

Synthesis

Understanding human-elephant interactions across time is key to illuminate pathways toward coexistence

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ABSTRACT. Research on human-elephant interactions (HEI) seeks to better understand relationships between people and elephants with the goal of reducing unwanted interactions for the long-term survival of elephants in social-ecological systems. Many examinations of HEI often rely on a short temporal scale of several seasons to several years, often because of limited data availability across time. These examinations offer limited understanding of processes that influence HEI and mutual adaptations of people and elephants. In this synthesis, I present an ethnographic case study from the Okavango Delta, Botswana, where human and elephant populations have increased in the past 20 years. I use bricolage, a practice of using available materials at hand, to weave together diverse historical and current scholarship and primary data to understand dynamics of HEI and coadaptation across three different periods (pre-colonial, colonial, and post-independence). I show that people and elephants were coadapted in the pre-colonial period when people were highly mobile and hunted elephants with rudimentary technologies in ways that supported human development across southern Africa with minimal impact on elephants. European colonization brought sweeping changes, including through the introduction of guns and the development of the ivory trade that led to massive declines in elephant populations. Development policies that were magnified in the years following independence, including the establishment of land policies that settled communities, additionally disrupted the formally fluid nature of HEI. Simultaneously, wildlife conservation policies that coincided with dramatic increases in elephant populations shape how people perceive HEI and elephants as a predominant environmental force today. I argue that the incorporation of wider historical contexts, where necessary through the practice of bricolage, reveals coadaptation across time and offers understanding of possibilities of coexistence where people and elephants thrive alongside each other.

Key Words: *Botswana; bricolage; coadaptation; coexistence; human-wildlife conflict; human-elephant interactions; temporal scale*

INTRODUCTION

Human-wildlife conflict (HWC) is often defined as the two-way interaction that occurs between humans and wildlife whenever they coincide (Sitati et al. 2003). The body of research on HWC has grown exponentially in recent years, from a focus on causes and outcomes of negative interactions toward the goals of sustainably safeguarding biodiversity and ecosystems, and supporting human well-being (Nyhus 2016). Increasingly, research on HWC identifies present-day coadaptation, conceptualized as the ability for people and wildlife to “change their behavior, learn from experience, and pursue their own interests with respect to each other” (Carter and Linnell 2016:577). Yet the ways in which people and wildlife can thrive alongside each other, or coexist, over longer periods of time, remains poorly understood, a gap this synthesis seeks to address through a case of human-elephant interactions (HEI; Naughton-Treves 1997, Carter and Linnell 2016).

Globally, elephant populations have been in decline for decades, and the African savannah elephant (*Loxodonta africana*) was estimated to decline by 8% per year across the continent because of illegal hunting for the ivory trade as well as habitat fragmentation and land use change (Chase et al. 2016). In 2021, the African savannah elephant was listed as endangered by the International Union for the Conservation of Nature. Elephants, much like people, are long-lived and socially complex mammals, capable of collective knowledge building, long-distance communication, and cooperation (Plotnik et al. 2011, Eleuteri et al. 2024). Elephants are deeply impacted by HEI when they are killed for their ivory, in retaliation to specific encounters with

people, or through culling programs when a government has decided that there are too many elephants in a given location (Nelson et al. 2003, Stiles 2004).

Increasingly, scholars argue that ethics are necessary to help make sense of the complex dynamics of in-situ HEI, though little is known about the emotional lives and well-being of elephants (e.g., Poole et al. 2011, Kopnina 2016, Guldemond et al. 2017). The growing body of behavioral work suggests that elephants are learning to navigate human presence on the landscape (e.g., Ball et al. 2022). For instance, elephants exhibit a learned response to people, approaching more population-dense areas at night and distinguishing people by ethnicity, gender, and age (McComb et al. 2014, Pozo et al. 2017, Buchholtz et al. 2019a). One of those ways in which they are adapting may have contributed to the deaths of an estimated 400 elephants who consumed water contaminated with cyanobacteria in 2020 during a prolonged period of drought likely made worse through climate change as well as physical human-made barriers (van Aarde et al. 2021).

What is better understood are the impacts of HEI on people who experience both visible and invisible burdens from living with elephants. Visible burdens include impacts to livelihoods, in particular through crop destruction, destruction of property such as buildings, impacts to woodlands and other natural resources, and, most tragically, the trampling and killing of people (e.g., Jackson et al. 2008, DeMotts and Hoon 2012, Pozo et al. 2017, Buchholtz et al. 2019a, Redmore et al. 2020). Other researchers have documented a myriad of “invisible,” uncompensated, delayed, emotional, psychological, or social costs of the impact of human-

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elephant interactions on people and rural communities (e.g., Ogra 2008, DeMotts and Hoon 2012, Jadhav and Barua 2012, Witter 2013, Mayberry et al. 2017). Invisible burdens tend to be overlooked in conservation and development policy and practice, though have ramifications for the people who live with elephants, impacting their mental well-being, ability to carry out livelihood activities, and desire to continue to reside in their home (Ogra 2008, Jadhav and Barua 2012, Witter 2013, Mayberry et al. 2017, Redmore et al. 2023).

Land use across time is increasingly used to understand where and when HEI occur, and seasonal variation is often explicitly included as a key temporal factor in research to understand drivers and outcomes of HEI (e.g., Buchholtz et al. 2019a, b). Other scholars may incorporate change over several years, documenting impacts across time to understand, for example, the financial burden of HEI or the impacts of wildlife tourism through community-based natural resource management schemes (Mbaiwa 2003, Mbaiwa and Stronza 2010, Pozo et al. 2017). Research that includes temporal dimensions ranging from seasons to several years or several decades can effectively advance strategies for mitigating the impacts of HEI within present-day socio-political contexts (Pooley et al. 2023).

Yet research that incorporates longer-term timescales, including timescales that span generations, are scant given the challenges of accessing longer-term data (e.g., many governments instituted HWC monitoring schemes in the last few decades, often tracking economic impacts to agricultural production, as well as killings or injuries; Pooley et al. 2023). This presents a major shortcoming of the HEI literature for several reasons. Humans and elephants have both shaped the landscape for millennia, and Herremans (1995:440) argued that elephants facilitate transitions between woodlands and grasslands “at a time and geographical scale well beyond the limits of human insight and patience of managers.” Human cultures are dynamic and socio-political contexts may mediate HEI over longer periods of time in both tangible and intangible ways (Ekblom et al. 2019). For instance, colonial-era policies and practices in Kenya disrupted the fluid cohabitation of people and elephants, leading to today’s conflicting interactions (Kamau and Sluyter 2018). Similarly, elephants may have their own cultures and histories that shape and are shaped by interactions with people over generations (Sukumar 2003, Pooley 2021).

A longer view of history offers a possibility of deepening our understanding of what HEI and coadaptation looked like in the past, how policies and practices enabled or disrupted those interactions and abilities to coadapt, and how they manifest in HEI or coadaptation today (Kamau and Sluyter 2018, Pooley et al. 2023). This ethnographic case study explores a longer view of HEI and past policies and practices that enabled or disrupted coadaptation. It is my hope that understanding HEI in the past can illuminate future possibilities for human-elephant coexistence.

Approach

I offer an ethnographic case study from the Okavango Delta, Botswana, an area where both human and elephant populations have grown in recent years and where 16,000 people share space with 18,000 elephants (Central Statistics Office 2011, Pozo et al. 2017). For people living in the Okavango today, elephants were

not always so physically omnipresent but have long shaped various facets of human society. Some scholars have referred to this part of Botswana as “an elephant landscape” (Salerno et al. 2018) because of the dominant role of elephants as ecosystem engineers across space. I refer to the significance of elephants in recent years through the “era of elephants” to indicate that present-day HEI departs from past HEI. I emphasize the importance of incorporating generational timescales because history offers a lens to understand how people today understand HEI and their relationships to elephants.

I introduce the study site and frame the case study as one that uses bricolage, an interdisciplinary practice that weaves together diverse sources of primary and secondary information and approaches (Kincheloe 2001). Bricolage offers a way to respond to the call for new methodologies that bridge diverse worldviews in the study of HEI and helps to contextualize HEI in light of shifting policies, institutions, and cultures (Pooley 2021, Pooley et al. 2023). Bricolage also can be used where scant historical data are available, and offers a way to contextualize HEI across time in the study site. Given the tectonic role of colonization in shaping southern African politics and institutions that influence HEI (Von Fintel and Fourie 2019, Pooley et al. 2023), I frame findings of HEI and coadaptation around three key time periods: precolonial (prehistoric through early 1800s), when the presence of elephants enabled the development of Botswana’s social and cultural life; colonial (1800s–1966), when expansion of colonial empire through ivory exploitation shaped governing institutions and rural communities; and post-independence (1966–2018 when data collection ended), when the “era of elephants” in recent years informed daily, seasonal, and longer-term human decisions.

I examine the dynamics of HEI and coadaptation and then conclude with an emphasis on incorporating socio-political historical evidence to understand today’s landscape of HEI and to offer lessons for what a dynamic state of coexistence might look like. My goal for this synthesis is two-fold: I seek to draw attention to the possibilities for using bricolage to advance historically grounded and multigenerational perspectives of HEI, HWC, and processes of coadaptation. I also aim to advance a more holistic, longer-term perspective on HEI in the area and inform how research communities seek to understand and promote human-wildlife coexistence.

STUDY LOCATION AND METHODS

Botswana, the Okavango Delta, and Mkgacha Village

At over five million hectares, the Okavango Delta in Botswana (hereafter referred to as the Delta) is one of the largest intact wetlands in the world and a wetland of global significance (Trouwborst 2019). Vegetation provides food, resources, and habitat year-round for wildlife and people, alike. Given the diverse array of wildlife that visit the flooded Delta, Botswana has a significant, international tourism industry (Mbaiwa 2003), in part because of a large population of elephants, between 130,000 and 142,000 elephants, approximately 37% of Africa’s savanna elephant population (Chase et al. 2016). In the Eastern panhandle of the Delta, the elephant population tripled from the mid-1990s through 2015 (Songhurst et al. 2016). Scholars hypothesized that during that time Botswana attracted immigrant elephants because of a combination of factors, including low human population

density, resource availability, and natural resource management policies, including a species-wide hunting ban that was in effect from 2014 to 2019 (Roskaft et al. 2014, Vandewalle and Alexander 2014, Selier et al. 2016, Mbaiwa and Mogende 2022).

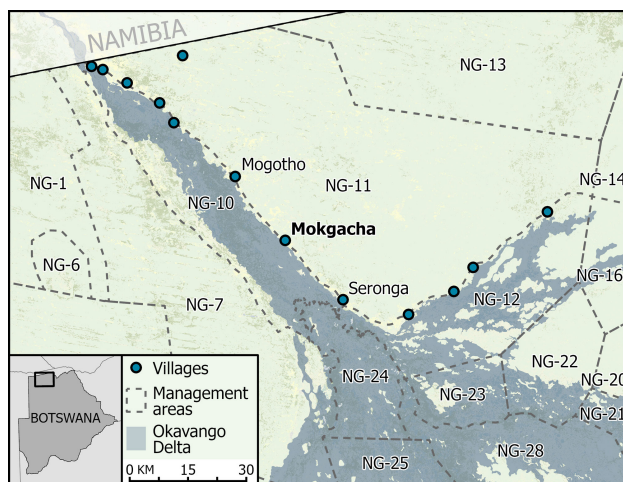
The focal site of the research was Mokgacha Village, a community of around 500 people belonging to four different ethnic groups: Yeyi, Hambukushu, Boga Khwe, and //ani Khwe, each with unique occupancies of the Okavango region (Table 1). At the time of primary data collection in 2017 and 2018, unemployment was around 25% of the adult population, and most residents engaged in diverse, natural resource-based livelihood activities, including cattle rearing, farming, fishing, harvesting of firewood and building materials, and gathering of wild fruits.

Table 1. Key ethnic groups residing in Mokgacha Village, their estimated occupancy date in the Okavango region, and corresponding reference.

Ethnic group	Approximate occupancy date in Okavango region	Reference
//ani Khwe	Autochthonous	Bolaane 2014
Boga Khwe	Autochthonous	Bolaane 2014
BaHambukushu	Early 1800	Larson 1969
Bayeyi (Yei)	1750	Larson 1989

Mokgacha was designated a government-sanctioned village in 2014 when its population reached ~500 people, triggering government investment into public facilities like government offices or a health clinic that had yet to be built at the time of this research. This meant that residents traveled to the neighboring villages of Seronga and Mogotho to see a nurse or doctor, or to file a report with the police or wildlife officers (Fig. 1). Transportation options were limited, with occasional public buses stopping in the village, so many people would walk 20 kilometers to either village if they were unable to find a ride, traversing elephant pathways at great risk of having unwanted encounters.

Fig. 1. A map of the study area, with the study site, Mokgacha Village, located north of Seronga Village, south of Mogotho Village, and situated between wildlife management units Ngamiland (NG-) 11 and NG-10 (credit: Erin Buchholtz).



Methods

I conducted historical and archival research, both prior to and following fieldwork, to understand the changing landscape of HEI over time, where possible integrating works written about the Delta, specifically, or southern Africa, more generally. Archival research included historical census data and government documents available at the Government Printing and Publishing Services, Central Statistics Office, and other government offices in Botswana's capital. Additional white, grey, and peer reviewed literature on Botswana's land use and land settlement policies, rural development programs and initiatives, natural resource use, and wildlife and protected area management was used to develop historical and present-day context around HEI, and to identify additional sources of information, for example, travel diaries of early British explorers and traditional stories captured by anthropologists. All texts were limited to what was available in English.

I also conducted ethnographic fieldwork from October 2017 through July 2018 when I lived in Mokgacha Village and used ethnographic methods, especially participant observation, to gain a culturally informed, emic, and nuanced perspective of life in the village, HEI, and how people and elephants may be coadapting (Emerson 2001). Field notes were collected throughout the day as I interacted with community members around their homes and in the village, engaged in daily activities that brought me into the woodlands and Delta (e.g., collecting water or firewood), and at community meetings.

Primary data collection also involved unstructured, open-ended interviews with residents and representatives whereby participants guided the interview based on their knowledge and expertise (Bernard 2006). First, I conducted unstructured interviews with 29 cultural representatives concerning historical and recent movement of groups of people, perceived changes in elephant populations and movement, and cultural connections to elephants. I used a snowball sample method to identify community elders from all four ethnic groups from Mokgacha and neighboring villages, ensuring diversity of culture and perspectives. I additionally conducted open-ended interviews with 14 government and nongovernment representatives to ask about HEI in Mokgacha and the larger study region, drawing from different domains of interest and expertise of the representatives, e.g., interviews with local Department of Wildlife and National Parks representatives focused on what kinds of HEI data they collect, their relationships with community members, and how HEI have changed since they took their position (Bernard 2006). Participants included government representatives from the Tswana sub-Land Board, Department of Forestry and Rangeland Resources, Department of Wildlife and National Parks, among others, as well as other official representatives including the Okavango Community Trust, the village land overseer, the village *Kgosi* (headman; plural: *dikgosi*), etc. Interviews were conducted in the participant's language of choice, and interpretation was provided by a local research assistant from the community who spoke all local languages and English.

I conducted interviews following Institutional Review Board approval informed consent protocols (Texas A&M IRB2016-0255) and research approval from the Government of Botswana and the Ministry of Environment, Wildlife, and Tourism (permit # EWT 8/36/4 XXXVII (15)). In addition, I gained local leader

approval from the *Kgosi* who supported my work in the village with assistance in finding a place to live and identifying a local research assistant. All names used are pseudonyms. I increased the credibility and trustworthiness of the findings through member checking, sharing back research findings with community members toward the end of the data collection period to ensure findings are reflective of participants' experiences and understandings and refine my interpretation of the findings (Harvey 2015).

Data analysis

All primary data were collected using handwritten notes only and typed up into Microsoft Word or Excel files as soon as possible following data collection. This provided time to clarify responses or the meaning of phrases or words, allowing us to ensure accurate data collection and interpretation. I created memos, reflecting on findings and the data collection process, to assist in the data interpretation process (Bernard 2006, Gibbs 2007). I integrated emergent results with methods, using a sequential approach to narrow in overtime on theoretical and practical findings (O'Reilly 2005). Using an ethnography-as-art combined with an ethnography-as-science approach (O'Reilly 2005, Wolcott 2005), I coded transcripts and documents for key emergent themes related to HEI and organized findings across time and by time periods.

FINDINGS: HUMAN-ELEPHANT INTERACTIONS ACROSS THREE TIME PERIODS

Pre-colonial (prehistoric through early 1800s): Human expansion by way of elephants

Elephants and people have long lived side-by-side. Some scholars argue that it is no mistake that pre-human ancestors and elephant species from the family *Elephantidae*, which includes mammoths and elephants, shared historical ranges as the availability of elephants as a food source was likely critical to the evolution of *Homo sapiens* (Yravedra et al. 2010, Ben-Dor et al. 2011). Pre-human ancestors were known to have more success when they hunted in groups, and elephant meat was shared within the group, likely furthering the evolution of human cooperative behavior (Sukumar 2003, Agam and Barkai 2018). Some species of elephants went extinct, likely in part from being overhunted by groups of early humans (Surovell et al. 2005, Brook and Barnosky 2012, Corlett 2013).

In central Southern Africa, there is growing documentation of widespread human use of the landscape dating back to the early Stone Age (e.g., Van Riet Lowe 1935, Coulson et al. 2022). Tsodilo Hills, an important historical human settlement site in proximity to Mokgacha Village, was occupied from 100,000 years ago by nomadic hunter-gatherer or pastoralist groups, especially //ani Khwe (Tlou and Campbell 1984, Wilmsen 2014). People there remained nomadic for thousands of years, which gave them the advantage of being able to seek out or avoid seasonally available resources and wildlife (Turner 1987). Despite little archeological evidence, hunter-gatherers undoubtedly relied on elephants for meat, hide, ivory, and bone, selectively removing weak or sick individuals from groups of elephants (Sukumar 2003). People used traditional methods to hunt elephants, using sneak-attacks and axes to cut at the Achilles tendon, or by waiting for them in

trees and stabbing them with heavy spears (Selous 1881). Hunting was a slow process that took several days to harvest a single elephant, and was likely tortuous for humans and elephants, alike (Selous 1881).

From about 1000 AD, other societies began interacting with the nomadic groups in southern Africa, trading goods originating from Indonesia and India for locally available goods, including ivory (Denbow 2011). This trade was part of early global networks, allowing cultural sharing and the development of economies (Wilmsen 1989). Records show that prior to their arrival in the 1790s in the Okavango Delta region, people from the Tawana ethnic group traded ivory as early as the mid-1660s with the Dutch East India Company (Campbell 1990, Håkansson 2004). As demand for ivory increased alongside European colonization of Africa, hunters developed new hunting methods, such as pit traps, fire, and barbed spikes in holes that would pin the elephant in place (Campbell 1990). The global demand for ivory and other elephant products facilitated the movement of hunters into the central part of the continent to Botswana as populations of elephants were decimated along coastal southern Africa (Vandewalle and Alexander 2014).

The Yeyi people from the Barotse Empire (a Kingdom that spanned Central Southern Africa, now the Zambezi region of Namibia, northern Botswana, Zambia, Angola, and Zimbabwe) are thought to have first settled Ngamiland in the early 1800s, though one ethnographic account describes a settlement history as early as 1650 in the region (Larson 1989). British Major A. St. H. Gibbons, who travelled across Africa from 1858 to 1916, kept a diary of his travels and briefly mentioned how he heard of a group of Hambukushu hunters, led by their rainmaking chief, followed a group of elephants and stumbled upon the Okavango (Gibbons 1904). Larson (1969) elaborated on how a hunt for elephants by Hambukushu hunters led to the settlement by the BaHambukushu in the Okavango Delta: In the mid-1700s, the powerful Hambukushu Rainmaker, Chief Mashambo of the Barotse Empire grew angry at the Lozi people (unified diverse ethnic groups from the Barotse Empire), who refused to pay him tribute for an abundance of rain the previous year. He decided to teach them a lesson by refusing to make rain that year. His own people, the BaHambukushu, suffered greatly and had to forage to survive. One day, a hunter reported to the Chief that he had sighted elephants to the west of their kingdom. The Chief and his hunters went out in search of elephants, and after growing weary from a failed hunt, they stumbled upon the rich Okavango Delta. "Though they never did catch the elephants, it was these animals who led them to the new land. In gratitude the Chief adopted the elephant as one of their tribal totems" (Larson 1972:114).

Tlou (1972) credited the expansion of the Barotse Empire for increased political tensions, resulting in successive waves of migration of the BaYeyi and BaHambukushu people from the Zambezi region to the Okavango Delta region. Throughout the course of history of peoples in southern Africa, different groups of people inhabiting the area around the Okavango Delta used available resources in culturally specific ways (Tlou 1972, Surovell and Waguespack 2008). Prior to colonization in 1885, people inhabited the Delta, either living on their own or in groups based

around cooperation, including marriage, and social tension between families and groups (Schapera 1970a). Though each group had their own *kgosi* who allocated land, governed resources, gave seeds, and resolved conflict, people from different ethnic groups likely interacted and shared knowledge with each other, leading to technological changes and improved resource exploitation over time (Schapera 1970b, Hoon 2004).

Natural resources were central to all aspects of life, as people extracted almost all livelihood from them, including the homes they built, the wild foods they harvested, the water they drank, and the land they farmed (Schapera 1970a). However, people did not settle in a single location as environmental factors mediated suitability of residence in and around the Okavango Delta. These factors included rainfall and the availability of water, natural boom and bust cycles of tsetse fly and other livestock diseases like rinderpest and hoof and mouth (Tlou 1972, Junker et al. 2008), as well as elephant and wildlife populations that influenced hunting and gathering strategies of people (Skarpe and Ringrose 2014). In other words, people were highly mobile out of necessity, which was an adaptation to the environment, generally, and wildlife, specifically.

Colonial (1800s–1966): Ivory-fueled colonization decimated elephant populations

Colonization across the region upended pre-existing HEI in several key ways. First, around the early 1800s, before mass ivory exploitation began, elephants numbered somewhere between 200,000 and 400,000 in Botswana, mostly in the north of the country (Campbell 1990). Driven by demand for ivory from colonial powers, hunters greatly reduced elephant populations from southern Botswana and left most of the population significantly reduced in the north of the country, leading to near extirpation of the species from the area (Junker et al. 2008, Skarpe and Ringrose 2014).

By 1830 the British colonial powers put in place the first of many southern African hunting bans on elephants in the Eastern Cape of South Africa because only two small herds were left (Meredith 2001). White ivory hunters and their families moved north in southern Africa, entering unexplored veld in the Botswana region and further east in what is now Zimbabwe (Meredith 2001). At first, explorers found a place teeming with elephants. In 1848, Scottish explorer David Livingstone, accompanied by English explorer William Cotton Oswell, reached near Lake Ngami at the drainage of the Okavango River. Oswell described how,

I came, as I got clear of the bush, upon at least four hundred elephants standing drowsily in the shade of the detached clumps of mimosa trees. Such a sight I had never seen before, and never saw again. As far as the eye could reach, in a fairly open country, there was nothing but elephants. (Oswell 1894:129)

When Livingstone returned to the same spot three years later, he noted that more than 900 elephants had been killed and he worried what the increasing trade of ivory in exchange for more efficient firearms might mean for the safety of the colonists (Livingstone and Cotton Oswell 1852). Though *dikgosi* in the area objected to hunting by outsiders, European hunters killed elephants in large numbers for their ivory (Campbell 1990), and by the end of 19th century, elephant herds were greatly reduced to a few thousand

individuals (Vandewalle and Alexander 2014). More remote areas still had large populations of elephants, and likely incentivized colonization further inland as the ivory trade flourished (Selous 1881). As the ivory trade reached the interior of southern Africa, trees were released from pressure and the woodland ecosystem flourished, influencing what is still today widely accepted as the ecosystem baseline across the region (Vandewalle and Alexander 2014).

Second, alongside impacts on wildlife and ecosystems, colonization had far-reaching social impacts that would influence human organization and land use for years to come. By the 1870s, missionaries had settled the area and diamond-mining operations in South Africa provided wage jobs for men from the region, facilitating migration across the broader Southern Africa region (Schapera 1970b). In 1885, under threat from encroachment by the Boers in South Africa, Scottish missionary John Mackenzie campaigned for the British Crown to protect the region, which came to be called Bechuanaland Protectorate. Originally excluded from the Protectorate, the Ngamiland region, where this research is based, became a part of the Protectorate in 1890 (Schapera 1970b). Until independence in 1966, the British ruled Bechuanaland from afar, investing minimally into the development of the then-colony (Schapera 1970b). British administrators imposed a series of policy changes, including depriving *dikgosi* of power in 1891, establishing an annual hut tax payable by all male household heads in 1899, and designating tribal reserves in 1899, among many others (Schapera 1970b). The main effect of these policy changes was the beginning of the process of settlement of people who had long been nomadic with flexible and adaptive livelihoods built around natural resources and kinship (Redmore et al. 2023). Other policy changes included the centralization of power to the British over wildlife resources at the expense of local community control and decision making, and sometimes with the effect of displacing entire communities in the process of creating game reserves (Bolaane 2004). However because land was administered by local *dikgosi* through rights of use, tribes accrued some financial benefits from wildlife hunting concessions even during colonial rule (Kgathi et al. 2011).

Yet the ecological and social changes ushered in through colonization led to feedback loops that further shifted the social-ecological system, especially ecosystems and economies. Specifically, as increasingly efficient firearms allowed easier wildlife hunting and the outbreak of rinderpest decimated cattle populations, soft-barked trees were released from browsing pressure and able to regenerate, leading to the woodland ecosystem outcompeting grasslands (Skarpe et al. 2004). A tsetse fly invasion in the 1940s further reduced cattle populations, likely leading to a growth of elephant populations (Junker et al. 2008). More elephants are thought to have, in turn, increased pressure on the woodlands as elephants browsed, uprooted, and knocked over trees (Skarpe et al. 2004).

Tsetse fly also forced many people to relocate from within the Delta to unaffected areas. Entire communities that had been settled in the Delta moved many kilometers to villages on the Western Panhandle, walking across the dry floodplains and using dugout canoes to cross the water. Many of those households relocated several more times, eventually settling back in the Eastern Panhandle where they found good grazing areas with

access to resources and away from dangerous wildlife and disease. One of those communities, Sedjwara, was a Delta island where Yeyi and Hambukushu families from across the Delta raised cattle, farmed, and harvested wild foods, until around the mid- or late 1940s when tsetse fly rendered the island uninhabitable. A resident of Mokgacha, an elder in his 80s who was born and spent his youth in Sedjwara in the 1930s and 1940s, recalled that one might see an elephant once a year, a cause for celebration in a time when they were a rarity. Sedjwara today is a wildlife tourist destination in a Wildlife Management Area, visited exclusively by wealthy foreigners on safari and a select handful of safari guides from the neighboring communities. Communities today are strictly accessible by road, part of the development project begun by colonial powers at a time when people were hard to count and harder to tax (Schapera 1970b). Furthermore, the dislocation of people from place in the name of wildlife conservation planted seeds of discontentment toward wildlife that would grow into modern understandings of HWC in the post-independence era (Bolaane 2004, Mbaiwa 2005, Mbaiwa and Stronza 2011).

Post-independence (1966–2018): The “era of elephants” in the Okavango Delta

Following independence in 1966, two processes were set in motion that intertwine to shape HEI. First, Botswana targeted rural development through agrarian expansion, offering more opportunities at home, and resulting in fewer men working in South Africa’s mines (Harvey and Lewis 1990). Land administration responsibilities were absorbed from the local leaders to the State (Kgathi et al. 2011), and starting in the 1970s, as rural populations began to grow, village siting began through a process whereby the government began to make strategic directives for the rural population to come together to receive infrastructural investments (Redmore et al. 2023). Permanent villages grew around population centers, and with it the infrastructure required to support children, adults, and the elderly, including schools, health clinics, and other social supports like pension (Harvey and Lewis 1990). Yet many people continued to reside in cattleposts, land outside of village households, and could relocate at will (Harvey and Lewis 1990).

Second, wildlife conservation policies were advanced in Botswana, including through the creation of Wildlife Management Areas (WMAs) in 1986, primarily zoned for wildlife utilization and management, including tourism (Kgathi et al. 2011). In 1993, Botswana initiated its first community-based natural resource management (CBNRM) programs aimed at decentralizing wildlife management decisions and benefits to local, rural communities (Thakadu 2005). Special Game Licenses, introduced in 1979 to allow subsistence hunting, were replaced with a quota system in 1996 that worked in concert with CBNRM, shifting wildlife benefits from individuals and households to communities (LaRocca 2016). The CBNRM program local to the study site, the Okavango Community Trust (OCT), was formalized in 1995 with the goal of delivering benefits from WMA Ngamiland (NG)-22 and 23 to the communities, specifically through the sharing of safari concession profits in the form of subsidized funeral costs, the establishment of local hardware shops, and prioritization of safari jobs hiring from affiliated villages, among other benefits (Magole and Magole 2011). Although the OCT formally spanned Seronga through Gudigwa in the East, Mokgacha at the time of the OCT formation was a

cattlepost governed by Seronga, and Mokgacha residents were critical to establishing the OCT, complicating governance years down the road, described below.

This constellation of rural development and wildlife conservation policies collided in Mokgacha in the mid-1990s, first with the 1994 government-mandated cattle kill operation following an outbreak of cattle lung disease around the country. Faced with the option to replace lost cattle with money or replacement cattle as compensation, most cattle holders around the Panhandle opted to accept cash (Hoon 2004, Kgathi et al. 2007). In the absence of cattle, people living in cattleposts moved to the villages, pulled into the village by the promise of future developments as well as government-sponsored temporary wage labor. Around the same time as the cattle kill, increasing elephant populations also served to push many people from cattleposts into Mokgacha as they sought safety from HEI in areas with more human activity (Redmore et al. 2023). The resulting growth of the population of Mokgacha led to its designation as a village, ultimately complicating the CBNRM program that, at the time of this research, split Seronga’s two representative positions between Seronga and Mokgacha to account for the newly designated village.

Until the mid-1990s, HEI were almost unheard of for most people living at the time of the research. For instance, following extensive ethnographic fieldwork spanning almost 50 years from 1950 through 1994, Larson (2001) noted that residents of the Delta experienced regular crop raiding by hippopotami yet made no reference to crop consumption by elephants. At the time of this research crop consumption by elephants was devastating to many families, but residents noted other changes in HEI, specifically pertaining to their sense of safety and ability to live a good life. In 2018 at the time of this research, several timeworn elephant pathways meandered across the road, the deep sand of the Kalahari Desert packed down and the bushes worn thin from frequent brushing against thick elephant skin. In more heavily wooded areas, larger trees were pushed over at their base or trunks broken off a few feet off the ground, left to sprout new leaves and branches or die. The impact of elephants on trees was a sign of the strength of elephants, a reminder to rural community members who relied on the use of fire to fell big trees that this is a shared landscape. A 73-year-old carpenter from a cattlepost just north of Mokgacha, explained that, “The elephants are doing a good job on the wood. [But] they bring sorrow and sadness to our fields where they destroy everything.” By this, the carpenter meant that the impact of elephants on trees is helpful to his livelihood because he benefits from easily available wood, yet this relationship was complex because he, like other rural residents, relied on a suite of livelihoods, including farming on which elephants were having a detrimental impact.

Changes in elephant populations influenced residents’ sense of safety across the landscape. Several older residents recalled only ever having seen elephant footprints in the sand for most of their lives until recently. They remembered how, as children, they confused elephant footprints in the sand for the print left by a mortar, a thigh-high hollowed-out log used to pound seed into grain with a circular bottom that, to an unaware eye, leaves a pattern resembling the distinct marks of an elephant foot when lifted from the sand. Mpho, an elder from a cattlepost south of

Mokgacha, described elephant populations in the past: “There were no elephants. We were farming at our fields and by this time [in the early evening], we’d knock off and walk home without any problems.”

Older residents claimed that elephant behavior, too, is different from in the past. Now, they say, elephants are aggressive and not afraid of people. As one Mokgacha elder explained, “In the past, we weren’t hearing about elephants killing people. Today there are so many. When I was young, I never heard of an elephant killing someone. Only if you were hunting them, that’s when an elephant could kill you.” As Mpho further explained, “Elephants these days are more aggressive. If they see someone they just want to fight. If you go back to Mokgacha at this time [in the early evening] you’ll see. Elephants in the past, if they saw a person, they’d just run.”

Increasing elephant populations restricted residents’ general freedom of mobility and reshaped other aspects of life and livelihoods, including an increase in the amount of time farmers and their families spent at their farms during the growing season often kilometers away from the village. Farmers and their children often live in rudimentary watch huts and make nighttime rounds to light chili pepper bombs or stoke fires at the borders of their farms, hoping to scare away elephants. Even harvesting firewood, a daily task for many Mokgacha residents, could quickly turn into a life-or-death situation while navigating woodlands with lower visibility. A general lack of employment opportunities and high dependence on natural resources exacerbates HEI, as explained by a Senior Wildlife Warden, responsible for community support and outreach for the DWNP:

Development may reduce the risk to elephants, and although education is low, education here in the area and the finding of jobs in the area will help to reduce the pressure on women, specifically. When people aren’t as dependent on natural resources, they will be at less risk than they are now.

Yet although elephants were a constant worry for most, a 39-year-old church leader explained that because “elephants are everywhere,” they can also become an invisible part of the background of life’s daily struggles, likely further influenced by overall sense of belonging and well-being. In other words, people perceived elephants both as a significant and persistent risk to their lives and livelihoods, as well as one that is almost forgettable because it has become a part of the everyday landscape background in the “era of elephants.”

In 2018 as fieldwork for this project was wrapping up, the *Kgosi* of Mokgacha explained at a community meeting that the newly installed President was listening about the elephant problem and would overturn the 2014 highly contentious hunting ban (LaRocca 2016). Normally a largely stoic group of people, all people present at the community meeting stood up to applaud the announcement, emphasizing the sense of frustration residents felt about living in the era of elephants. Although Mokgacha as a village would not benefit through increased revenue from hunting as a part of the OCT’s non-consumptive utilization area leases, residents felt they were being heard. Perhaps residents might benefit as neighbors to NG-11, a concession where elephants would be hunted.

DISCUSSION: DYNAMICS OF HEI AND COADAPTATION

Throughout the three key time frames identified through this work, HEI and coadaptation appear to be uneven across time, though are heavily influenced by wide ranging policies governing land and wildlife use, rural development, and more, as well as processes spanning global trade to colonization to cultural exchange (Table 2). Arguably at the expense of elephant species, some scholars claim that people are people because of, not in spite of, elephants (Locke 2013, Lorimer 2010). Early humans cooperated to hunt elephants, developing culture and communication, and spanning out across the continent because of the availability of wildlife resources (Turner 1987). People also followed elephants in search of water and other resources, and some groups of people made migration decisions based on elephant movements (Denbow 2011). People hunted sick or weak elephants in part because hunting technologies were rudimentary (Selous 1881). This meant hunting pressure on elephant populations was relatively low until the growth of global trade for ivory and the advent of new technologies that facilitated hunting alongside cultural exchange and the growth of early economies (Wilmsen 1989).

Environmental and socio-political conditions pushed and pulled different groups of people to settle across the region prior to the colonization of Botswana, ultimately leading to the settlement of Bantu communities in the Delta alongside Indigenous groups who long occupied the area (Gibbons 1904). These groups brought their own cultures, practices, and beliefs that shape where and how people live today. Yet people were highly mobile out of necessity, which likely reduced HEI, though the extent of negative interactions between humans and elephants is unknown. Regardless, that people relied on elephants to survive in times of hardship and to engage in global trade indicates that the possibility of conflict did not deter people from interacting with elephants.

Colonization had far-reaching impacts on HEI and coadaptation. Improved hunting technologies and the proliferation of gun technologies brought to Botswana by the Europeans facilitated increased elephant hunting, expanding the colonial imprint across the continent (Selous 1881). Ecologically, the decimation of elephants at the hands of European hunters during this era released pressure on woodlands, while cattle disease outbreaks meant cattle populations could not readily thrive (Vandewalle and Alexander 2014). The expansion of woodlands at the edge of grasslands subsequently impacted where and how people could live, and as communities moved deeper into the Delta, the sighting of elephants was a rarity and a cause for celebration (Redmore 2020).

In the years following independence, HEI have changed dramatically. People’s mobility across the landscape has decreased significantly, influenced by settlement policies that encouraged farming and cattle-based livelihoods (Schapera 1970b). Although elephant populations were not notable in the years prior to 1994, increasing elephant populations that temporally overlapped with a large-scale reduction in cattle in response to cattle lung disease fundamentally transformed the landscape (Junker et al. 2008). Without cattle, households began to move from cattleposts to

Table 2. Summary table of findings by time frames, dynamics of human-elephant interactions (HEI), and implications for conflict and coadaptation.

Study time frame	Dynamics of HEI	Implications for conflict and coadaptation
Pre-colonial (prehistoric through early 1800s)	Elephant populations high, human pressure on elephants low, mainly to hunt sick or weak elephants; People migrated in response to elephant movement, following them in search of food and water; Cultural totems celebrated elephants.	People co-evolved alongside elephants and both population numbers were relatively low; Evidence of low levels of conflict as people and elephants shared landscapes but did not often come into direct, unwanted contact.
Colonial (1800s–1966)	Development of global ivory trade and new hunting technologies; Elephant populations crashed because of hunting while cattle populations decreased because of disease, triggering ecological shifts; People transitioned to more permanent settlements with the introduction of taxation and development policies.	New human technologies threatened elephant populations, signaling high levels of conflict for elephants; People came to value elephants as a market commodity or as a cause for celebration given their rarity, signaling low levels of conflict for people.
Post-Independence (1966–2018)	New conservation and development policies altered how people access resources; Increases in elephant and human populations coincided with changes to landscape use because of policies and practices that encouraged settlement and agricultural-based livelihoods.	Human mobility for environmental adaptation was less feasible than in the past, leading to a growing social-ecological divide; Social and ecological changes happened at a more rapid pace, resulting in less time for mutual coadaptation than in the past.

Mokgacha and other permanent villages, both to seek safety from increasing elephant populations and to develop their own communities (Redmore et al. 2023).

As the elephant population increased, people noted big shifts in elephant movement and behavior. Fear of being attacked by elephants reshaped how people move across the landscape, with people being exceptionally aware at dawn and dusk when HEI are more likely. Although CBNRM was created in part to reduce the burden of HEI on rural communities, HEI are experienced acutely at the individual and household levels meaning CBNRM as a solution may, in some ways, be misaligned with realities on the ground. Because the landscape is shared in the era of elephants, people's well-being and relationships to each other and the land shape how people are able to adapt to elephants and possibilities for coexistence. Mobility has historically been one key coadaptation for both people and elephants, and while the increasing sedentarization of people has introduced new opportunities for communities to access critical infrastructure like schools, hospitals, and potable water, high rural unemployment and the continued reliance on natural resources may reduce people's abilities to coadapt to life with elephants.

Furthermore, the constellation of policies interacting with people's everyday decisions and sense of well-being likely further complicate HEI and coadaptation. In the generational view of HEI and coadaptation, changes that took place over hundreds of years in the past are now occurring at a much more rapid pace, yet the impacts of those changes may not be felt or known for decades. For instance, the hunting ban of 2014 that was lifted in 2019 opened up trophy hunting licenses to under 300 elephants per year, and a recent study showed declines in areas with hunting and increases in areas without hunting, potentially indicating elephant movement in response to hunting (Schlossberg and Chase 2024). Yet the policy reversal may have helped people feel heard and respected by their government (Hitchcock et al. 2020), and may, perhaps years in the future, reduce people's frustration from living in an era of elephants. Coadaptation of people and elephants is likely a slow process compared to the relatively rapid pace of policy development and modern social change, more generally. As a result, it is critical to interrogate our understanding

of HEI and coadaptation against the backdrop of shifting policy and governance decisions, whilst remaining humble to the fact that HEI occur in a myriad of ways that researchers are only beginning to unveil.

CONCLUSION: FROM COADAPTATION TOWARD COEXISTENCE

In this article I use bricolage to draw together diverse sources of evidence to advance socially and politically grounded and historically contextualized research on HEI (Kamau and Sluyter 2018, Pooley et al. 2023). Through bricolage, I showed that HEI, like other human-wildlife interactions, are dynamic and rooted in history and culture (Goldman et al. 2010). I also showed that HEI are integral to land and resource access in guiding where people settle and carry out livelihoods, dialectically influencing where and how people interact with elephants as they move across the landscape (Gupta 2013, Redmore et al. 2020). As Hitchcock et al. (2020) pointed out, elephant population numbers can be leveraged to varying policy ends, based on what time frames are presented and what is presumed to drive change. Bricolage can offer longer-term perspectives on HEI, in particular those that consider the whole system—including elephant populations, vegetation, rural human communities, and colonial and post-independence land use and social policies—and offer insights into the dynamic nature of HEI and the numerous social-ecological factors that play into outcomes on the ground (Vandewalle and Alexander 2014). Written historical records are often biased toward Western, dominant languages, in particular English in the case of southern Africa, but they can be complimented with oral histories and traditional stories to provide a deeper look back in time (Echo-Hawk 2000). Available information tracing changes in social-ecological systems across time is scant, but diverse literature, historical documents, and oral histories offer little windows into HEI at various points in time that when pulled together offer a more complete picture.

Furthermore, as scholars increasingly grapple with what coexistence looks like and how to define it, this article responds to the need to examine what “sustainable though dynamic states” of human-wildlife coadaptation look like (Pooley et al. 2021:785). By shifting the framing from an “elephant landscape” toward an

“era of elephants,” I show that generational timescales can influence understanding of the dynamics of HEI and coadaptation across time, and how they are shaping and being shaped by culture and policies linking land use, livelihoods, wildlife management, and more. HEI do not just occur over seasonal, annual, or decadal time spans, but over centuries and millennia, shaping not just whether humans and elephants interact, but where and how. Combined, these facets of human-elephant interaction and coadaptation across time suggest that coexistence may be increasingly more dynamic. The incorporation of longer timescales offers a more complete picture of on-the-ground dynamic realities for both species and how they interact and coadapt (Pooley et al. 2023). Combined they may also offer insights into the present and future dynamics of HEI and coadaptation toward a more holistic understanding of human-elephant coexistence.

Author Contributions:

LR conceived of the research, conducted fieldwork, analyzed the data, and wrote and edited the manuscript.

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Data Availability:

The data/code that support the findings of this study are available on request from the corresponding author, LR. None of the data/code are publicly available because they contain information that could compromise the privacy of research participants. Ethical approval for this research study was granted by Texas A&M's Institutional Review Board, study #IRB2016-0255D.

LITERATURE CITED

- Agam, A., and R. Barkai. 2018. Elephant and mammoth hunting during the Paleolithic: a review of the relevant archaeological, ethnographic and ethno-historical records. *Quaternary* 1(3):3. <https://doi.org/10.3390/quat1010003>
- Ball, R., S. L. Jacobson, M. S. Rudolph, M. Trapani, and J. M. Plotnik. 2022. Acknowledging the relevance of elephant sensory perception to human-elephant conflict mitigation. *Animals* 12(8):1018. <https://doi.org/10.3390/ani12081018>
- Ben-Dor, M., A. Gopher, I. Hershkovitz, and R. Barkai. 2011. Man the fat hunter: the demise of *Homo erectus* and the emergence of a new hominin lineage in the Middle Pleistocene (ca. 400 kyr) Levant. *PLoS ONE* 6(12):e28689. <https://doi.org/10.1371/journal.pone.0028689>
- Bernard, H. R. 2006. Research methods in anthropology: qualitative and quantitative approaches. Fourth edition. AltaMira Press, Lanham, Maryland, USA.
- Bolaane, M. 2004. The impact of game reserve policy on the River BaSarwa/Bushmen of Botswana. *Social Policy and Administration* 38(4):399-417. <https://doi.org/10.1111/j.1467-9515.2004.00398.x>
- Bolaane, M. 2014. San cross-border cultural heritage and identity in Botswana, Namibia and South Africa. *African Study Monographs* 35(1):41-64.
- Brook, B. W., and A. D. Barnosky. 2012. Quaternary extinctions and their link to climate change. Pages 179-198 in L. Hannah, editor. *Saving a million species*. Island Press, Washington, D.C., USA. https://doi.org/10.5822/978-1-61091-182-5_11
- Buchholtz, E., L. Fitzgerald, A. Songhurst, G. McCulloch, and A. Stronza. 2019b. Overlapping landscape utilization by elephants and people in the Western Okavango Panhandle: implications for conflict and conservation. *Landscape Ecology* 34(6):1411-1423. <https://doi.org/10.1007/s10980-019-00856-1>
- Buchholtz, E. K., L. E. Redmore, L. A. Fitzgerald, A. Stronza, A. C. Songhurst, and G. McCulloch. 2019a. Temporal partitioning and overlapping use of a shared natural resource by people and elephants. *Frontiers in Ecology and Evolution* 7:117. <https://doi.org/10.3389/fevo.2019.00117>
- Campbell, A. 1990. History of elephants in Botswana. Pages 5-15 in P. Hancock, editor. *The future of Botswana's elephants*. Proceedings of a workshop organized by the Kalahari Conservation Society in conjunction with the Department of Wildlife and National Parks, Gaborone, Botswana.
- Carter, N. H., and J. D. Linnell. 2016. Co-adaptation is key to coexisting with large carnivores. *Trends in Ecology and Evolution* 31(8):575-578. <https://doi.org/10.1016/j.tree.2016.05.006>
- Central Statistics Office. 2011. 2011 Population and housing census. Government Printing, Gaborone, Botswana.
- Chase, M. J., S. Schlossberg, C. R. Griffin, P. J. C. Bouché, S. W. Djene, P. W. Elkan, S. Ferreira, F. Grossman, E. M. Kohi, K. Landen, P. Omondi, A. Peltier, S. A. J. Selier, and R. Sutcliffe. 2016. Continent-wide survey reveals massive decline in African savannah elephants. *PeerJ* 4:e2354. <https://doi.org/10.7717/peerj.2354>

- Corlett, R. T. 2013. The shifted baseline: prehistoric defaunation in the tropics and its consequences for biodiversity conservation. *Biological Conservation* 163:13-21. <https://doi.org/10.1016/j.biocon.2012.11.012>
- Coulson, S., S. Staurset, S. Mothulatshipi, S. L. Burrough, D. J. Nash, and D. S. Thomas. 2022. Thriving in the Thirstland: new Stone Age sites from the Middle Kalahari, Botswana. *Quaternary Science Reviews* 297:107695. <https://doi.org/10.1016/j.quascirev.2022.107695>
- DeMotts, R., and P. Hoon. 2012. Whose elephants? Conserving, compensating, and competing in northern Botswana. *Society and Natural Resources* 25(9):837-851. <https://doi.org/10.1080/08941-920.2011.638362>
- Denbow, J. 2011. Excavations at Divuyu, Tsodilo Hills. *Botswana Notes and Records* 43:76-94.
- Echo-Hawk, R. C. 2000. Ancient history in the New World: integrating oral traditions and the archaeological record in deep time. *American Antiquity* 65(2):267-290. <https://doi.org/10.2307/2694059>
- Ekblom, A., A. Shoemaker, L. Gillson, P. Lane, and K. J. Lindholm. 2019. Conservation through biocultural heritage—examples from sub-Saharan Africa. *Land* 8(1):5. <https://doi.org/10.3390/land8010005>
- Eleuteri, V., L. Bates, J. Rendle-Worthington, C. Hobaiter, and A. Stoeger. 2024. Multimodal communication and audience directedness in the greeting behaviour of semi-captive African savannah elephants. *Communications Biology* 7(1):472. <https://doi.org/10.1038/s42003-024-06133-5>
- Emerson, R. M. 2001. Producing ethnographies. Theory, evidences and representation. Pages 239-259 in R. M. Emerson, editor. *Contemporary field research: perspectives and formulations*. Waveland, Long Grove, Illinois, USA.
- Gibbons, A. S. H. 1904. *Africa from south to north through Marotseland*. 2 vols. J. Lane, London, UK.
- Gibbs, G. R. 2007. *Analyzing qualitative data*. SAGE, London, UK. <https://doi.org/10.4135/9781849208574>
- Goldman, M. J., J. Roque De Pinho, and J. Perry. 2010. Maintaining complex relations with large cats: Maasai and lions in Kenya and Tanzania. *Human Dimensions of Wildlife* 15 (5):332-346. <https://doi.org/10.1080/10871209.2010.506671>
- Guldemond, R. A., A. Purdon, and R. J. Van Aarde. 2017. A systematic review of elephant impact across Africa. *PloS ONE* 12(6):e0178935. <https://doi.org/10.1371/journal.pone.0178935>
- Gupta, A. C. 2013. Elephants, safety nets and agrarian culture: understanding human-wildlife conflict and rural livelihoods around Chobe National Park, Botswana. *Journal of Political Ecology* 20(1):238-254. <https://doi.org/10.2458/v20i1.21766>
- Håkansson, N. T. 2004. The human ecology of world systems in East Africa: the impact of the ivory trade. *Human Ecology* 32 (5):561-591. <https://doi.org/10.1007/s10745-004-6097-7>
- Harvey, C., and S. R. Lewis Jr. 1990. *Policy choice and development performance in Botswana*. Macmillan, London, UK.
- Harvey, L. 2015. Beyond member-checking: a dialogic approach to the research interview. *International Journal of Research and Method in Education* 38(1):23-38. <https://doi.org/10.1080/1743-727X.2014.914487>
- Herremans, M. 1995. Effects of woodland modification by African elephant *Loxodonta africana* on bird diversity in northern Botswana. *Ecography* 18(4):440-454. <https://doi.org/10.1111/j.1600-0587.1995.tb00147.x>
- Hitchcock, R. K., N. Winer, and M. C. Kelly. 2020. Hunter-gatherers, farmers, and environmental degradation in Botswana. *Conservation and Society* 18(3):226-237. <https://doi.org/110.4103/cs.cs.19.87>
- Hoon, P. N. 2004. Impersonal markets and personal communities? Wildlife, conservation, and development in Botswana. *Journal of International Wildlife Law and Policy* 7 (3-4):143-160. <https://doi.org/10.1080/13880290490883223>
- Jackson, T. P., S. Mosojane, S. M. Ferreira, and R. J. van Aarde. 2008. Solutions for elephant *Loxodonta africana* crop raiding in northern Botswana: moving away from symptomatic approaches. *Oryx* 42(1):83-91. <https://doi.org/10.1017/S0030605308001117>
- Jadhav, S., and M. Barua. 2012. The elephant vanishes: impact of human-elephant conflict on people's wellbeing. *Health and Place* 18(6):1356-1365. <https://doi.org/10.1016/j.healthplace.2012.06.019>
- Junker, J., R. J. van Aarde, and S. M. Ferreira. 2008. Temporal trends in elephant *Loxodonta africana* numbers and densities in northern Botswana: is the population really increasing? *Oryx* 42 (1):58-65. <https://doi.org/10.1017/S0030605308000756>
- Kamau, P. N., and A. Sluyter. 2018. Challenges of elephant conservation: insights from oral histories of colonialism and landscape in Tsavo, Kenya. *Geographical Review* 108(4):523-544. <https://doi.org/10.1111/gere.12288>
- Kgathi, D. L., M. Bolaane, and S. Mosojane. 2011. Property rights and access to natural resources in conservation areas of the Okavango Delta, Botswana. Pages 133-148 in B. N. Ngwenya, D. L. Kgathi, and M. B. K. Darkoh, editors. *Rural livelihoods, risk and political economy of access to natural resources in the Okavango Delta*. Nova Science, New York, New York, USA.
- Kgathi, D. L., B. N. Ngwenya, and J. Wilk. 2007. Shocks and rural livelihoods in the Okavango Delta, Botswana. *Development Southern Africa* 24(2):289-308. <https://doi.org/10.1080/0376835-0701327186>
- Kincheloe, J. L. 2001. Describing the bricolage: conceptualizing a new rigor in qualitative research. *Qualitative Inquiry* 7 (6):679-692. <https://doi.org/10.1177/107780040100700601>
- Kopnina, H. 2016. Wild animals and justice: the case of the dead elephant in the room. *Journal of International Wildlife Law and Policy* 19(3):219-235. <https://doi.org/10.1080/13880292.2016.1204882>
- LaRocca, A. 2016. The comprehensive hunting ban: strengthening the state through participatory conservation in contemporary Botswana. Pages 179-207 in M. Ramutsindela, G. Miescher, and M. Boehi, editors. *The politics of nature and science in Southern Africa*. Basler Afrika Bibliographien, Basel, Switzerland.

- Larson, T. J. 1969. The Hambukushu of Ngamiland. Botswana Notes and Records 2(1):29-44.
- Larson, T. J. 1972. Tales from the Okavango. Howard Timmins, New York, USA.
- Larson, T. J. 1989. The Bayeyi of Ngamiland. Botswana Notes and Records 21(1):23-42.
- Larson, T. J. 2001. The Hambukushu Rainmakers of the Okavango. iUniverse, Lincoln, Nebraska, USA.
- Livingstone, D., W. Cotton Oswell. 1852. Latest explorations into Central Africa beyond Lake'Ngami by the Rev. Dr. Livingstone and William Cotton Oswell, Esq. Journal of the Royal Geographical Society of London 22:163-174. <https://doi.org/10.2307/1798209>
- Locke, P. 2013. Explorations in ethnoelephantology: social, historical, and ecological intersections between Asian elephants and humans. Environment and Society 4(1):79-97. <https://doi.org/10.3167/ares.2013.040106>
- Lorimer, J. 2010. Elephants as companion species: the lively biogeographies of Asian elephant conservation in Sri Lanka. Transactions of the Institute of British Geographers 35 (4):491-506. <https://doi.org/10.1111/j.1475-5661.2010.00395.x>
- Magole, L., and L. Magole. 2011. From community based to community driven; the evolution of the commons management in the Okavango Delta, Botswana. Conference paper from Sustaining commons: sustaining our future, the thirteenth biennial conference of the International Association for the Study of the Commons in Hyderabad, India. <https://hdl.handle.net/10535/7137>
- Mayberry, A. L., A. J. Hovorka, and K. E. Evans. 2017. Well-being impacts of human-elephant conflict in Khumaga, Botswana: exploring visible and hidden dimensions. Conservation and Society 15(3):280-291. <https://doi.org/10.4103/cs.cs.16.132>
- Mbaiwa, J. E. 2003. The socio-economic and environmental impacts of tourism development on the Okavango Delta, north-western Botswana. Journal of Arid Environments 54(2):447-476. <https://doi.org/10.1006/jare.2002.1101>
- Mbaiwa, J. E. 2005. The socio-cultural impacts of tourism development in the Okavango Delta, Botswana. Journal of Tourism and Cultural Change 2(3):163-185. <https://doi.org/10.1080/14766820508668662>
- Mbaiwa, J., and E. Mogende. 2022. The state, community-based tourism, and wildlife user rights in tourism concessions in Botswana. Pages 139-149 in R. Musavengane and L. Leonard, editors. Conservation, land conflicts, and sustainable tourism in Southern Africa. Routledge, London, UK. <https://doi.org/10.4324/9781003188902-12>
- Mbaiwa, J. E., and A. L. Stronza. 2010. The effects of tourism development on rural livelihoods in the Okavango Delta, Botswana. Journal of Sustainable Tourism 18(5):635-656. <https://doi.org/10.1080/09669581003653500>
- Mbaiwa, J. E., and A. L. Stronza. 2011. Changes in resident attitudes towards tourism development and conservation in the Okavango Delta, Botswana. Journal of Environmental Management 92(8):1950-1959. <https://doi.org/10.1016/j.jenvman.2011.03.009>
- McComb, K., G. Shannon, K. N. Sayialel, and C. Moss. 2014. Elephants can determine ethnicity, gender, and age from acoustic cues in human voices. Proceedings of the National Academy of Sciences 111(14):5433-5438. <https://doi.org/10.1073/pnas.1321543111>
- Meredith, M. 2001. Elephant destiny: biography of an endangered species in Africa. Public Affairs, Cambridge, Massachusetts, USA.
- Naughton-Treves, L. 1997. Farming the forest edge: vulnerable places and people around Kibale National Park, Uganda. Geographical Review 87(1):27-46. <https://doi.org/10.2307/215656>
- Nelson, A., P. Bidwell, and C. Sillero-Zubiri. 2003. A review of human-elephant conflict management strategies. People and wildlife initiative, a wildlife conservation research unit. Oxford University Press, Oxford, UK.
- Nyhus, P. J. 2016. Human-wildlife conflict and coexistence. Annual Review of Environment and Resources 41:143-171. <https://doi.org/10.1146/annurev-environ-110615-085634>
- Ogra, M. V. 2008. Human-wildlife conflict and gender in protected area borderlands: a case study of costs, perceptions, and vulnerabilities from Uttarakhand (Uttaranchal), India. Geoforum 39(3):1408-1422. <https://doi.org/10.1016/j.geoforum.2007.12.004>
- O'Reilly, K. 2005. Ethnographic methods. Routledge, London, UK.
- Oswell, W. C. 1894. South Africa fifty years ago. Badminton Library of Sports and Pastimes, Big Game Shooting, London, UK.
- Plotnik, J. M., R. Lair, W. Suphachoksahakun, and F. B. De Waal. 2011. Elephants know when they need a helping trunk in a cooperative task. Proceedings of the National Academy of Sciences 108(12):5116-5121. <https://doi.org/10.1073/pnas.1101765108>
- Poole, J. H., W. K. Lindsay, P. C. Lee, and C. J. Moss. 2011. Ethical approaches to elephant conservation. Pages 318-336 in C. J. Moss, H. Croze, and P. C. Lee, editors. The Amboseli elephants: a long-term perspective on a long-lived mammal. The University of Chicago Press, Chicago, Illinois, USA. <https://doi.org/10.7208/chicago/9780226542263.003.0021>
- Pooley, S. 2021. Coexistence for whom? Frontiers in Conservation Science 2:726991. <https://doi.org/10.3389/fcsc.2021.726991>
- Pooley, S., S. Bhatia, and A. Vasava. 2021. Rethinking the study of human-wildlife coexistence. Conservation Biology 35(3):784-793. <https://doi.org/10.1111/cobi.13653>
- Pooley, S., C. Hill, and J. Linnell. 2023. How histories shape interactions. Pages 68-73 in IUCN SSC guidelines on human-wildlife conflict and coexistence. IUCN, Gland, Switzerland.
- Pozo, R. A., T. Coulson, G. McCulloch, A. L. Stronza, and A. C. Songhurst. 2017. Determining baselines for human-elephant conflict: a matter of time. PLoS ONE 12(6):e0178840. <https://doi.org/10.1371/journal.pone.0178840>
- Redmore, L. E. 2020. In the era of elephants: rural change and vulnerability in the Okavango Delta, Botswana. Dissertation. Texas A&M University, College Station, Texas, USA.

- Redmore, L., I. Katholo, A. Sene-Harper, A. Songhurst, G. McCulloch, G., and A. Stronza. 2023. The village, the elephant, and the state: land access and vulnerability in rural Botswana. *Human Ecology* 51(2):237-249. <https://doi.org/10.1007/s10745-023-00390-4>
- Redmore, L., A. Stronza, A. Songhurst, and G. McCulloch. 2020. Where elephants roam: perceived risk, vulnerability, and adaptation in the Okavango Delta. *Ecology and Society* 25(4):27. <https://doi.org/10.5751/ES-12001-250427>
- Roskaft, E., T. Larsen, R. Mojaphoko, A. R. Sarker, and C. Jackson. 2014. Human dimensions of elephant ecology. Pages 271-288 in C. Skarpe, J. T. du Toit, and S. R. Moe, editors. *Elephants and savanna woodland systems: a study from Chobe National Park, Botswana*. Wiley-Blackwell, Chichester, UK. <https://doi.org/10.1002/9781118858615.ch16>
- Salerno, J., L. Cassidy, M. Drake, and J. Hartter. 2018. Living in an elephant landscape. *American Scientist* 106(1):34-42. <https://doi.org/10.1511/2018.106.1.34>
- Schapera, I. 1970a. A handbook of Tswana law and custom. Frank Cass and Company Limited, London, UK.
- Schapera, I. 1970b. Tribal innovators: Tswana chiefs and social change, 1795-1940. Athlone, UK.
- Schlossberg, S., and M. Chase. 2024. Population trends and conservation status of elephants in Botswana and the Kavango Zambezi Transfrontier Conservation Area: a review of elephant aerial surveys, 2010 - 2022. Technical Report. *Elephants Without Borders*, Kasane, Botswana. <https://elephantswithoutborders.org/site/wp-content/uploads/Final-EWB-Ele-Pop-Trends-KAZA-report-Mar24.pdf>
- Selier, S.-A. J., R. Slotow, and E. D. Minin. 2016. The influence of socioeconomic factors on the densities of high-value cross-border species, the African elephant. *PeerJ* 4:e2581. <https://doi.org/10.7717/peerj.2581>
- Selous, F. C. 1881. A hunter's wanderings in Africa: being a narrative of nine years spent amongst the game of the far interior of South Africa, containing accounts of explorations beyond the Zambesi, on the River Chobe, and in the Matabele and Mashuna countries, with full notes upon the natural history and present distribution of all the large mammalia. R. Bentley and Son, UK. <https://doi.org/10.5962/bhl.title.8854>
- Sitati, N. W., M. J. Walpole, R. J. Smith, and N. Leader-Williams. 2003. Predicting spatial aspects of human-elephant conflict. *Journal of Applied Ecology* 40(4):667-677. <https://doi.org/10.1046/j.1365-2664.2003.00828.x>
- Skarpe, C., P. A. Aarrestad, H. P. Andreassen, S. S. Dhillion, T. Dimakatso, J. T., du Toit, D. J. Halley, H. Hytteborn, S. Makhabu, M. Mari, W. Marokane, G. Masunga, D. Modise, S. R. Moe, R. Mojaphoko, D. Mosugelo, M. Sekgowa, G. Neo-Mahupeleng, M. Romatadima, L. Rutina, L. Sechele, T. B. Sejoe, S. Stokke, J. E. Swenson, C. Taolo, M. Vandewalle, and P. Wegge. 2004. The return of the giants: ecological effects of an increasing elephant population. *Ambio: A Journal of the Human Environment* 33(6): 276-282. <https://doi.org/10.1579/0044-7447-33.6.276>
- Skarpe, C., and S. Ringrose. 2014. The Chobe environment. Pages 7-29 in C. Skarpe, J. T. du Toit, and S. R. Moe, editors. *Elephants and savanna woodland ecosystems: a study from Chobe National Park, Botswana*. Wiley-Blackwell, Chichester, UK. <https://doi.org/10.1002/9781118858615.ch2>
- Songhurst, A., G. McCulloch, and T. Coulson. 2016. Finding pathways to human-elephant coexistence: a risky business. *Oryx* 50(4):713-720. <https://doi.org/10.1017/S0030605315000344>
- Stiles, D. 2004. The ivory trade and elephant conservation. *Environmental Conservation* 31(4):309-321. <https://doi.org/10.1017/S0376892904001614>
- Sukumar, R. 2003. The living elephants: evolutionary ecology, behaviour, and conservation. Oxford University Press, New York, New York, USA. <https://doi.org/10.1093/oso/9780195107784.001.0001>
- Surovell, T. A., and N. M. Waguespack. 2008. How many elephant kills are 14?: Clovis mammoth and mastodon kills in context. *Quaternary International* 191(1):82-97. <https://doi.org/10.1016/j.quaint.2007.12.001>
- Surovell, T., N. Waguespack, and P. J. Brantingham. 2005. Global archaeological evidence for proboscidean overkill. *Proceedings of the National Academy of Sciences* 102(17):6231-6236. <https://doi.org/10.1073/pnas.0501947102>
- Thakadu, O. T. 2005. Success factors in community based natural resources management in northern Botswana: lessons from practice. *Natural Resources Forum* 29(3):199-212. <https://doi.org/10.1111/j.1477-8947.2005.00130.x>
- Tlou, T. 1972. The taming of the Okavango swamps. *Botswana Notes and Records* 4(1):147-159.
- Tlou, T., and A. Campbell. 1984. History of Botswana. Macmillan, Gaborone, Botswana.
- Trouwborst, A. 2019. Global large herbivore conservation and international law. *Biodiversity and Conservation* 28(14):3891-3914. <https://doi.org/10.1007/s10531-019-01856-y>
- Turner, G. 1987. Hunters and herders of the Okavango Delta, northern Botswana. *Botswana Notes and Records* 19(1):25-40.
- Van Aarde, R. J., S. L. Pimm, R. Guldemond, R. Huang, and C. Maré. 2021. The 2020 elephant die-off in Botswana. *PeerJ* 9: e10686. <https://doi.org/10.7717/peerj.10686>
- Van Riet Lowe, C. 1935. Scientific results of the Vernay-Lang Kalahari Expedition, March to September, 1930. Remains of the Stone Age. *Annals of the Transvaal Museum* 16(3):495-496.
- Vandewalle, M. E., and K. A. Alexander. 2014. Guns, ivory and disease: past influences on the present status of Botswana's elephants and their habitats. Pages 91-103 in C. Skarpe, J. T. du Toit, and S. R. Moe, editors. *Elephants and savanna woodland ecosystems: a study from Chobe National Park, Botswana*. Wiley-Blackwell, Chichester, UK. <https://doi.org/10.1002/9781118858615.ch6>
- Von Fintel, D., and J. Fourie. 2019. The great divergence in South Africa: population and wealth dynamics over two centuries. *Journal of Comparative Economics* 47(4):759-773. <https://doi.org/10.1016/j.jce.2019.08.005>
- Wilmsen, E. N. 1989. Land filled with flies: a political economy of the Kalahari. University of Chicago Press, Chicago, Illinois, USA.

Wilmsen, E. N. 2014. Myths, gender, birds, beads: a reading of Iron Age hill sites in interior Southern Africa. *Africa* 84 (3):398-423. <https://doi.org/10.1017/S0001972014000370>

Witter, R. 2013. Elephant-induced displacement and the power of choice: moral narratives about resettlement in Mozambique's Limpopo National Park. *Conservation and Society* 11 (4):406-419. <https://doi.org/10.4103/0972-4923.125756>

Wolcott, H. F. 2005. *The art of fieldwork*. Rowman Altamira, Walnut Creek, California, USA.

Yravedra, J., M. Domínguez-Rodrigo, M. Santonja, A. Pérez-González, J. Panera, S. Rubio-Jara, and E. Baquedano. 2010. Cut marks on the Middle Pleistocene elephant carcass of Áridos 2 (Madrid, Spain). *Journal of Archaeological Science* 37 (10):2469-2476. <https://doi.org/10.1016/j.jas.2010.05.007>