegal activities (Nasi et al. 2021). These countries are also enhancing wildlife management laws, recognizing the rights of Indigenous peoples and local communities, incorporating gender considerations, and addressing conflicts. The DRC, for example, recently enacted a law to protect the rights of Indigenous Pygmy Peoples though outcomes are yet to be experienced. Regional initiatives have supported legal reforms and enforcement. Programs such as the Central African Regional Program for the Environment (CARPE) and the Congo Basin Forest Partnership (CBFP) have fostered cross-border collaboration, resource-sharing, and intelligence exchange. Regional capacity building for law enforcement has also been a priority, with initiatives like the Monitoring of Illegal Killing of Elephants (MIKE) program, which trains law enforcement personnel and gathers data on illegal activities to inform decision-making (Mubalama and Bashige 2006). These efforts have enhanced enforcement capabilities and helped combat poaching networks (Van Doormaal et al. 2022). Nevertheless, research has shown the need to further improve public awareness, the surveillance and investigative capabilities of frontline officers, and education of judicial actors on wildlife laws to strengthen the criminal enforcement system (Ntungfor and Atanga 2017; Cox et al. 2006). More recently, efforts from different donors (EU, USFW, GEF, etc.) have developed into long-term programs (e.g., FAO Gestion durable de la faune, Sustainable Wildlife Management, etc.) generating momentum for sustainable use in the Congo Basin. These large programs have contributed to enhance governmental capacities to improve policies for sustainable wildlife use. The CBFP's 2023 report highlights the success of a Ba'ka project in promoting gender equity and forest conservation in Cameroon. In the Central African Republic, efforts have focused on managing transhumance. Additionally, the Sustainable Wildlife Management Program (SWM), implemented since 2018 in DRC, Republic of Congo, Cameroon, and Gabon, aims to strengthen legal frameworks for sustainable exploitation of wildmeat and fish (SWM Report 2021). Legal hubs have been established to analyze policies and provide recommendations to improve national wildlife management, aiming to ensure these resources contribute to the food security and well-being of Indigenous Peoples and Local Communities (IPs and LCs), for whom forests are vital cultural and natural resources.

From Mitigation of Impacts to Biodiversity-Positive Measures in Logging and Mining Concessions

Logging is one of the most extensive extractive activities across Central Africa's remaining forests, where 30–40% of forests fall within commercial logging concessions (Laporte et al. 2007). The conservation value of degraded forests depends on how logging affects biodiversity, either directly, through forest structure alteration and fragmentation, or indirectly, through increased hunting, disease transmission, and deforestation for agriculture (Clark et al. 2009). Logging often leads to road building, more job seekers moving in, and a rise in commercial hunting and wildlife

trade (Wilkie et al. 2000; Fa et al. 2005). These indirect impacts affect wildlife more significantly than the extraction of timber itself (Milner-Gulland and Bennett 2003). Given the large tracks of selectively logged forests they manage, private logging concessions expand conservation areas in Central Africa by maintaining viable large mammal populations (Clark et al. 2009). Research from certified concessions in countries like the Republic of Congo and Gabon indicates that these areas support healthy wildlife populations, comparable to those in national parks (Poulsen and Clark 2010; Yoh et al. 2024). While forest elephants face increasing constraints from roads across the Congo Basin (Blake et al. 2008), logging roads do not act as barriers to them. Scalbert et al. (2023) found that secondary logging roads and skid trails are not avoided by large mammals—forest buffalos prefer secondary roads, while gorillas and chimpanzees use a mix of secondary roads, skid trails, and elephant paths.

As such, when integrated with proper management strategies, certified logging concessions can contribute to wildlife conservation. Until now, certification schemes, such as those from the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC), have mostly focused on reducing the negative impacts of logging operations on wildlife. These certifications promote responsible logging by enforcing environmental, legal, and social standards (ATIBT 2023). While FSC operates based on global principles, PEFC supports national schemes. Both seek to minimize logging's negative impacts on wildlife by addressing poaching and wildmeat consumption through hunting management strategies (Haurez et al. 2020). FSC emphasizes documenting and regulating hunting, whereas PEFC requires comprehensive wildlife management plans and designated legal hunting zones. Effective interventions within certified forests include optimal road network planning, providing alternative protein sources for staff, managing community-based hunting to benefit local livelihoods (e.g., CIB concession in the Republic of Congo), controlling external access, and preserving high-biodiversity ecosystems within concessions (van Vliet and Nasi 2008; Nasi et al. 2012; Poulsen and Clark 2010; Clark et al. 2009). However, these effective and positive actions toward biodiversity in logging concessions have a cost for the private sector, which they can't bear, even less so with the increased competition from non-certified logging companies. Until now, most support to implement these positive measures has come from projects that have tested these measures at site level. Bringing those measures at scale and mainstreaming them across all logging concessions will require new legal provisions, the renewal of management plans, and sustainable financial resources to support the logging sector in better contributing to the 30*30 agenda.

While certification in logging concessions has made significant steps in addressing wildlife conservation, certification in the mining sector in the Congo Basin was driven by the urgent need to address human rights abuses, promoting gender equality, eradicating child labor, improving worker safety, and ensuring fair wages, with less emphasis on mitigating environmental impacts. A recent study by the World-Wide Fund for Nature (WWF) provides recommendations for reconciling

mining and biodiversity conservation in the Congo Basin. These include improving governance in the mining sector, enforcing bans on mining exploration and activities in protected areas, and developing a common policy and strategy for the sector's sustainable growth, but no mention is made about the need to address the impacts of mining on wildlife (WWF 2017). Much could be learned from the forestry sector in that respect, specially with the expected growth of mining activities in the Congo Basin.

From Project-Driven Wildlife Management to Sustainable Finance for Permanence

Most wildlife conservation and management initiatives in the Congo Basin over the past 40 years have been largely driven by official development assistance (ODA) and through project cycles. While these efforts have certainly provided the possibility to test meaningful conservation models at site or landscape scales, there is a growing interest in ensuring efforts on the ground can be sustained for permanence through sustainable financial mechanisms. Broadly speaking, countries are transitioning from public finance for nature to private financial streams (Piemonte et al. 2019). The recent collapse of USAID and the stagnation of ODA funds (except for refugee costs and humanitarian aid) (OECD, https://www.oecd.org/en/topics/oda-trends-and-statistics.html) urges governments in the Congo Basin to explore innovative solutions for the long-term sustainability of biodiversity conservation, including wildlife conservation and management. Most donors are transitioning from grant-based processes to blended finance as mechanisms that can leverage the financial flows necessary to cover the biodiversity funding gap.

Wildlife is an economic asset by nature, as it can generate a diverse range of wildlife economies. Wildlife economies are businesses and economic activities that either directly depend on wildlife or contribute to wildlife conservation through their activities (Snyman and Bricker 2021). Wildlife economies in Central Africa focus on five categories of activities: ecotourism, trophy hunting and fishing, game meat hunting, artisanal and small-scale fishing, and wildlife ranching. In wildlife economies, the use of wildlife generates enough income to manage the resource in a sustainable manner while providing meaningful revenues for people. However, as opposed to Eastern and Southern Africa, the Congo Basin hasn't yet explored its full potential in developing wildlife-based economies, and there is scope for innovation in the development of wildlife economies that can benefit local communities and sustain stewardship for wildlife.

However, given the financial gap to conserve wildlife in Central Africa, there is a clear need to expand financial flows for the long-term permanence of wildlife conservation and management initiatives. There is now a global surge in the practice of valuing nature in the global economy through the development of "nature markets" (Nature Finance 2024). The biodiversity finance landscape is changing, with both domestic and international financial flows growing and the range of financing instruments significantly wider than ever before, including debt-for-nature

swaps, corporate funding, biodiversity and carbon markets, payments for ecosystem services, and bonds (BIOFIN 2024). Central African countries have not yet explored the full potential for developing innovative funding mechanisms to benefit wildlife conservation and management. A fundamental challenge for Central African governments is understanding how various financial flows are, or can be, better leveraged to fund the biodiversity gap (BIOFIN 2024).

CAFI (Central Africa Forest Initiative) was established in 2015 for six partner countries (Central African Republic, the Democratic Republic of the Congo (DRC), the Republic of Cameroon, the Republic of Congo, the Republic of Equatorial Guinea, and the Republic of Gabon) as a trust fund supporting direct investments on the ground and a political negotiation platform that aims to drive high-level policy dialogue for forests and biodiversity conservation. More recently, the High Integrity Forest Finance Initiative (HIFFI) was launched to reshape conservation finance by ensuring long-term, high-integrity funding for tropical forests. Led by COMIFAC (Central African Forest Commission) and supported by WWF, the HIFFI demonstrates that conservation is not just about protecting species; it is about creating economic models that incentivize governments, businesses, and communities to prioritize nature-based solutions.

Conclusions

Sustainable hunting and fishing in the Congo Basin face multiple, interconnected challenges. Poverty, limited alternatives, and high costs of other protein sources keep communities reliant on wildmeat and fish for food and income, especially during crises. Modern hunting and fishing gear, improved preservation, and better transport have shifted practices from subsistence to large-scale commercial exploitation, increasing efficiency and pressure on wildlife. Rapid population growth, urbanization, and migration, driven by conflict, climate change, and industrial expansion, boost demand for wild protein, while infrastructure like logging roads facilitates access to remote areas. Colonial-era erosion of customary governance weakens traditional resource controls, and conflict exacerbates hunting through displacement, insecurity, and greater firearm availability, with some armed groups exploiting wildlife for trade. Additionally, deforestation, habitat fragmentation, and pollution, particularly from mining, degrade ecosystems and threaten biodiversity and human health, complicating sustainable resource management.

To address these challenges, Congo Basin countries have made significant efforts to address the drivers of unsustainable hunting and fishing. First, there has been a shift from exclusionary, militarized conservation to community-based wildlife management (CBWM), which empowers Indigenous Peoples and local communities (IPLCs) to combine traditional knowledge with modern conservation, addressing ecological, cultural, spiritual, and livelihood concerns. Efforts to reduce wildlife pressure and enhance food security have evolved from expert-driven solutions, like sustainable agriculture, livestock, and aquaculture, which struggled with

enforcement, to community-centered approaches that promote nature-based business opportunities. Emerging campaigns aim to reduce wildmeat consumption by shifting behavior in urban and rural areas, though cultural and socioeconomic factors remain challenging. A comprehensive strategy combining behavior change, community engagement, and nature-positive economies is critical for lasting impact.

Second, there is growing recognition of hunting and inland fisheries at the national level. Despite their key role in poverty reduction, these sectors are often stigmatized or labeled "illegal," complicating regulation and sustainability. Legal ambiguities have fostered underground markets, but recent policy reforms and initiatives, such as those promoted by the Sustainable Wildlife Management (SWM) program and the Central African Regional Program for the Environment (CARPE), are strengthening legal frameworks and aligning with global biodiversity goals. Countries are also adopting the One Health framework, recognizing the link between human, animal, and environmental health.

Furthermore, Congo Basin nations increasingly see potential to move from mitigating logging and mining impacts to adopting biodiversity-positive measures. Certification schemes like the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) promote responsible logging practices, including hunting management and road planning. However, scaling these across concessions is challenged by financial burdens and competition from non-certified companies. New legal frameworks, updated management plans, and sustainable financing are needed to support the logging sector's role in the 30 × 30 conservation agenda. The mining sector has been slower to implement wildlife conservation measures, focusing more on human rights and worker safety. While governance has improved, comprehensive strategies to reduce mining's wildlife impact are still lacking. Lessons from forestry could guide biodiversity-friendly mining, especially as mining expands.

Finally, wildlife management is shifting from donor-driven projects to sustainable financial mechanisms for long-term biodiversity protection. Declining official development assistance (ODA) and short-term funding have pushed Congo Basin governments to explore innovative finance models such as blended finance, debt-for-nature swaps, and biodiversity markets. These tools can help close the funding gap and foster wildlife-based economies, including ecotourism, that generate sustainable income for local communities while supporting conservation. Though promising, these opportunities remain underdeveloped, and governments face challenges in mobilizing long-term financial flows. Initiatives like the Central Africa Forest Initiative (CAFI) and the High Integrity Forest Finance Initiative (HIFFI) are reshaping conservation finance by promoting nature-based economic models, encouraging investment, enabling policy dialogue, and developing mechanisms to sustain wildlife management over time.

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