



# Hunting for common ground between wildlife governance and commons scholarship

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**Abstract:** *Wildlife hunting is essential to livelihoods and food security in many parts of the world, yet present rates of extraction may threaten ecosystems and human communities. Thus, governing sustainable wildlife use is a major social dilemma and conservation challenge. Commons scholarship is well positioned to contribute theoretical insights and analytic tools to better understand the interface of social and ecological dimensions of wildlife governance, yet the intersection of wildlife studies and commons scholarship is not well studied. We reviewed existing wildlife-hunting scholarship, drawing on a database of 1,410 references, to examine the current overlap with commons scholarship through multiple methods, including social network analysis and deductive coding. We found that a very small proportion of wildlife scholarship incorporated commons theories and frameworks. The social network of wildlife scholarship was densely interconnected with several major publication clusters, whereas the wildlife commons scholarship was sparse and isolated. Despite the overarching gap between wildlife and commons scholarship, a few scholars are studying wildlife commons. The small body of scholarship that bridges these disconnected literatures provides valuable insights into the understudied relational dimensions of wildlife and other overlapping common-pool resources. We suggest increased engagement among wildlife and commons scholars and practitioners to improve the state of knowledge and practice of wildlife governance across regions, particularly for bushmeat hunting in the tropics, which is presently understudied through a common-pool resource lens. Our case study of the Republic of Congo showed how the historical context and interrelationships between hunting and forest rights are essential to understanding the current state of wildlife governance and potential for future interventions. A better understanding of the interconnections between wildlife and overlapping common-pool resource systems may be key to understanding present wildlife governance challenges and advancing the common-pool resource research agenda.*

**Keywords:** bushmeat, commons, common pool resource, institutions, tenure, hunting, social network analysis

En Búsqueda de Terreno Común entre la Gobernanza de Fauna y el Conocimiento sobre Bienes Comunes

**Resumen:** *La caza de fauna es esencial para el sustento y la seguridad alimentaria en muchas partes del mundo pero presenta tasas de extracción que podrían amenazar a los ecosistemas y a las comunidades humanas. Por esto, gobernar el uso sustentable de la fauna es un dilema social importante y un reto para la conservación. El conocimiento sobre los bienes comunes está bien posicionado para contribuir con ideas teóricas y herramientas analíticas para un mejor entendimiento de la interfaz entre las dimensiones sociales y ecológicas de la gobernanza de fauna, aunque la intersección de los estudios sobre fauna y el conocimiento sobre los bienes comunes no esté bien estudiada. Revisamos el conocimiento existente sobre la caza de fauna a partir de una base de datos de 1, 410 referencias para examinar el traslape actual con el conocimiento sobre los de bienes comunes por medio de múltiples métodos, incluyendo el análisis de redes sociales y la codificación deductiva. Encontramos que una proporción muy pequeña de estudios de fauna incorporaban marcos de trabajo y teorías de bienes comunes. La red social de conocimiento sobre la fauna tenía una interconexión muy densa con varios grupos de publicaciones importantes, mientras que la del conocimiento*

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**Article impact statement:** *Wildlife hunting and commons scholarship are largely disconnected yet their mutual utility can help solve wildlife-governance dilemmas.*

*Paper submitted September 11, 2017; revised manuscript accepted July 20, 2018.*

*de bienes de fauna era escasa y estaba aislada. A pesar del enorme vacío entre el conocimiento de bienes y la fauna, algunos están estudiando los bienes de fauna. El pequeño cuerpo de becas que construye un puente entre estas literaturas desconectadas proporciona ideas valiosas sobre la dimensión de las relaciones poco estudiadas de la fauna y otros recursos comunes que se traslapan. Sugerimos una participación mayor entre el conocimiento de fauna y bienes comunes y los practicantes para mejorar el estado de conocimiento y de las prácticas de la gobernanza de fauna a lo largo de todas las regiones, particularmente para la caza de fauna en los trópicos, la cual actualmente está poco estudiada dentro de la visión de los recursos comunes. Nuestro estudio de caso sobre la República del Congo mostró cómo el contexto histórico y las interrelaciones entre la caza y los derechos de bosque son esenciales para el entendimiento del estado actual de la gobernanza de fauna y el potencial para las futuras intervenciones. Un mejor entendimiento de las interconexiones entre la fauna y los sistemas de recursos comunes que se traslapan puede ser una clave para entender los retos actuales de la gobernanza de fauna y el avance de la agenda de investigación sobre los recursos comunes.*

**Palabras Clave:** análisis de redes sociales, bienes, carne de caza, caza, recursos comunes, tenencia, instituciones

**摘要:** 在世界上很多地方, 野生动物狩猎对人们的生计和食物保障至关重要, 但目前狩猎的速率可能威胁到生态系统和人类社会。因此, 野生动物资源可持续利用的管理是重要的社会困境和保护挑战。公共资源的学术研究有助于提供深入的理论认识和分析工具, 来更好地理解野生动物管理中社会和生态维度的交界, 然而, 野生动物研究和公共资源研究的交叉点还没有得到深入探索。我们借助于一个含有 1,410 篇参考文献的数据库, 回顾了现有野生动物狩猎的知识, 并通过包括社会网络分析和演绎编码在内的多种方法分析其与公共资源研究的重叠。我们发现, 只有很少一部分的野生动物研究纳入了公共资源的理论和框架。野生动物研究的社会网络与几个主流出版物集群紧密相连, 而野生动物公共资源研究则稀少且孤立。尽管野生动物与公共资源的研究之间存在巨大差距, 但仍有一些学者在研究野生动物公共资源。这一小部分学术研究将一些关系不紧密的文献联系起来, 为理解野生动物和其它重叠的公共资源的关系提供了宝贵的见解。我们建议加强野生动物和公共资源学者和管理实践者之间的交流, 来提高各地区野生动物管理的知识和实践水平, 特别是目前从公共资源角度研究较少的热带地区丛林肉狩猎问题。我们对刚果共和国的案例研究表明了狩猎和林权之间的历史背景和相互关系在了解目前野生动物管理状态和未来干预措施的潜力中起到重要作用。更好地理解野生动物和重叠的公地资源系统的相互关系可能是理解野生动物管理目前面临的挑战和推进公地资源研究议程的关键。【翻译: 胡怡思; 审校: 聂永刚】

**关键词:** 丛林肉, 公共资源, 公地资源, 机构任职, 狩猎, 社会网络分析

## Introduction

The status and use of wildlife resources are ongoing dilemmas among conservation practitioners, scientists, and resource users (Naughton-Treves & Sanderson 1995; Robinson & Bennett 2002; Bennett et al. 2007). Long-standing disputes revolve around how to balance competing uses, social values, and politics of wildlife to sustainable and socially desirable ends. We reviewed the gaps and opportunities for engagement between 2 bodies of literature centrally concerned with resource governance—wildlife studies and commons scholarship—to improve current understandings of the practices and governance of wildlife hunting.

Globally, wildlife remains significant to many peoples' for subsistence (Wenzel 1991; Nuttall et al. 2005; Fa et al. 2015), income (Child 1996; Murphree 2005; Muchapondwa & Stage 2013), and cultural purposes (Bullock 1999; Wagner et al. 2007; Triezenberg et al. 2011; van Gils et al. 2014). Yet, wildlife also poses a liability for human communities (threats to property and life), although risks are often unevenly distributed (Naughton-Treves et al. 2003; Kideghesho & Mtoni 2008; Dickman 2010). Coupled with the costs of resource loss and displacement that often

come with protected areas and other forms of “green grabbing” (Fairhead et al. 2012), the fraught political question of who pays for wildlife conservation and who benefits remains (Neumann 1998; Kideghesho & Mtoni 2008).

In addition to the complex dynamics of direct human-wildlife interactions, wildlife is also essential to ecosystem functioning. For instance, wildlife regulates plant communities through grazing, seed dispersal, and predation (Terborgh et al. 2008). While many hunter-gatherer communities have long relied on low-intensity use of wildlife resources, these practices depended on territorial access and mobility, which are increasingly disputed and circumvented (Berkes 1986; Haller 2013). With restricted mobility and the introduction of new kinds of economic demands, the present scale of wildlife extraction may threaten ecosystems and biodiversity and simultaneously livelihoods and food security, which makes the bushmeat crisis a key issue in global conservation and development agendas (Redford 1992; Milner-Gulland & Bennett 2003; Nasi et al. 2011). Nonetheless, the links between hunting, livelihoods, markets, and ecosystems are currently not well understood, inhibiting progress toward viable solutions (Nasi et al. 2008).

Debates about the best course for studying and managing wildlife are increasingly diverse and conflicted. Beneath these disagreements are underlying ideological questions of what constitutes nature, where there is a deeply ingrained aesthetic predilection toward seemingly pristine landscapes emptied of human inhabitants (Neumann 1998). The separation of nature and culture is reflected in the history of wildlife studies, traditionally dominated by ecology, biology, and wildlife management, as well as in the more recent, crisis-driven discipline of conservation science. Despite significant contributions from these fields to wildlife studies, the lack of connections between ongoing research efforts and other fields may be contributing to the seeming intractability of wildlife governance (Milner-Gulland 2011). There is growing consensus around the need for new perspectives that better contend with the human dimensions of wildlife outside the paradigm of fortress conservation (Mascia et al. 2003; Naughton-Treves et al. 2005) and that overcome disciplinary silos that stifle progress toward sustainable solutions (Milner-Gulland 2011). In response, approaches to wildlife studies are expanding to include underrepresented disciplines in the social sciences and theoretical frameworks developed from other systems, such as fisheries (Milner-Gulland 2011).

Like fisheries, wildlife hunting can be conceptualized as a common-pool resource system (CPR) because hunting reduces the total available resource pool and it is costly to exclude users (Ostrom 1990). Much of commons or CPR scholarship focuses on the role of institutions (i.e., norms and rules) in shaping behaviors related to resource use and management in light of characteristics of the resource system and the distribution of rights (Ostrom et al. 2002). Commons scholars are interested in understanding local-level CPR governance systems within a multilevel governance framework. Despite recent emphasis on scaling up analyses and interventions to address global governance dilemmas (Ostrom 2009), local-level collective action and institution crafting remain persistent themes. Commons scholars' expertise in local governance and multilevel dynamics could provide important insights into the institutional arrangements that structure human-wildlife interactions, but currently the intersection of commons scholarship and wildlife use is understudied. We sought to identify thematic and geographic commonalities and knowledge gaps between studies of wildlife hunting and the commons through a review of the literature on these subjects. We also considered the theoretical and policy implications of present knowledge of wildlife commons and critical areas for future research.

Wildlife hunting has received relatively little attention among commons scholars, despite commonalities and spatial overlap with well-studied resource systems. For instance, there are clear parallels between wildlife hunting and capture fisheries. Both are mobile animal resources that support diverse livelihoods through a combination

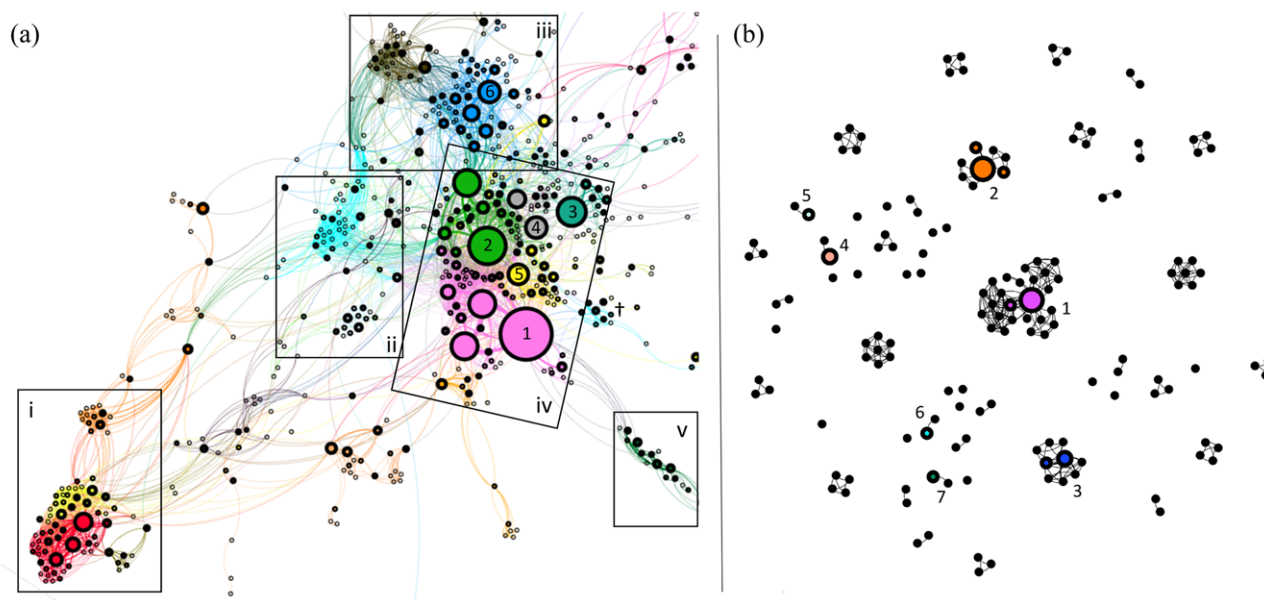
of small- and large-scale extraction alongside other competing uses (e.g., tourism). Moreover, access to fishing and wildlife commons share a similar history of resource enclosure, often resulting in marginalization of traditional resource users (Haller & Chabwela 2009; McCay 2011). Enclosure takes manifold forms, including straightforward grabs by colonial and state powers (McCay 1987), and can have cumulative effects (e.g., "creeping enclosure" [Murray et al. 2010]). Both wildlife and fisheries have been subject to top-down management for much of the 20th century, under which centralized regimes often fail to engender ecologically sustainable or socially just outcomes despite reliance on strict enforcement (Ostrom 1990; Hulme & Murphree 2001; Beddington et al. 2007).

Commons scholarship could offer new insights to the study of wildlife use by drawing attention to the understudied dynamics of overlapping, interrelated CPR systems. Although cross-scale interactions are increasingly central to analysis of individual CPRs (Berkes & Folke 1998; Basurto 2013), interrelationships across resource systems, such as wildlife and forests, are not well understood. The lack of case studies framing wildlife as a CPR relegates it from the general movement toward comparative studies and meta-analyses of a large number of cases (large-N studies). These efforts aim to scale up knowledge, compare sector-independent factors, and examine interactions and trade-offs among outcomes in CPR governance (Agrawal 2002; Agrawal & Benson 2011; Frey & Rusch 2014). Although several databases house CPR case studies from different resource sectors (e.g., Common-Pool Resource Database, Social-Ecological Systems Library), only 1 database (SES Library) contains case studies focused on wildlife (Lu 2001).

Likewise, wildlife studies could benefit from the institutional insights of common scholars. Although 1-way management prescriptions have long dominated (e.g., the state or the market), adding an institutional perspective can situate wildlife management within linked political, cultural, social, and economic processes—potentially opening a new range of unexplored dynamics, opportunities, and challenges to wildlife managers and conservationists. Commons scholarship has identified many biophysical and sociopolitical variables associated with improved governance outcomes in CPRs (Agrawal 2002). Insights garnered from other CPR systems could illuminate key dynamics and variables to attend to in wildlife science and management.

## Methods

We conducted an extensive search of the literature pertaining to bushmeat, community-based wildlife governance, and subsistence hunting. We retrieved peer-reviewed papers, conference papers and books using Web of Science ( $n = 1189$ ) and Google Scholar ( $n = 258$ ).



**Figure 1.** Social network of (a) wildlife-use authors from the initial set of 1410 papers and (b) authors from the 68 wildlife-commons publications (colors correspond to different co-authoring groups and numbers to scholarly themes: (i) Zoonoses (i.e., ebola and anthrax); (ii) large-scale analyses, including human variables; (iii) southern and eastern African trophy hunting and community-based natural resource management; (iv) bushmeat hunting in tropical forests of East and Central Africa, South America, and Asia; and (v) North America). Networks delineated with Gephi (version 9.1) network modularity tool.

**Table 1.** Major author groups from the social-network analysis and study locations within the wider wildlife-use literature and the wildlife-commons literature.

Literature and group number	Author group	Study locations
<b>Wildlife use<sup>a</sup></b>		
1	Milner-Gulland, E.J., Rowcliffe, J., Cowlishaw, G., Kumpel, N., and Coad, L.	Africa and Asia
2	Fa, J., MacDonald, D., Et, O., and Dupain, J.	Pan-tropical and Europe
3	Peres, C., Levi, T., and Shepard, G.H.	South America
4	Nasi, R., and Van Vliet, N.	Pan-tropical
5	Wilkie, D., Brown, D.	S. America and Central Africa
6	Lindsey, P., Hunter, L., Balme, G., Funston, P., and Loveridge, A.	Southern and Eastern Africa
<b>Wildlife commons<sup>b</sup></b>		
7	Milner-Gulland, E.J., Bunnefeld, N. <sup>c</sup>	East Africa and Asia
8	Haller, T., Chabwela, H., Saum, R. and others	Zambia and Botswana
9	Gray, S., Nyaki, A., and others <sup>d</sup>	Tanzania
10	Balint, P. and Mashinya, J.	Southern Africa
11	Altrichter, M. and Basurto, X.	Argentina
12	McNeeley, S.M. and Shulski, M.D.	Alaska
13	Dowsley, M. and Schmidt, J.	northern Canada

<sup>a</sup>Ordered based on number of papers (most papers first).

<sup>b</sup>Ordered alphabetically.

<sup>c</sup>Authors also in group 1.

<sup>d</sup>Authors also in group 6.

To identify the subset of papers addressing wildlife from a CPR perspective, we ran a text search on the titles, keywords, and abstracts of all references ( $n = 1410$ ) using a set of key terms related to common-pool resource scholarship (Supporting Information).

The returned papers ( $n = 68$ ) were coded relative to several criteria (see Supporting Information). Each paper was coded and checked by a second coder; coding disagreements were resolved through further discussion until consensus was reached. Qualitative analysis of

**Table 2.** Ten journals publishing the most articles on wildlife hunting and use.

Rank	Publication	No. of articles
1	<i>Oryx</i>	94
2	<i>Biological Conservation</i>	93*
3	<i>Conservation Biology</i>	85*
4	<i>Plos One</i>	59
5	<i>Animal Conservation</i>	48
6	<i>Biodiversity and Conservation</i>	32
7	<i>Human Ecology</i>	32*
8	<i>Ecology and Society</i>	29*
9	<i>Environmental Conservation</i>	29
10	<i>South African Journal of Wildlife Research</i>	27

\*Journals also publishing the most wild-commons articles (Table 3).

the smaller subset (hereafter wildlife-commons subset) allowed us to examine the ways wildlife uses were conceptualized, the primary CPR system or systems studied, and the application of CPR theories to study wildlife.

We used the software Gephi 0.9.1 (Bastian et al. 2009) to conduct a social network analysis (SNA) of authors in both the broader wildlife hunting literature and the wildlife-commons subset. The purpose of the SNA was to examine authorship connections, thematic areas of work, and geographic relationships among authors in the wildlife-hunting literature and the wildlife-commons literature and to compare general patterns in the shape and overlap of these 2 networks. We examined the wildlife-commons subset in greater detail to determine how commons or CPR theories have been applied in wildlife studies and the major themes and contributions of existing wildlife-commons studies.

## Results

### Comparing Social Networks, Geographic Coverage, and Outlets Among Wildlife Studies and the Commons

Overall, the 2 communities of scholars diverged along multiple dimensions: they worked on different geographies, focused on distinct thematic areas, and their social networks were shaped differently. The SNA showed a lack of connectivity between the distinct groups publishing on wildlife and wildlife-commons. Five major dense and interconnected publication clusters of wildlife utilization scholars (Fig. 1a) contrasted with the network of wildlife-commons scholars, consisting of 7 isolated subnetworks with no connections among them (Fig. 1b).

Each major group in both the wildlife and wildlife-commons social networks (Fig. 1a & 1b) consisted of key authors and collaborators associated with specific study geographies (Table 1). The 6 largest groups in the wider wildlife utilization scholarship were highly

**Table 3.** Nine journals<sup>a</sup> publishing the most articles on wildlife commons.

Rank	Publication	No. of articles
1	<i>Ecology and Society</i> <sup>b</sup>	6
2	<i>Development Southern Africa</i>	5
3	<i>Ecological Economics</i>	4
4	<i>Conservation and Society</i>	3
5	<i>International Journal of the Commons</i>	3
6	<i>Conservation Biology</i> <sup>b</sup>	2
7	<i>Biological Conservation</i> <sup>b</sup>	2
8	<i>Human Dimensions of Wildlife</i>	2
9	<i>Human Ecology</i> <sup>b</sup>	2

<sup>a</sup>Thirty-seven journals had 1 publication each.

<sup>b</sup>Journals also publishing the most wildlife use articles (Table 2).

interdisciplinary, with 5 of the 6 groups focused largely on bushmeat hunting in tropical forests, and the sixth group on southern and eastern African trophy hunting and community-based wildlife management. Although not represented within the largest coauthoring clusters, several other prominent themes in the network included studies of zoonotic disease, large-N comparative studies, and North American recreational hunting. The major wildlife-commons research groups published a mix of case studies, large scale analyses and conceptual papers focusing mostly on Sub-Saharan Africa and temperate or Arctic regions.

The geographic distribution of the scholarship also differed across the 2 wider social networks. Wildlife hunting was most commonly studied in West and Central Africa ( $n = 406$ ), Southern and Eastern Africa ( $n = 272$ ), North America ( $n = 197$ ), South America ( $n = 105$ ), and South and Southeast Asia ( $n = 85$ ) (Fig. 2). The distribution of wildlife-commons scholarship revealed a different spatial pattern, in which southern and eastern Africa ( $n = 29$ ) and the Arctic ( $n = 9$ ) emerged as the regions where wildlife CPRs were most frequently studied. Outside of these regions, wildlife-commons publications were few, thinly distributed, and isolated; not exceeding 1 per country.

The most common publication outlets also differed between the 2 literatures. Conservation science, ecology, and interdisciplinary human-environment journals were the most common outlets within the broader wildlife hunting literature (Table 2), whereas the wildlife-commons scholarship was more often published in social and environmental science journals (Table 3). Only ~15% of wildlife-commons papers were published in the top journals publishing articles on wildlife hunting (ranked by number of publications), and only 4 of the journals have published more than 2 papers about wildlife-commons, which indicates this literature is thinly spread and largely found outside of the most prominent wildlife publication outlets.

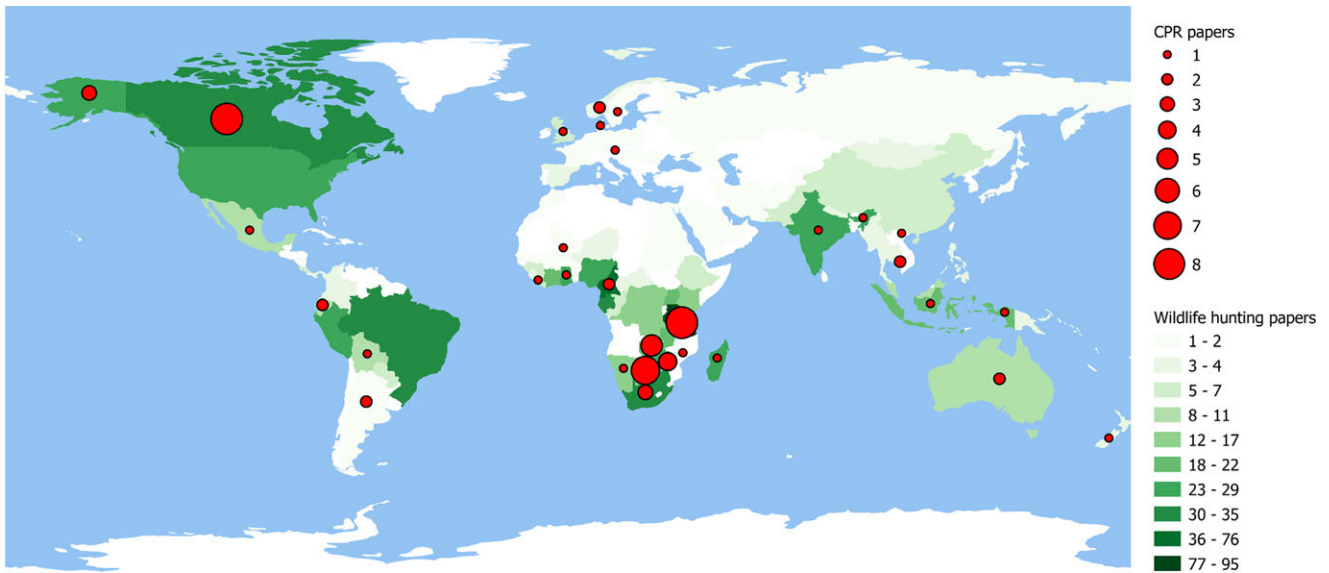


Figure 2. Distribution and frequency of wildlife-hunting publications and wildlife-commons publications (CPR).









					Others
	56	14	13	12	9
		15	8	6	4
			18	6	5
				15	7
Others					15

Figure 3. Number of papers addressing a given resource system (diagonal) and number of papers addressing overlapping resource systems (rows). The darker the shading, the greater the number of papers.

### Intersection of Wildlife-Commons and Wildlife Studies

The subset of wildlife-commons publications ( $n = 68$ ) represented only 5% of the total wildlife hunting literature identified ( $n = 1410$ ). Of this small minority of papers bridging the 2 fields, 63% were social science oriented, 35% mixed social and natural sciences, and <2% were natural science papers. The majority presented primary data (63%), whereas 37% were secondary studies.

Wildlife-commons studies included a range of resource sectors besides wildlife (Fig. 3). Over half of the articles ( $n = 37$ ) discussed some combination of resource systems. The most frequent systems discussed alongside

wildlife included fisheries ( $n = 14$ ), forests ( $n = 13$ ), grasslands ( $n = 12$ ) and other systems ( $n = 9$ ) (row 1, Fig. 3). While some of these articles compared different resource systems in separate locations (e.g., coastal fisheries with inland forest systems), many discussed resource systems with spatial overlap (e.g., wildlife hunting on pasture commons).

While all the wildlife-commons articles ( $n = 68$ ) included some reference to commons scholarship, not all directly framed wildlife as a common-pool resource. Over two-thirds of the wildlife-commons articles explicitly ( $n = 32$ ) or implicitly ( $n = 16$ ) connected their broader discussion of CPR theory to wildlife as a common-pool resource. Whereas nearly one-third of the papers used terminology and cited commons scholarship in some capacity but did not identify wildlife as a CPR ( $n = 20$ ).

Authors also engaged with commons scholarship in a variety of ways. To understand this variation, we categorized how each article used CPR scholarship and whether the engagement was significant (Table 4). Commons scholarship was most frequently cited in the background or conclusions—using the commons as problem framing or to discuss broader research implications. Most articles citing commons scholarship in the article background or conclusion engaged significantly with CPR theories. However, 20% of articles cited commons scholarship in passing without deeper engagement or consideration of the possibilities of collective action in the commons. Forty articles used CPR theories to inform their empirical data collection and analysis, while only 14 of these drew from one of the major CPR analytical frameworks. Additionally, we tracked the number of articles using a social-ecological systems (SES) orientation because of its closeness with CPR theory. Most articles used SES to conceptualize their system and frame their background

**Table 4.** How articles from the wildlife-commons literature<sup>a</sup> used common-pool resource (CPR) and social-ecological systems (SES) theory and whether the engagement is theoretically significant.<sup>b</sup>

Where theory was incorporated	Engages with CPR		Engages with SES
	significant	not significant	
Background	47	8	15
Methods	40	3	7
Conclusions	44	2	10

<sup>a</sup>Wildlife-commons articles ( $n = 68$ ) include those in which either CPR or SES theories were applied.

<sup>b</sup>Determined qualitatively as significant if authors considered the possibility of collective action in common-pool resource outcomes and not significant if authors assumed collective action was not possible and the tragedy of the commons was inevitable.

( $n = 15$ ) or conclusions ( $n = 10$ ), whereas very few applied SES to data collection and analysis ( $n = 7$ ) or used the SES framework ( $n = 3$ ).

Consumptive use of wildlife was the most commonly studied, including subsistence use for direct consumption or local or regional sale ( $n = 55$ ). Only 3 papers discussed industrialized commercial extraction of wildlife (i.e., game ranching or commercial harvest). Other uses included trophy hunting and recreational hunting ( $n = 14$ ), biodiversity conservation ( $n = 14$ ), and nature tourism ( $n = 8$ ).

#### Qualitative Analysis of the Wildlife-Commons Literature

Among the 48 wildlife papers that significantly engaged with commons theory one of the most common themes was the role of CPRs and indigenous livelihoods and resource rights. These papers focused on indigenous communities of the Arctic (Armitage 2005; Dowsley 2010; Schmidt & Dowsley 2010; McNeeley 2012; Wray & Parlee 2013; Zabel et al. 2014; Tyson 2017), and temperate regions (Berkes 1986; Bråta 2003; Kahui & Richards 2014). Very few papers studied indigenous wildlife institutions in the Global South. Yet, we found notable exceptions, including a case study of wildlife common property institutions among the San in Botswana (Magole 2009), a study of Batwa fishermen in Zambia's Kafue flats (Haller & Chabwela 2009), and a review of Amazonian indigenous groups' management of overlapping commons (Lu 2006). Outside of these, studies of tropical bushmeat hunting as wildlife commons were notably absent, with the exception of an analysis of joint forest management and wildlife governance in Afromontane forests (Nielsen & Treue 2012).

A diverse group of studies explore historical dynamics of institutional change in wildlife management. Some studies drew insights from political ecology (Armitage 2005; Bluwstein et al. 2016; Bollig 2016), including an analysis of the market-oriented turn in wildlife management in Namibia, which simultaneously generated new market potentials and also problematic dependencies for communities (Bollig 2016). A sizeable group of articles and book chapters explored the historical dynamics and

power dimensions of resource access within floodplains that seasonally and spatially encompass a diverse array of CPRs, including fisheries, pasture, forest, and wildlife resources (Haller et al. 2008; DeMotts et al. 2009; Haller & Chabwela 2009; Hara et al. 2009; Chabwela & Haller 2010; Haller 2010a, 2010b; Saum 2010). A comparative study of floodplain commons in sub-Saharan Africa unpacked processes of resource fragmentation (e.g., the separation of local rights to wildlife from other resources) under colonial rule, state control, and the more recent turn toward CBNRM (Haller 2010a). Several studies focused on community-based wildlife management and decentralization mostly in Southern Africa (Balint 2006, 2007; Balint & Mashinya 2008b; DeMotts et al. 2009; Poteete 2009; Saum 2010; Child & Child 2015; Nyirenda 2015), including the well-known CAMPFIRE programs (Balint & Mashinya 2008a, 2008b), whereas others described the largely invisible history of Zimbabwe's early experiments with democratic principles of wildlife management on both private and communal lands (Child & Child 2015).

Wildlife governance and collective action around sport hunting were also prevalent within the subset of wildlife-commons papers. Cases included deer hunting wildlife management areas in Texas (Wagner et al. 2007), a critical mixed-methods study of collective action in waterfowl hunting and wildlife trapping institutions in New York (Triezenberg et al. 2011), analysis of commercial red deer hunting estates in Scotland (Bullock 1999), and relationships between characteristics of property owners and hunting outcomes in Denmark (Primdahl et al. 2012).

Finally, several wildlife-commons papers applied some of the core frameworks from commons scholarship. For example, Mutenje et al. (2011) used Ostrom's (1990) design principles to examine the influence of traditional common property institutions on forest degradation in Zimbabwe, treating wildlife as a non-timber forest product. Thomsen and Davies (2007) used the institutional grammar framework developed by Crawford and Ostrom (1995) to analyze formal and informal rules for commercial kangaroo harvest in Australia. Others explicitly considered how different bundles of property

rights affect the management of wildlife CPRs (Altrichter 2008; Altrichter & Basurto 2008; Nyirenda 2015).

## Discussion

We found a significant gap between wildlife–use literature and commons scholarship; <5% of the wildlife literature engaged with commons literature. Beyond the magnitude of the gap, we identify several possible reasons for, and implications of, the disconnect between these 2 bodies of literature.

First, although the wider network of wildlife scholarship displays a high degree of centrality, the subset of wildlife-commons scholarship is diffuse and thinly spread. Scholars are producing case studies and comparative analyses of wildlife commons, but these works are isolated within the wider social network of wildlife utilization scholarship. Although publication outlets contain some overlap, the wildlife-commons scholarship is not generally found in the top wildlife journals, potentially inhibiting its wider circulation and use. The isolation of case studies within the wider network likely impedes opportunities for collaborative and comparative work, meta-analyses, and efforts to scale up knowledge on wildlife commons. Although many wildlife scholars are actively seeking theoretical tools and methods outside of traditional wildlife studies to contend with governance challenges (Milner-Gulland et al. 2010; Milner-Gulland 2011; Bunnefeld et al. 2013), currently commons scholarship and frameworks are not widely used.

This point is both a finding and a limitation of our own study—our literature search and review is ultimately not exhaustive, even though we employed multiple searches to locate relevant sources. Although we focused on peer-reviewed journal articles, books and conference papers, a large volume of work produced by wildlife practitioners exists in gray literature, which is outside the purview of this study. Overall, despite revisions to our search terms and employing multiple search methods, our study does not capture much of the work produced by southern African wildlife scholar-practitioners that share principles with, and even precedes the work of Elinor Ostrom and other commons scholars (Child & Child 2015). We agree with the observation made by Barrow and Murphree (2001) that the relative invisibility of wildlife scholar-practitioners' work is a current barrier and an important area for future research. Our study indicates that social networks and language are crucial factors: literature on trophy hunting CBNRM programs often did not reference *hunting* (or related synonyms) in the title, abstract, or keywords. Further, sources from this literature in our analysis often discussed concepts closely related to CPRs but didn't index their articles with CPR keywords. Where differences in seman-

tic networks present challenges for systematic reviews, they also reveal key fault lines that separate communities and are worthy of study in their own right (Haddaway et al. 2015).

Despite the relatively sparse overlap between these literatures, through our qualitative analysis we demonstrated existing wildlife-commons scholarship contributes unique insights on the dynamics of overlapping and interrelated social and ecological dimensions of wildlife with other CPRs (DeMotts et al. 2009; Haller & Chabwela 2009; Hara et al. 2009; Poteete 2009; Chabwela & Haller 2010; Haller 2010a; Saum 2010; Nielsen & Treue 2012). Yet, overall this is largely a missed opportunity and underexplored perspective in the broader fields of the commons and wildlife studies. Therefore, it seems greater attention to wildlife commons, especially to existing studies of overlap and also fragmentation of access rights to commons, could advance CPR theory and present understandings of wildlife governance.

We propose several possible reasons behind the inattention to wildlife CPRs in commons scholarship. First, the practice of studying single resource systems might preclude examining wildlife in relation to other focal resources. The current emphasis on isolatable resource units and systems in the commons belies the complexity of both the historical context of institutional change and the present reality of many people's livelihoods and worldviews (Brooks et al. 2008; Schmidt & Dowsley 2010; Kahui & Richards 2014). Analysis of CPRs could benefit from looking beyond the constellations of present user groups and rules in use in single sectors to consider institutional dynamics at the level of livelihoods (Brooks et al. 2008) and landscapes (Haller 2010b). This may also open space to rethink the dominance of Western perspectives on science that underlie both the fragmentation of resource management and CPR scholarship at present. Second, the illegality of local wildlife hunting may inadvertently preclude studies of wildlife commons. Commons scholars often study current institutions or rules in use. Guided by this analytic approach, wildlife may be treated separately or left out entirely when *de jure* rules exclude local rights to wildlife. Yet, starting from present institutional divisions ignores the historical context, politics and processes of institutional change which produced this separation. Colonial and state division of resources into separate sectors fragmented rights to a range of common resources, often to different effects (Haller 2010b; Mhlanga et al. 2014). In the case of wildlife, local rights were typically fully appropriated by colonial states, turning longstanding hunters into poachers, whereas limited management and use rights were retained for other resources (Hara et al. 2009; Chabwela & Haller 2010; Bollig 2016). Attention to historical institutional context would help scholars avoid reifying and further replicating the apparent "naturalness" of resource fragmentation, which may require applying



historical methods and analysis (de Moor et al. 2016; Laborda-Pemán & de Moor 2016). Finally, commons scholarship likely exhibits path dependency. Strong system-focused research groups formed and continue to produce new scholars and work largely within the same systems: forests, fisheries, pastures, and water. Further research on the role of social networks driving systems-based scholarship in the commons is needed.

Despite these present challenges, insightful wildlife-commons scholarship is underway among a small group of scholars. While the overlap between wildlife studies and the commons is scant, existing wildlife-commons studies demonstrate the utility of institutional perspectives across a range of geographies, ecologies, and social dimensions. Thus far, these perspectives have been most commonly applied to study indigenous wildlife institutions in the Arctic and temperate regions, the politics and history of wildlife enclosure in southern Africa, the rise of CBNRM, recreational hunting in Western nations, and the application of the CPR frameworks to understand dimensions of property rights arrangements in wildlife commons. Considering that most papers in the broader wildlife utilization literature are situated in African and South American cases, the underrepresentation of bushmeat and subsistence hunting in these regions from CPR perspectives stands out as a key geographic disparity. Given the importance of bushmeat to local livelihoods and its saliency within policy circles, this is a key area for future research. We considered the case of tropical bushmeat hunting to illustrate the dynamic governance challenges among overlapping CPRs unfolding in the Republic of Congo.

### **Case Study on Wildlife and Forest Commons in Republic of Congo**

Bushmeat provides a year-round food source and often the main source of income for inhabitants of the forests of Northern Congo. Almost the entire western half of the Congo rainforest is divided into industrial logging concessions, in which relatively low density selective logging is practiced and some small-scale harvest of non-timber resources, including wildlife, is permitted. These overlapping common-pool resource systems are subject to a combination of different institutional arrangements enforced with variable effort and compliance, implemented with varying degrees of success and often with unequal outcomes across resource systems.

As with other countries in the region, Congo forestry law is fairly strong, whilst compliance is poor (Nasi et al. 2006). However, a substantial forest area is certified through Forest Stewardship Council (FSC), which shifts responsibility from the state and increases industry compliance with forestry law, in exchange for market access to discerning consumers who are willing to pay a premium for ethically sourced products. The influence

of the FSC is not trivial; FSC certification demands compliance with national forestry law, as well as additional criteria of environmental, social, and economic sustainability, which includes wildlife protection (Forest Stewardship Council 2015). Critically, FSC certification involves a regular auditing process which is otherwise absent (Tsanga et al. 2014). The state's role in monitoring is therefore replaced by private auditors, and certification induces industry to support the state's role in managing the forest commons. In addition to the roles of the state, industry and FSC, recently a raft of Civil Society Organizations have taken up roles in forest governance, largely due to 2 international processes: The Forest Legality, Governance and Trade (FLEGT) of the EU and REDD+ of the UN, which share overlapping remits of improving forest governance and increasing representation of indigenous groups and gender equity. Communities are not included in comanagement but have the right to access forests, harvest non-timber forest products, and can harvest timber from community zones near to villages.

Compared with forests, efforts to improve wildlife management have not been as successful. In the Congo basin, wildlife is owned by the state and local people hold limited access and extraction rights. Hunting restrictions limit the types of gear, times of day, and species available for hunting, but the majority of hunting occurs outside of these restrictions. Recently, the state has entered into comanagement arrangements with an international wildlife NGO and the forestry company *Projet de Gestion des Ecosystèmes Périphériques (PROGEP)*, tasked with managing wildlife in the concessions which border national parks. Despite restrictive hunting regulations, the state (and now PROGEP) lacks enforcement capacity, and hunting is often de facto open access. While wildlife is managed with many of the same actors and under the same land management unit as forests, actors inhabit different roles which results in distinct processes and outcomes for forest and wildlife governance.

At the community level, wildlife-management institutions are scarce at present (Mavah 2011). This may be attributable to the loss of customary land rights undermining pre-existing local institutions and agency, whilst the criminalization of hunting as practiced may be a significant barrier to organization among hunters and their integration into multilevel wildlife management. Presently, communal rights to wildlife do not extend to management, ownership, or exclusion, and communities are excluded from formal comanagement. In response to this situation, the FAO has implemented a sustainable bushmeat project at sites in 5 countries in Central Africa, including Northern Congo. The project seeks to implement interventions recognizable as design principles (Ostrom 1990), including state recognition of hunters' rights to organize, participation in collective-choice arrangements, self-monitoring, and clearly delineating resource boundaries. The legitimacy of

small-scale commercialization of bushmeat is explicit in the project's activities and goals, a notable shift away from the current tacit tolerance of the bushmeat trade by officials. However, efforts toward explicit recognition of local harvesting rights come into conflict with many wildlife conservationists who ascribe to a protectionist paradigm, where local hunting is viewed as inherently incompatible with conservation goals. Therefore, the legitimization of bushmeat is viewed differently amidst the constellation of governance actors, where some predict it will accelerate already unsustainable hunting and others see it as necessary for food and livelihood security.

### Spatial and Institutional Linkages

Forests and wildlife in northern Congo are linked through spatial overlap of resource extraction and ecological connectivity: forestry disturbs the habitat of wildlife communities and hunting directly alters wildlife communities, which in turn affects forest communities. These CPRs are also intertwined through institutional arrangements that share similar boundaries, actors, and shortcomings without being consciously linked. Hunters remain conspicuously absent from both governance processes, aside from an isolated pilot project.

The case from northern Congo demonstrates the social, political and ecological overlap among forest and wildlife commons in the region and the contours of fragmented management and use rights divided among a diverse repertoire of actors. Yet, communities still have little influence in the process, particularly in the case of wildlife governance. Attention to the interconnections and historical junctures in resource management and tenure across these overlapping resources may be key to understanding the present challenges and opportunities for more sustainable resource management in this region and others.

Many of the issues seen in Congo are repeated in hunting systems elsewhere. Harvesters of wildlife are often treated as either legitimate hunters or illegitimate poachers (e.g., Haller 2013), sometimes simultaneously or in the same context but over different time periods. Other issues differ in important ways geographically. While recognition of hunters' rights to wildlife extraction and governance is in its infancy in central Africa, where top-down approaches are dominant, it has a longer history in South America, which includes devolved indigenous reserves (Peres 1994). Increasing visibility and circulation of wildlife-commons case studies would enhance opportunities to elicit comparisons across and within geographies of wildlife use.

### Key Areas for Future Research

Our review of the current overlap between wildlife hunting and commons scholarship is an initial step toward increased engagement among scholars and practitioners

of both wildlife and the commons. We recommend the following for wildlife scholars and practitioners. Prioritize attention to issues beyond the ecological and economic dynamics of wildlife to include more diverse social science perspectives including commons scholarship. To increase engagement with commons scholars, wildlife scholars could directly incorporate commons theories and concepts or forge collaborations. Comparative studies of wildlife institutions that incorporate commons frameworks could generate new insights into the human dimensions of wildlife use across different geographies, and enable comparisons of wildlife governance and other CPRs, such as forests and fisheries.

Likewise, recommendations and opportunities for commons scholars include the following. Explore the dynamics of overlapping and interacting CPRs, which are presently not well understood, to advance the commons research agenda. Existing wildlife-commons studies that address overlapping CPRs indicate the value in this approach and ways to contend with these dynamics. Expand engagement across disciplines that are currently largely isolated from commons scholarship, including wildlife studies. Although commons scholarship is inherently interdisciplinary—in dialogue with political science, anthropology, economics and policy studies—wildlife practitioners and scholars are not well represented.

Finally, we suggest 2 key areas for future research. First, bridging isolated social networks to increase collaboration among those who have expertise in wildlife case studies and other CPRs can forge new research agendas. Within wildlife hunting, increased collaboration across scholars who focus on different geographies (e.g., the Arctic and West Africa) could enhance present understanding of shared governance challenges offering fresh insights to the seeming intractability of wildlife issues, including the bushmeat crisis. Second, continued development of diagnostic frameworks that balance local context with generalizability will require increased communication and engagement among scholars outside the established silos of wildlife and commons scholars. Deeper engagement with scholar-practitioners who work with CPRs, including wildlife, would add needed empirical knowledge on the ongoing dynamics of CPR governance challenges on the ground. We believe that increased engagement between wildlife and commons scholarship can help reconceptualize access, use, and management rights as part of sustainable and just solutions to the wildlife governance crisis.

### Acknowledgments

This research collaboration is the result of ongoing discussions and curiosity among colleagues across disciplines and was made possible partly through the support by

the Robert Bosch Foundation and the German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig, funded by the German Science Foundation (FZT 118), that supported S.M.'s travel to the United States and tenure at the Duke University Marine Laboratory.

## Supporting Information

Information on the data-retrieval process (Appendix S1) and information on qualitative coding (Appendix S2) are available online. The authors are solely responsible for the content and functionality of these materials. Queries (other than absence of the material) should be directed to the corresponding author.

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