# The relationship between large mammalian carnivores and Maasai pastoralists in pastoral

# rangelands of the South Rift region of Kenya

by

# Daniel Silver

Under the supervision of Dr. John G. Galaty



Male lion in the Maasai Mara National Reserve

# ENVR485

McGill University

December, 2017

## Introduction



Two female lions in the Olkiramatian Conservancy

Across the globe, wild mammalian carnivore populations are threatened due to loss of habitat and human wildlife conflict. Apex, keystone predators, in addition to holding important ecological niches at the top of food webs, capture human interest to a degree matched by few other animal groups. They are charismatic and conspicuous; loved and respected; feared and hated, not least because of the potential danger they pose to humans. One of the countries best known for its large carnivores is Kenya, where robust numbers of lions, leopards, hyenas, and cheetahs still exist in the wild. These savanna carnivores are unique and captivating creatures, which intrinsic-value proponents believe is itself reason to protect them. Moreover, these iconic carnivores attract vast numbers of international visitors to the country, which helps support an important tourism industry that makes up a significant portion of Kenya's economy.

Efforts to conserve such wildlife have historically focused on removing anthropogenic influences by creating protected areas (PAs). Such top-down, people-absent PAs represent a model known as fortress conservation, which asserts that the presence of humans is inherently detrimental to wildlife (Brockington, 2002). Employing this fortress conservation framework, Kenya's efforts to protect wild animals has led in many cases to the eviction of indigenous people from their traditional land in order to create PAs (Okech, 2010; Jacobs, 1975; Robertshaw, 1991; Hughes, 2002; Homewood & Rogers, 1984; Brockington, 2002).

PAs, in addition to alienating and displacing indigenous peoples, have also been unable to stop the worldwide decrease in carnivore numbers (Western & Gichohi, 1993). Thus, in order to conserve carnivores in an ethical and sustainable manner going forward, it is imperative to establish models of conservation that include land between and beyond the insulated habitats formed by PAs, while also respecting the land rights and livelihood needs of indigenous inhabitants. Such a model necessarily entails interaction between carnivores and humans, and hence *coexistence* becomes the central factor on which success will depend. In light of this, I explore conservation practices in the South Rift region of Southern Kenya, between Amboseli National Park and the Maasai Mara National Reserve, an area in which successful coexistence between carnivores, Maasai pastoralists, and livestock has been occurring for centuries.

Through a detailed examination of the relationship between Maasai pastoralists and carnivores in South Rift pastoral rangelands, this paper aims to address several questions that are pertinent to the future of wild carnivores in Kenya and beyond. Specifically, I ask: 1. Why have carnivores been conserved in pastoral rangelands? 2. What factors allow Maasai pastoralists and carnivores to cohabitate? 3. What are the drivers of conflict between pastoralists and wild carnivores, and why has tolerance for carnivores decreased in recent years? 4. Can community

based conservation (CBC) and the use of community conservancies increase tolerance for carnivores and preserve human-wildlife coexistence into the future? By answering these questions, I hope to uncover themes and ideas from the South Rift that may be applicable in the many areas around the world in which apex carnivores face anthropogenic threats, and where carnivore-human coexistence is vitally needed.

This paper concludes that carnivore numbers persisted in Southern Kenya pastoral rangelands due to the relative compatibility of semi-nomadic pastoralism with large carnivore populations. However, increasing rangeland conversion, driven by subdivision and privatization of communal lands, is now reducing these once viable habitats. In areas that remain pastoral rangeland, the traditional livelihood of Maasai people plays a key role in creating and maintaining savanna flora, thus supporting upper trophic levels such as apex carnivores. This scenario of coexistence, however, is not perfect, and is worsening in some areas. Carnivores depredate livestock and humans and are killed in retribution, which drives most conflicts in the area. Notably, the Maasai's tolerance for this conflict has decreased in recent years, which I attribute in part to the poor treatment of Maasai pastoralists by the conservation movement, as well as other environmental and social factors. Finally, in a time when mitigating such human-wildlife conflict is crucial to the survival of carnivore populations, CBC seems, in certain circumstances, to be able to improve communities' perception towards wildlife. In the majority of cases, however, CBC ventures still have significant shortcomings.

Many of my findings are based on the three months I spent living in the Olkiramatian Group Ranch in summer 2017. Olkiramatian is a Maasai pastoralist community within which populations of lions, leopards, striped and spotted hyenas, and cheetah live, all of which I observed in the wild while there. During my stay, I also had the opportunity to interview Maasai pastoralists as part of a research project in the neighboring Oldonyo-Nyokie Group Ranch. Throughout this summer, I was also able to hear firsthand about people's experience living with large carnivores. Thus, while the majority of this paper's information is cited from peer reviewed literature, I have also included material from my personal observations, which I cite as "(PO)". I do not claim that the people I spoke to are representative of these communities as a whole, and the information I cite as PO represents the situation in the South Rift as it was told to me by a limited number of people from two specific Group Ranches. However, my conversations were with the main stakeholder in the area—Maasai pastoralists—and their thoughts and opinions may in fact be more relevant than scientific articles for the issue at hand.

# Background: Pastoral Rangelands in the South Rift



Zebra grazing on contiguous, unfenced pasture in the Shompole rangelands

Before investigating the relationship between carnivores and Maasai pastoralists in the South Rift, I present some context about pastoral rangelands. Rangelands are a grassland ecosystem in which the main livelihood is pastoralism, the practice of raising domestic animals on naturally occurring pasture (Galaty, 2015). In the South Rift area of Kenya, thousands of Maasai people, one of Kenya's 42 ethnic tribes, raise herds of cattle, sheep, and goats, much the way they have for centuries (Moiko, 2013). While the development of towns and agricultural areas in Kenya extirpated carnivores, around half of Kenya's wildlife has been conserved in these pastoral rangelands (Western & Gichohi, 1993). Indeed, outside of PAs and hunting concessions with the explicit purpose of conserving wildlife, the majority of Kenya's remaining robust carnivore populations are found in rangelands, including Maasailand in the South Rift (Hazzah et al., 2009; Blackburn et al., 2016). Ultimately, carnivores have persisted in these rangelands because pastoralism, unlike other livelihoods, is relatively conducive to the cohabitation of humans, livestock, carnivores and many of their wild prey species such as zebra, wildebeest, and antelope.

Pastoralists require mobility over large expanses of land in order to access spatially and temporally variable pasture (Galaty, 2015). In Maasailand, mobility was for centuries facilitated through communal tenure systems, which allowed rangelands to function as a contiguous, undivided ecosystem (Homewood et al., 2009). Rangelands also maintained dispersed human populations to avoid over-saturating and exhausting a location's pasture, among other reasons (PO). These two features—lack of habitat fragmentation and low population density—allowed carnivores to populate areas where pastoralists were living, which was not the case for Kenya's other rising land uses (Boon & Hobbs, 2004; Reid et al., 2004).

In agricultural areas, by contrast, fences restrict the home ranges of wildlife, thus restricting the movement of populations and eventually preventing gene flow (Reid, 2012, pg. 133). When

genetic diversity is limited, the expression of negative recessive traits tends to increase. This effect has been documented in small, genetically isolated lion populations, where individuals showed tangible reductions in disease resistance and reproduction rate compared to more genetically diverse populations (Packer et al, 2013). The growth of towns and agricultural areas in Kenya propagated habitat fragmentation, either because wildlife was unable to cross fences, or because behaviorally they were inclined to avoid high population densities of humans (Reid, 2012, pg. 112). Contrarily, the unobtrusive infrastructure and settlement patterns characteristic of pastoral rangelands allowed for the significant—often exceeding 1000 square kilometers for lions—range requirements of large carnivores (Funston, 2011).

Additionally, while pastoralism was for the most part tolerant of carnivores and their natural prey species, robust wildlife populations were antithetical to other livelihoods (Hazzah et al., 2009). Farming fundamentally creates human-wildlife conflict because crop raiding by wildlife directly impacts crop yields and therefore income (Reid, 2012, pg. 133). Removing crop raiding herbivores implies that carnivores can also not survive, as their main prey sources are reduced from the ecosystem. Carnivores also fared poorly in towns and cities, where their presence was not tolerated due to the danger they posed to humans living in high densities (PO). In the South Rift however, carnivores not only found suitable habitat, but were also not categorically antagonistic to pastoralism, the main livelihood of the people inhabiting the area (Hazzah et al., 2009; Reid, 2012, pg. 49).

Today however, carnivore numbers are generally decreasing in the South Rift (Hazzah et al., 2009). Aside from increasing human-wildlife conflict, which I will discuss later, this loss of wildlife is highly correlated with the relatively recent subdivision and privatization of traditionally

communal pastoral rangelands, which encourages the construction of fences, conversion of land to agriculture, and development in general (Hazzah, 2006; Maclennan et al., 2009).

Ironically, the Kenyan government, which has prioritized the protection of wildlife, was largely responsible for the conversion of much of Maasai communal rangeland. This started with Land Group Representatives Act of 1968, which provided the legal framework for creating "Group Ranches" over the next decade by dividing pastoral rangelands into commonly-held "group" property with boundaries and a defined membership (Moiko, 2013). This structural change was designed to introduce 'responsibility' to pastoral peoples for their land, enable the government to extend targeted social and economic aid to communities, and, though often unstated, eventually to bring pastoral land into the housing market of Kenya (Galaty, 1980; Galaty, 1994; Moiko, 2013). This act effectively implemented the framework by which Group Ranches could subdivide and privatize their land, so, by 1990, around 80 percent of Group Ranches were no longer communal (Moiko, 2013).

Often headed by Maasai communities themselves, subdivision and privatization in many cases led to individual profiteering, the impoverishment of many, rampant land-sales to outsiders, the erosion of Maasai pastoralism, and the loss of wildlife, including large carnivores (Ragan et al., 2017; Hazzah, 2006; Maclennan et al., 2009). Indeed, where rangelands were developed or converted, wild predators usually became extirpated soon thereafter (Woodroffe & Frank, 2005). This suggests a cascading effect: land privatization and the erosion of pastoralism leads to the loss of unfenced savanna rangelands, thus destroying what was a suitable habitat for wildlife. This is considered one of the greatest threats to Kenya's savanna carnivores (Homewood et al., 2009).

Despite the demarcation of many Group Ranches, there are still many areas in Southern Kenya where Group Ranches remain communal and largely unfenced, where Maasai people continue to practice pastoralism, and where carnivore populations have been sustained (PO). Indeed, a friend and colleague from the Olkiramatian Group Ranch told me with visible pride that the Maasai are the only group in Kenya who still genuinely practice their culture, while many other tribes have blended into a modernizing Kenyan society. The rest of this paper explores carnivorehuman coexistence in these Maasai Group Ranches, where pastoralism is the predominant livelihood, and a remnant of an ancient and fascinating relationship between people and carnivores persists.

## Introducing Maasai Pastoralism: A Livelihood Which Supports the Ecosystem



Cattle grazing amongst Grant's gazelle, ostrich, and wildebeest in the Shompole rangelands

In areas of the South Rift where rangeland pastoralism is still the main livelihood, the ecological role that Maasai people play is an indispensable reason why humans and carnivores can

coexist. Here, Maasai people practice semi-nomadic pastoralism, which is a livelihood strategy designed to maximize access to pasture that is both spatially and temporally variable and, at times, unpredictable (Galaty 2015). Traditionally, this lifestyle entails seasonal movement from dry season to wet season pastures; the establishment of semi-permanent settlements in areas that may be grazed for extended periods of time; and extended travel when droughts are particularly severe. Maasai pastoralists construct *bomas*, or enclosures large enough to accommodate up to several families, which are surrounded by thorny fences, designed to contain livestock at night. This traditional livelihood is practiced by many Maasai communities today, especially within Group Ranches that have remained communal (PO).

In much of the historic literature, African pastoralists like the Maasai were portrayed as savanna degraders and agents of desertification (Hoben, 1995; Hersovitz, 1926; Moiko, 2013). This viewpoint was greatly influenced by Garrett Hardin's *Tragedy of the Commons* (1968), which asserted that communal tenure over natural resources was a system inherently doomed to failure due to the degradation which individual self-interest would necessarily encourage (Hardin, 1968; Galaty, 2015). Other scientific articles added to the paradigm by promoting carrying capacity, climax vegetation, and other ecosystem equilibrium theories as relevant to African savannas. These articles supported the claim that pastoralists propagated soil erosion and converted grasslands to desert through overgrazing (Moiko, 2013; Behnke et al., 1993; Scoones, 1994).

Now, new research suggests that this historical analysis of pastoralism is over-simplistic and, in many ways, simply wrong. The new field of thought in savanna socio-ecological research argues that livestock and pastoralists occupy important niches in grassland ecosystems (Western & Gichohi, 1993). Humans have lived in savannas since our species' genesis in the Great Rift Valley, with pastoralism and livestock dating back three to four thousand years in East Africa (Western & Gichohi, 1993; Murdock, 1959). Pastoralists and livestock have functioned in this ecosystem on an evolutionary time scale, so their participation in biological feedbacks and processes is thus as much a part of savanna ecology, as is the presence of any wildlife (Collett, 1987). In rangelands, carnivores require functioning ecosystems down to the primary producer trophic level in order to be supported at viable levels. The Maasai lifestyle is conducive, if not vital, to the maintenance of these trophic levels, and therefore indirectly supports carnivore populations.

Several recent studies have empirically supported the claim that pastoralists do not categorically degrade savanna vegetation and compete with wild ungulates (Reid, 2012, pg. 108). Zoologist Rudolph Bigalke, for example, found that wildlife grew faster when they grazed with cattle, which he attributed to livestock's expansion and creation of new water sources and diversification of savanna grasses (Bigalke, 1978). Ecologist Helen Gichohi performed another influential study, running a case-control experiment in which she fenced off plots of East African savanna from livestock. After three years, she found that these plots supported a lower diversity of plant species than did similar areas that were grazed by livestock. She concluded that grazing "leveled the flora playing field," hindering the proliferation of one or two dominant grass species and allowing rarer ones a chance to flourish (Gichohi, 1996). Finally, Ellis and Swift (1998) investigated the effects of grazing in Turkana, Kenya. They found that irreversible overgrazing was effectively prevented by the losses of livestock (and wild ungulate) populations during droughts. This feedback prevented livestock populations from ever growing to the point where they could inflict long-term damage to savannas (Ellis & Swift, 1998).

Overall, these studies do not imply that wildlife and livestock exist in perfect harmony when pasture is scarce, or that overgrazing is not a real phenomenon that occurs when wild and domesticated herbivores are overabundant. Rather, this research demonstrates that savanna ecosystems are complex, and that the cohabitation of livestock and wildlife has variable effects across different locations. Importantly, all of these studies were performed in East Africa, while much of the previous literature was performed in Western temperate environments and then applied to East African savannas (Moiko, 2013). This suggests that the more recent literature is a more accurate representation of the effect of pastoralism on savannas.

There is also evidence that pastoralists are a driving force in the creation of grassland in certain areas. This is premised on a two-fold categorization of savanna: rainfall driven and disturbance driven. Making up around 43% of Africa's savannas, rainfall driven grasslands support grasses because limited rainfall prevents forests from growing (Elvis & Galvin, 1994; Marshall 1990). Disturbance driven savannas have sufficient rain to support trees, but instead support highly productive grasslands due to interference in the proliferation of trees (Elvis & Galvin, 1994; Marshall 1990). In disturbance-driven savanna, Maasai pastoralists play a role in preventing forests from taking over the landscape by periodically burning overgrown areas, which they do to promote pasture growth and, to a lesser extent, to remove tall grasses which may hide dangerous snakes and ticks (Reid, 2012, pg. 112). Pastoralists also burn wooded areas to destroy the habitat of tsetse flies, an insect that bites humans and can transmit trypanosomiasis to cattle (Reid, 2012, pg. 112; PO).

The immediate result of burning is a release of floral nutrients, particularly sulfur and nitrogen, into the air via smoke (Reid, 2012, pg. 112). When it next rains, these nutrients return to the soil, creating a "green flush" or "green lawn" which is particularly fertile (Western & Gichohi, 1993). This process effectively removes large, thick vegetation that browsers such as giraffes eat, and replaces it with grasses favored by grazers such as wildebeest, zebra, Grant's gazelle,

Thomson's gazelle, as well as cattle, sheep, and goats (Fuhlendorf & Engle, 2001). Green lawns have a mixed effect on carnivores: on the one hand they remove tall grasses which predators use to stalk prey; but on the other hand they create herbivore hot spots where grazers congregate and carnivores can reliably find prey (Reid, 2012, pg. 112). Though these green lawns typically dissipate after a few months, they leave behind grasses designed to survive periodic fires, which prosper until thicker forest vegetation starts to slowly regrow (Frost & Robertson, 1987; Leach & Givinish, 1996).

Periodic burning leaves behind a spectrum of burnt and unburnt vegetation of different types and distributions, some being burned more recently than others. This appears to support a greater diversity of herbivores, each with unique grazing behavior (Fuhlendorf & Engle, 2001). Small herbivores benefit in particular from the younger and more nutritious grasses, as it is easier for them to digest (Runyoro et al., 1995). Additionally, pastoralists clearly burn overgrown vegetation to support their livestock, which implies that other wild grazers would similarly benefit. For carnivores, a greater number and diversity of herbivores means a better source of prey.

Savanna ecosystems support unique carnivores and ecological systems that, without the presence of grasslands, would not exist as we know them. Since Maasai pastoralists help create and maintain this ecosystem, they are de facto also promoting the existence of viable savanna carnivore populations. This is a fundamental reason why savanna carnivores, livestock and Maasai pastoralists are able to cohabitate in the rangelands.

#### Conflict at the Hands of Livestock and Human Depredation



Pair of hyenas in the Maasai Mara National Reserve

This paper has so far examined some aspects of why Maasai pastoralists and carnivores can coexist in savanna rangelands. In general, the ecological characteristics of rangelands, driven by the lifestyle of the Maasai pastoralists inhabiting them, create a scenario in which people, carnivores and their natural prey are able to share space and resources. However, in a landscape where carnivores, people, and livestock live so closely together, some instances of conflict are inevitable. Livestock depredation, though usually not as significant a danger as drought and disease, is seriously damaging to the livelihoods of pastoralists (Mishra, 1997; Marker et al., 2003; Groom, 2007; Holmern et al., 2007). This makes it the predominant reason for conflict between carnivores and livestock herders (Nowell & Jackson, 1996; Woodroffe & Ginsberg, 1998). When depredation occurs, carnivores also fare poorly, as they are themselves sometimes killed in retaliation (Blackburn et al., 2016).

Carnivores have several approaches to killing livestock. One common tactic used by lions and leopards is to attack at night when the herd is unguarded. While solidly built *bomas* generally deter hyenas and cheetahs, leopards and lions can jump or stealthily penetrate them. Lions will sometimes purposely approach *bomas* upwind to panic a herd of cattle, causing them to break out of their enclosure where the pride is waiting to attack (Ogada et al., 2003). Leopards hunt more surreptitiously, and are considered the hardest to guard against because they are silent, stealthy, agile, and, unlike lions, undeterred by dogs and humans. Carnivores also attack livestock during the day when they are out grazing (Mizutani et al., 2005).

Overall, livestock depredation inflicts serious economic damage on people who are in many cases already struggling to meet basic needs (Mishra, 1997; Marker et al., 2003; Groom, 2007; Holmern et al., 2007; Ragan et al., 2017). Attacks on cattle are also emotionally painful for Maasai people, who have a deep cultural connection to the animal (Hazzah et al., 2009). This is evidenced by the fact that lions, which partake in a fraction of the total livestock depredation of spotted hyenas (hyenas accounted for 98% of depredation in the Mara region), are perceived more negatively by many Maasai people, as they more often kill the more culturally endeared cattle (Hazzah et al., 2009).

Additionally, carnivores will on rare occasions attack humans (Mizutani et al., 2003; Ogada et al., 2003). These attacks occur most frequently late at night when individuals are walking home drunk and alone (Moss, 2001). Some of these cases occur when an individual collapses unconscious from alcohol poisoning, rendering them defenseless against any wildlife that comes across them (PO). The very real and serious fear of being killed by large carnivores when walking in the bush has always been present for Maasai people, and the immeasurable pain felt when a family member or friend is attacked or killed needs not be stated (Meguro, 2010).

Responses to depredation are understudied (Hazzah et al., 2009). Overall, despite the 1977 Kenyan Wildlife Act, which banned any killing of wildlife, retribution killings of carnivores still occur in parts of Maasailand (Hazzah et al., 2009; Maclennan et al., 2009). It is also likely that figures for such retaliatory killings are underestimated, given the contentious nature of the practice and the desire of communities (and local authorities) to hide such behavior (Blackburn et al., 2016). Famously, Maasai communities surrounding Amboseli National Park eradicated the park's lion populations between 1990 and 1993 to protest restrictions on grazing and access to swamp lands, as well as livestock depredation in general (Hazzah et al., 2009). Later, after lion populations had returned to Amboseli, more than 140 lions were speared or poisoned in the same area between 2001 and 2006 (Hazzah et al., 2009). This is a dramatic example of retributive killings, however, and is not reflective of the practice in most communities.

While Maasai have historically killed problem animals with spears, poisoning has now become an easier and more accessible practice due to the "widely available and inexpensive pesticide" known as Carbofuran/Furadan (Maclennan et al., 2009). While spearing carnivores to protect the homestead is considered a heroic act in Maasai culture (killing a lion is part of the traditional '*Olamayio*' manhood rite of passage), poisoning is often done in secret (Hazzah, 2006). People will usually poison a carcass, on which the troublesome carnivore will scavenge (Hazaah, 2006). This has ramifications on the entire ecosystem, as many organisms in addition to the targeted carnivore will feed on the carcass. Indeed, obligate scavengers such as vultures have suffered acutely from the practice in recent years (Virani et al., 2011).

In general, carnivores represent a conspicuous and controllable threat to livestock. While disease and drought are typically more devastating to herds, their effects are largely out of pastoralists' control. Carnivore depredation, on the other hand, can be easily managed, especially

given access to poison. Thus, the unpredictable and decisive nature of depredation, as well as the fact that Maasai people are able to have some influence over it, seems to drive people's desire to kill carnivores in retribution (Hazzah et al., 2009).

Such conflict, however, is nothing new. Over the centuries, countless livestock have been killed by carnivores, and countless carnivores have been killed by Maasai in retaliation. This has led to a mutual respect for the power and potential danger each poses to the other, and consequently behaviors have evolved which carnivores and Maasai pastoralists use to avoid destructive encounters with each other. These behaviors mitigate conflict in areas where carnivores and people cohabitate, which has promoted coexistence in rangelands.

For carnivores, these behavioral modifications usually involve altering spatiotemporal occupancy in order to avoid encounters with Maasai. Researcher Kay E. Holekamp (2009/2010) found that hyenas that regularly encountered herders were "more nocturnal, spent twice as much of their time being vigilant for potential threats, avoided humans during the day, travelled longer distances from their dens, and occurred in smaller clans in open grassland—when compared to hyenas isolated from humans" (Pangle & Holekamp, 2010). This supports the notion that hyenas become more cautious when living closer to humans (Schuett, 2012; Boydston et al., 2003). Neils L. Mogenson (2011) and his colleagues found similar behavioral modifications in lions living in the Koyiaki pastoral ranch which, compared to those living in the neighboring Maasai Mara, spent less time in open grasslands and brought kills to more secluded/wooded areas (Mogenson et al., 2011). In the Olkiramatian Group Ranch, researcher Paul Schuette (2012), using motion-censored trail cameras, found that seasonal land used by Maasai pastoralists affected the occupancy of wildlife (Schuette, 2012). Specifically, lion and spotted hyena occupancies were skewed towards Olkiramatian's conservation-area, the least-used portion of land. This led Schuette to conclude

that, "[in Olkiramatian] these two potential conflict species prefer areas used less by people and livestock" (Schuette, 2012).

Similarly, Maasai pastoralists also take precautions to protect their livestock. The most important of these measures is the confinement of livestock in thorny enclosures at night to prevent predators from accessing the herd while the homestead is sleeping (Woodroffe & Frank, 2004). Additionally, Maasai avoid nighttime grazing when possible, keep watchdogs, and supervise their herds when they are out grazing (PO). In areas known to have high densities of carnivores, sending larger and more imposing adults as herders, rather than small children, helps reduce the likelihood of depredation (Reid, 2012, pg. 57). These practices are all motivated primarily by the threat of carnivores and have all been shown to be highly effective at reducing depredation (Ogada et al., 2003). These preventative measures help decrease the incidence of depredation and therefore the need for retaliatory killings (Ogada et al., 2003).

Ultimately, it seems that these behavioral modifications, made by carnivores and Maasai pastoralists when in the presence of each other, were historically effective at reducing conflict. This is illustrated simply by the fact that both pastoralism and carnivore populations persisted in rangelands until recently. However, changing dynamics in the past number of decades are reducing the ability of these methods alone to effectively mitigate conflict. The following section examines the social and ecological reasons why this is the case.

#### Human-wildlife Conflict on the Rise



Spotted hyena in the Mara

Centuries of coexistence in the South Rift allowed both Maasai pastoralists and large carnivores to survive into the 21st century. However, tolerance for carnivores has dwindled in the past few decades, largely due to rising human population and settlements in rangelands, which forces wildlife into more marginal areas and increases their interactions with humans (Hazzah et al., 2009; Mishra, 1997; Marker et al., 2003). This is of serious concern, as experts believe that carnivore conservation will depend most heavily on mitigating human-wildlife conflict, even more so than managing human population density (Hazzah et al., 2009; Nowell & Jackson, 1996; Woodroffe & Ginsberg, 1998; Linnell et al., 1999; Blackburn et al., 2016). Indeed, local tolerance for carnivores is perhaps the greatest influencer of whether populations are sustained, and Robin Reid asserts that "where wildlife exists in pastoral rangelands it is because pastoral people have chosen not to extirpate them" (Reid, 2012, 49). Despite a fair amount of research on the topic, it

is poorly known which determining factors cause certain communities to extirpate carnivores and others to tolerate them (Hazzah et al., 2009).

Climate change is likely one factor for why tolerance is decreasing. It has been well reported across East Africa that the climate is changing, leading to longer and more unpredictable droughts (Ragan et al., 2017). These droughts diminish livestock herds, which makes pastoral livelihoods more tenuous and the damage from depredation a more significant portion of the total herd (Ragan et al., 2017). Additionally, droughts inhibit the effectiveness of the aforementioned conflict mitigation strategies. Namely, during droughts, livestock is often taken to distant areas in search of pasture, which can require both nighttime traveling and movement through areas with potentially high densities of carnivores (Ogada et al., 2003). Further, the natural prey of carnivores may also be less abundant during these droughts; hence human-wildlife conflicts tend to increase when both carnivores and pastoralists are desperate and less able to take their usual precautions (Kolowski & Holekamp, 2006).

There are also socio-political factors at play. While Maasai pastoralists used to accumulate cattle largely for subsistence, social status, and as a means of storing wealth, increased access to national markets has allowed them to participate in the national livestock trade, which has been speculated to be a possible driver of lowered tolerance for depredation (Bagchi & Mishra, 2006; Hazzah et al., 2009). Indeed, an interview-based study found that "respondents who raise livestock for sale have a higher reported likelihood of retaliating against predators compared to those who keep stock only for domestic consumption or traditional reasons" (Hazzah et al., 2009).

However, I believe that there is another, deep socio-political factor that may be a significant driver of Maasai people's negative feelings towards carnivores: mistreatment by the conservation

20

movement. I refer to the 'conservation movement' as all the groups from KWS and the Kenyan government, to international NGOs and eco-tourism lodges, whose main interest is conserving Kenya's wildlife. Before the rise of the conservation movement and associated laws, Maasai people dealt with problem carnivores as they saw fit, but now, conservation laws fundamentally restrict communities' ability to autonomously manage problem wildlife (Kissui, 2016). Many herders now perceive wildlife on their land as belonging to the government, which indeed legally is the case (Reid, 2012, pg. 149). Due to perceived and actual vulnerability to imposed conservation laws, many feel more inclined to resent carnivores, the object of so many restrictions on how they can manage their land and resources (Lindsay, 1987; Adams & McShane, 1996). This perceived lack of control, rather than actual levels of depredation, has been suggested to be the driving force of an individual's propensity to be intolerant of carnivores and partake in retaliatory killings (Mishra, 1997; Marker et al., 2003; Naughton-Treves & Treves, 2005).

A long and troubling history of conservation in Kenya has also likely influenced people's attitudes towards carnivores. Indeed, although indigenous people were often forced to sacrifice their land and way of life for the sake of wildlife protection, their lack of economic, social, and political power historically excluded them from the profits generated by wildlife tourism (Okello et al., 2009). Kenya's tourism industry was at one point controlled almost entirely by Western investors and, to the extent Kenyans had ownership, it was restricted to a minority of elite individuals (Okello et al., 2009; Thompson & Homewood, 2002; Manyara & Jones, 2007). Given this situation, and the (legal) inability to deal with problem wildlife, communities often viewed their connection to wildlife simply as a cost, and thus had no incentive to take interest or initiative in conservation (Meguro, 2014). Research suggests that when communities do not see direct

benefits from wildlife, they may be more inclined to participate in retaliatory killings of carnivores (Baur et al., 2015; Blackburn et al., 2016).

Conservation laws were largely resented in the Oldonyo-Nyokie Group Ranch. Here, herders reported being told that they would receive compensation for depredated livestock by government officials in the late 90's. Yet, based on statements made to me in Oldonyo-Nyokie, in the more than two decades since that promise was apparently made, it seems no one has actually received any compensation, except in one or two cases when an individual had a personal connection to a Kenyan Wildlife Service (K.W.S.) official. Additionally, informants unanimously told us that K.W.S. responded quickly and effectively when herders kill wildlife, yet were unresponsive and apathetic when carnivores killed livestock. In addition to feeling neglected and mistreated, Oldonyo-Nyokie herders were discouraged by the fact that carnivores, which caused serious damage to their pastoralist livelihoods, seemed to be getting preferential treatment by the government. Importantly though, most pastoralists in Oldonyo-Nyokie stated that they were willing to live with wildlife. It seemed that not following through with compensation promises and the half-hearted responses from K.W.S., rather than the carnivores themselves, were the driving forces of their particular bitterness about livestock depredation.

In contrast, in the neighboring Olkiramatian Group Ranch, many seemed to have a less resentful attitude towards wildlife. I believe this is partly due to a program called Rebuilding the Pride (RTP), which is run in partnership with the South Rift Association of Landowners (SORALO), a land trust established in 2004. RTP employs several members of the Maasai community, and, through the use of quadrats and radio collaring, tracks the Group Ranch's lions and informs herders in the vicinity when the pride is close to livestock. Additionally, when livestock depredation or human injury occurs at the hands of carnivores, RTP visits the individual, records their story, and does what they can to console them. This service sends a message that people concerned with protecting carnivores also care about the damage that those carnivores are inflicting on the community, and that they are committed to looking for win-win situations where carnivores and pastoralists can both benefit.

Unfortunately, there is no data on retaliatory killings in either of these communities, nor have any major studies been performed gauging the attitudes of these pastoralists towards carnivores. However, my personal (albeit perhaps biased) conversations suggested a tangible difference in these communities' optimism regarding carnivores. In general, it seems that the Kenyan government and the conservation movement have, throughout history, failed in many respects to productively and respectfully interact with Maasai communities. Notably, promising compensation for depredation and not following through undermined people's trust, while disproportionate responses to conflict-cases by K.W.S. marginalized pastoralists and augmented their bitterness towards depredation.

I believe this case study comparing the Oldonyo-Nyokie and Olkiramatian Group Ranches highlights an important factor in promoting coexistence between humans and carnivores: respect for Maasai people by the conservation movement. Compensation and financial benefits are an integral component of this respect. However, a meaningful and genuine recognition of the damage carnivores cause to pastoralists, as well as the sacrifice they are making by allowing carnivores to share their land, is an essential, but often lacking, component of this dialogue. Given demonstrated respect, communities may show a greater willingness to work towards conservation goals and to coexist with carnivores. My evidence for this assertion is largely anecdotal: it was the impression I obtained from speaking with many people involved with this issue, from Maasai pastoralists themselves, as well as conservationists and academics.

#### CBC: A Way Forward?



Lucky tourists in the Mara see a cheetah and a small herd of elephants

In the 1980s, a framework emerged to address the many underlying issues the conservation movement had with respect to local communities: community-based conservation (CBC) (Tyrell et al., 2017; Lamprey & Reid 2004; Schroeder 2010; Thirgood et al., 2008). Its fundamental claim was that economic development and wildlife conservation could be simultaneously promoted by encouraging communities to create their own ecotourism enterprises and, more generally, to make local stakeholders into substantial beneficiaries of wildlife conservation (Homewood et al., 2009). This goal went hand in hand with a growing realization that indigenous communities had much to offer the conservation movement through their traditional ecological knowledge, developed over millennia of experience living with wildlife (Homewood et al., 2016). It was also motivated by recognition that locals had immense power over the success or failure of conservation projects, and that, by being meaningfully involved in the management and included in the benefits, they

were more likely to support conservation on their land (Homewood et al., 2016; Western, 1994). These ideas ultimately led to a conclusion that locals, rather than external interests, should be principally managing conservation (Homewood et al., 2016; Western, 1994).

However, the growing inclusion of Maasai people in the tourism industry was not only enhanced by external stakeholders. Maasai themselves have also played a major role in the shift towards CBC and their increased inclusion in the benefits of wildlife. Toshio Meguro (2014) argues that CBC was driven in part by Maasai communities who altered their 'positioning' with respect to wildlife in an attempt to maximize their benefits. He reasons that in the early-mid 20<sup>th</sup> century, Maasai communities focused their efforts on trying to maintain their rights to land, combatting conservationists who wanted to reserve it for wildlife. Later in the 20<sup>th</sup> century, however, communities began to learn that they could leverage cooperation with conservationists to receive compensation for 'putting up' with wildlife, at which point they refocused their efforts to negotiating compensation.

Over the past two decades, Meguro claims that a new stage began in how some Maasai communities position themselves. Namely, many Maasai communities learned that the greatest benefits from wildlife could be gained not by presenting themselves as *victims*, but as *guardians* of wildlife. By framing requests for compensation in terms of the needs of wildlife, rather than for losses they incurred from wildlife, the Kenyan government and wealthy foreigners became significantly more supportive. This strategy appeared to be driven by the fact that communities portraying themselves as living sustainably and harmoniously with wildlife could gain the attention, approval, and financial backing of NGOs, tourists, and the Kenyan government (Meguro, 2014).

The results of this change of narrative are complicated however. An argument could certainly be made that powerful conservationist interests, over time, pressured Maasai communities reluctantly into an identity that agreed with their environmental goals. The differential power dynamics between Maasai people and the conservation movement throughout this shift are indeed apparent. From a carnivore conservation standpoint, the result of CBC in some cases has been quite ideal: locals more involved in conserving wildlife, and reduced conflict and retaliatory killings in communities that are now more empowered and benefit from coexistence with wildlife (Blackburn et al 2016; Baur et al 2015). The socio-cultural impacts, however, are more complex, and it is important to recognize that communities as a whole are usually making a net economic sacrifice when they restrict development, agriculture, or pastoralism for the sake of wildlife (Godfrey, *unpublished*).

In practice, communities that are involved in conservation often do so by designating a portion of their land as a 'conservancy' (Godfrey, 2016). Conservancies have different implications for land usage, depending on the community. In many of the conservancies surrounding the Maasai Mara, Maasai communities have made arrangements with external tourism operators to restrict their grazing activities and allow the tourist lodge to be placed on their land, in exchange for a portion of the profits (Thompson et al., 2009; Butt, 2011). In the Olkiramatian and Shompole Group Ranches, a conservancy doubles as a dry season grass bank, meaning that grazing is only restricted during the wet season (PO). These two Group Ranches in many ways exemplify successful community based conservation and human wildlife coexistence: numerous community members are employed in wildlife-related tourism and research, entry fees to the conservancies are (supposedly) passed to the community, and the existence of conservancies is largely compatible with pastoralism, as they only restrict grazing during the dry season. In

Olkiramatian, the income generated from campsite accommodation fees is given to the Olkiramatian Reto Women's Group, an association of over 200 Maasai women, who use the funds for community projects and scholarships for female students.

In general, most communities have such an arrangement: a portion of the land is specifically designated to conserve wildlife, but grazing is usually allowed during parts of the year, and benefits from eco-tourism or research ventures are in some manner transferred into the community (Godfrey, 2016). Still, many people even in Olkiramatian and Shompole report not receiving any tangible benefits from wildlife, perhaps due to difficulties in effectively and equitably transferring conservancy fees to the community, or in communicating the fact that certain benefits, such as projects and the scholarships for female students, are indirectly provided by wildlife (Godfrey, *unpublished*). This illustrates some of the common limitations of CBC, found even in well-structured systems striving to achieve transparency and equity.

Indeed, in most CBC cases, only a small number of people actually end up being employed directly in wildlife tourism relative to the whole community (Brooks et al., 2012). However, I had a conversation with an individual from Olkiramatian, employed in the wildlife industry, who explained to me why many of the people he knew in the community had a more positive outlook on it, simply because they were happy for his situation. Thus, social factors (often simple friendships), can compel people who do not depend on or benefit directly from wildlife to alter their opinions and behavior towards various species, for the sake of a friend or fellow community member who does.

In terms of communities' relationship to carnivores, receiving economic benefits from wildlife can greatly improve the desire to coexist with carnivores. Simply put, when carnivores

27

become an essential 'product' from which communities can generate income, their motivation to protect them inherently becomes greater. Blackburn et al. (2016) performed a small meta-analysis comparing Maasai communities with and without conservancies and found that "associated [wildlife] benefits such as the sharing of tourism revenues may significantly reduce the frequency and/or severity of reaction to livestock depredation by lions" (Blackburn et al., 2016). It seems that where communities benefit from wildlife, livestock depredation is no longer seen exclusively as a cost, but rather as a sacrifice that is (sometimes) outweighed by the benefits simultaneously being provided by wildlife (Baur et al., 2015; Blackburn et al., 2016).

However, CBC ventures have important shortcomings (Manyara & Jones, 2007; Homewood et al., 2009). CBC cases usually suffer from elite capture and uneven distribution of benefits, often related to the spatial positioning of communities (Meguro & Inoue 2011; Thompson & Homewood, 2002). Namely, while communities located in areas with abundant wildlife, such as those surrounding the Maasai Mara, are able to "receive considerable sums [from wildlife]", households located in drier, less biologically rich areas are usually excluded from the benefits (Homewood et al 2009; Thompson & Homewood, 2002; Reed et al., 2009). Additionally, critics of the CBC approach assert that proponents' praise is based on theory and ethics, not practical rigor, and that successful portrayals of CBC often deviate from what is actually occurring on the ground, where power and knowledge dynamics undermine the 'win-win' scenario and lead to the majority of locals still being excluded from wildlife benefits (Brooks et al., 2012).

As a whole, CBC can, given the right circumstances and structure, promote strengthened local livelihoods, improve tolerance for carnivores, and as a whole revive the human-wildlife coexistence which is so essential to conserving carnivore populations in non-PA areas going forward (Manyara & Jones 2007). Evidence shows that success is context dependent (Meguro & Inoue 2011) and that strong and ethical leadership, transparency and equity regarding the distribution of wildlife profits, and the gift of abundant and charismatic wildlife populations seem to be the essential components of successful CBC ventures (Godfrey, *unpublished*). In other cases, corruption and skewed power and knowledge dynamics inhibit true empowerment of communities, which strains local perceptions of wildlife (Brooks et al., 2001).

It is important to note that fortress conservation and the exploitation of Maasai land still occurs in Kenya (Thompson & Homewood, 2002). Many communities, perhaps the majority, still fail to receive any benefits from wildlife even when their traditional land is being used by external interests for ecotourism (Godfrey, 2016; Thompson & Homewood, 2002). I have undoubtedly biased my analysis regarding CBC and ecotourism disproportionately towards communities that see benefits from wildlife, simply because they are more prominently represented in the literature, and because the people I interacted with in Olkiramatian were employed in some capacity by occupations tied to wildlife.

# Discussion



Pastoralist, a herd of sheep and goats, and a giraffe sharing pasture in Shompole

South Rift pastoral rangelands are unique in Kenya in their conservation of diverse and robust large carnivore populations. As agriculture and densely populated towns have eradicated carnivores, the contiguous and sparsely populated rangeland savannas, ecologically supported by Maasai pastoralists, preserved a viable habitat for wildlife. In this landscape, millennia of cohabitation allowed carnivores and Maasai pastoralists to adapt to each other's presence and coexist. Conflicts do occur between these two keystone members of the rangeland ecosystem, mostly due to depredation. But, for centuries, this conflict was tolerated, evidenced by the fact that carnivores persisted in Maasailand into the 21st century.

Today, however, coexistence in parts of the South Rift is threatened, which means that carnivores are as well. Key to this issue is a growing erosion of contiguous, pastoral rangelands due to subdivision and privatization. But even within pastoral rangelands retaining a more contiguous landscape, environmental and socio-political factors have inhibited communities' tolerance of livestock depredation. Climate change has undoubtedly played a role, making the impact of losing livestock more severe; but perhaps even more significant is communities' perception of 'conservation' generally. In many cases, the presence of carnivores is associated with restrictions on land and resource usage; of a government that does much to enforce punishments for retaliatory killings, but does little to find win-win solutions for carnivores and humans. This has led to a resentment of conservation by many local communities, and consequently a perilous scenario for wild carnivores.

The conservation paradigm of CBC is relatively new in the field, and its effectiveness is still in question. At present, we can conclude that success is heavily context dependent, and that ethical leadership, transparency and wise distribution of wildlife conservation profits are key characteristics of productive outcomes. I believe also that tolerance of carnivores may be largely influenced by the context and manner in which 'conservation' is discussed with locals. My impression is that communities whose losses to carnivores are sincerely acknowledged in dialogue and addressed thoughtfully in policies are significantly more receptive to tolerating carnivores on their land.

Given a changing climate, rising populations, and new socio-economic realities, the historic system of coexistence between carnivores and Maasai pastoralists may be more vulnerable than it once was. That stated, Maasai pastoralists have preserved carnivore populations to a degree matched by few other peoples in the world, and there is much to be learned from the ancient relationship between carnivores and Maasai people, which has endured in South Rift rangelands for centuries. And going forward, positive ecological and socio-economic outcomes of the conservancy/CBC model in Group Ranches like Olkiramatian indicate that the framework does have potential to conserve carnivore populations in an ethical manner with respect to local inhabitants. Indeed, given more time in the field to adjust and optimize this conservation model, I am optimistic that coexistence between people and carnivores can persist long into the future, in the South Rift and beyond.

#### Acknowledgements

The inspiration for this paper was my twelve-week internship in Olkiramatian, Kenya. There are many people and organizations that made this summer experience not only possible, but also deeply rewarding for me. First, I would like to thank Dr. Robert M. Hurley for the funding he provided for me to participate in this internship. Without his financial support, my internship and all the amazing experiences I had would not have been possible. I would also like to express my gratitude to the Institutional Canopy of Conservation (ICAN) for their role in organizing internships in Kenya for me and my colleagues. ICAN's support and East African connections were a vital reason my internship was so incredible. Finally, I would like to thank the Arts Internship Office, which provided significant logistical support necessary for me and numerous other students to participate in international internships.

During my internship, I lived in the Olkiramatian, Shompole, and Oldonyo-Nyokie Group Ranches, which are members of the South Rift Association of Landowners (SORALO), my host organization for the summer. I am incredibly grateful to everyone in these three communities, as well my hosts at SORALO, in particular Samantha Russel, who not only welcomed me, but also went to considerable lengths to create a fun, informative, and engaging summer for me. I cannot thank you all enough for such an impactful and memorable experience.

I am very appreciative of my friends and colleagues, Liam, Kathleen, Gilbert, and all the other people I met in Kenya, who share my interest in conservation and, through their own incredible work, have inspired me to continue working towards my academic goals.

And last, I would like to sincerely thank Dr. John Galaty for supervising this paper, and for his support, counsel, and openness to discussing these issues, which helped me transform scattered ideas into a completed paper.

## References

- Adams, J., McShane, T.O. (1996). *The Myth of Wild Africa: Conservation without Illusion* University of California Press, Los Angeles.
- Bagchi, S., Mishra, C. (2006). Living with large carnivores: predation on livestock by the snow leopard (Uncia uncia) *Journal of Zoology 268*, 217-224.
- Bauer, H., Müller, L., Van Der Goes, D., & Sillero-Zubiri, C. (2017). Financial compensation for damage to livestock by lions (Panthera leo) on community rangelands in Kenya. *Oryx* 51(1), 106-114.
- Bauer, H. (2015). Lion (Panthera leo) populations are declining rapidly across Africa, except in intensively managed areas. *Proceedings of the National Academy of Sciences of the United States of America* 112(48), 14894–14899.
- Behnke, R. H., Scoones, I., and Kerven, C. (1993). Range Ecology at Disequilibrium: New Models of Natural Variability and Pastoral Adaptation in African Savannas. London: Overseas Development Institute.
- Boone, R. B., and Hobbs, N. T. (2004). Lines around fragments: Effects of fencing on large herbivores. *African Journal of Range and Forage Science 21*, 79–90.
- Bigalke, R. C. (1978). Present-day mammals of Africa. In *Evolution of African Mammals*, ed. Magio V. J. and Cooke, H. B. S. 1–16. Cambridge, Mass: Harvard University Press.
- Blackburn, S., Hopcraft, J. C., Ogutu, J. O., Matthiopoulos, J., & Frank, L. (2016). Human-wildlife conflict, benefit sharing and the survival of lions in pastoralist community-based conservancies. *Journal of Applied Ecology* 53(4), 1195-1205.
- Brockington, D. (2002). Fortress Conservation: The Preservation of the Mkomazi Game Reserve, Tanzania. Oxford: International African Institute.
- Brooks, J., Waylen, K., and Mulder, M. (2013). Assessing community-based conservation projects: A systematic review and multilevel analysis of attitudinal, behavioral, ecological, and economic outcomes. *Environmental Evidence* 2(1), 2.
- Boydston, E. E., Kapheim, K. M., Watts, H. E., et al., (2003). Altered behavior in spotted hyenas associated with increased human activity. *Animal Conservation* 6, 207–219.
- Butt, B. (2011). Coping with uncertainty and variability: The influence of protected areas on pastoral herding strategies in East Africa. *Human Ecology 39*, 289–307.
- Collett, D. (1987). Pastoralists and wildlife: Image and reality in Kenya Maasailand. In *Conservation in Africa: People, Policies, and Practice*, ed. Anderson D. M. and Grove, R. 129–148. Cambridge: Cambridge University Press.
- Ellis, J. E., and Swift, D. M. (1988). Stability of African pastoral ecosystems: Alternative paradigms and implications for development. *Journal of Range Management* 41, 450–459.

- Ellis, J. E., and Galvin, K. A., (1994). Climate patterns and land-use practices in dry zones of Africa. *BioScience* 44, 340–349.
- Frost, P. G. H., and Robertson F. (1987). The ecological effects of fire in savannas. In *Determinants* of *Tropical Savannas*, ed. Walker, B.H. 93–140. Oxford: IRL Press.
- Fuhlendorf, S. D., and Engle, D. M. (2001). Restoring heterogeneity on rangelands: Ecosystem management based on evolutionary grazing patterns. *BioScience 51*, 625–632.
- Funston, P. (2011). Population Characteristics of Lions (Panthera leo) in the Kgalagadi Transfrontier Park. *South African Journal of Wildlife Research* 48(12), 1–10.
- Galaty, J. G. (1980). The Maasai Group Ranch. In *When Nomads Settle: Processes of Sedentarisation as* Adaptation and Response, ed. Salzman P. 157–172. Praeger, New York.
- Galaty, J. G. (2015) Pastoralism in Anthropology. (2015). International Encyclopedia of the Social & Behavioral Sciences, 577–583.
- Galaty, J. G. (1994). Ha(l)ving Land in Common: the Subdivision of Maasai Group Ranches in Kenya. *Nomadic Peoples 34-35*, 109–122.
- Godfrey, K. (2016). "Approaches to Community-based Conservation in Kenya: Case Studies from Amboseli, Maasai Mara, and Laikipia." Undergraduate research paper. Submitted to J. G. Galaty.
- Godfrey, K. *Unpublished. Working title:* Beyond "Conservation", Toward Coexistence: Exploring meaning, practice, and relationships to wildlife in the Maasai communities of Olkiramatian and Shompole, Kajiado County, Kenya. Master's Thesis.
- Groom, R. (2007). How to make land subdivision work: Ananalysis of the ecological and socioeconomic factors affecting conservation outcomes during land privatization in Kenyan Maasailand. PhD diss., University of Bristol.
- Gichohi H. (1996). The ecology of a truncated ecosystem: The Athi-Kapiti Plains. PhD diss., University of Leicester.
- Hughes, L. (2002). Moving the Maasai: A colonial misadventure. PhD diss., Oxford University.
- Homewood, K., and Rodgers W. A. (1984). Pastoralism and conservation. Human Ecology 12, 431-442.
- Hardin, G. (1968). The tragedy of the commons. Science 162, 1243–1248.
- Hazzah, L. (2006). Living among lions (Panthera leo): Coexistence or Killing? Community attitudes towards conservation initiatives and the motivations behind lion killing in Kenyan Maasailand. Conservation Biology and Sustainable Development, University of Wisconsin-Madison, Madison.
- Hazzah, L., Mulder, M. B., and Frank, L. (2009). Lions and warriors: Social factors underlying declining African lion populations and the effect of incentive-based management in Kenya. *Biological Conservation* 142, 2428–2437.
- Homewood, K., Trench, P. C., and Kristjanson, P. (2009). *Staying Maasai? Livelihoods, Conservation, and Development in East African Rangelands*. London: Springer.

- Hoben, A. (1995). Paradigms and politics: The cultural construction of environmental policy in Ethiopia. *World Development 23*, 1007–1021.
- Herskovits, M.(1926). The cattle complex in East Africa. American Anthropologist 28, 230–272.
- Holmern, T., Nyahongo, J., and Roskaft, E. (2007). Livestock loss caused by predators outside the Serengeti National Park, Tanzania. *Biological Conservation 135*, 518–526.
- Jacobs, A. H. (1975). Maasai pastoralism in an historical perspective. In *Pastoralism in Tropical Africa*, ed. Monod, T. 406–425. Oxford: International African Institute.
- Kissui, B. M. (2008). Livestock predation by lions, leopards, spotted hyenas, and their vulnerability to retaliatory killing in the Maasai steppe, Tanzania. *Animal Conservation 11*, 422–432.
- Kolowski, J. M., and. Holekamp, K. E. (2006). Spatial, temporal, and physical characteristics of livestock depredations by large carnivores along a Kenyan reserve border. *Biological Conservation* 128, 529–54.
- Leach, M. K., and Givnish, T.J. (1996). Ecological determinants of species loss in remnant prairies. *Science* 273, 1555–1558.
- Lindsay, W. K. (1987). Integrating parks and pastoralists: Some lessons from Amboseli. In *Conservation in Africa: People, Policies, and Practice*, ed. Anderson, D. and Grove, R. 149–167. Cambridge: Cambridge University Press.
- Lamprey, R. H., and Reid, R. S. (2004). Expansion of human settlement in Kenya's Maasai Mara: What future for pastoralism and wildlife? *Journal of Biogeography 31*, 997-1032.
- Maclennan, S. D., Groom, R. J., Macdonald, D. W., and Frank, L. G. (2009). Evaluation of a compensation scheme to bring about pastoralist tolerance of lions. *Biological Conservation 142*, 2419–2427.
- Manyara, G., and Jones E. (2007). Community based tourism enterprises development in Kenya: An exploration of their potential as avenues of poverty reduction. *Journal of Sustainable Tourism* 15(6), 628-644.
- Murdock, G. P. (1959). Africa-Peoples and their Culture, History. New York: McGraw Hill.
- Marshall, F. (1990). Cattle herds and caprine flocks. In Early Pastoralists of Southwestern Kenya, ed. P. Robertshaw, 205–260. Nairobi: British Institute of Eastern Africa.
- Meguro, T. (2014). Becoming Conservationists, Concealing Victims: Conflict and Positionings of Maasau, Regarding wildlife Conservation in Kenya. African Study Monographs, Suppl. 50, 155– 172.
- Meguro, T. (2010). The possibility of local people being involved in wildlife conservation: From the case of Maasai land in southern Kenya. *Journal of Environmental Sociology 19*, 127–142.
- Mizutani, F., E. N. Muthiani, P. Kristjanson, and H. Recke. (2005). Impact and value of wildlife in pastoral livestock production system in Kenya: Possibilities for healthy ecosystem conservation and livestock development for the poor. In *Conservation and DevelopmentInterventions at the*

*Wildlife/Livestock Interface: Implications for Wildlife, Livestock, and Human Health*, ed. Osofsky, S. A. Occasional Paper of the IUCN Species Survival Commission, No. 30.

- Mishra, C. (1997). Livestock depredation by large carnivores in the Indian trans-Himalaya: conflict perceptions and conservation prospects. *Environmental Conservation* 24, 338-343.
- Mogensen, Niels L., Ogutu, J.O., Dabelsteen, T. (2011). The Effects of Pastoralism and Protection on Lion Behaviour, Demography and Space use in the Mara Region of Kenya. *African Zoology* 46(1), 78–87.
- Moiko, S. (2013). Pastoralists at crossroads: Community resource governance in the context of a transitioning rangelands tenure system. McGill University.
- Moss, C. (2001). The demography of an African elephant (Loxodonta africana) population in Amboseli, Kenya. *Journal of Zoology* 255, 145–156.
- Naughton-Treves, L., and Treves, A. (2005). Socio-ecological factors shaping local support for wildlife: Crop-raiding by elephants and other wildlife in Africa. In *People and Wildlife: Conflict or Coexistence?*, ed. Woodroffe, R., Thirgood, R., and Rabinowitz, A. 252–277. Cambridge: Cambridge University Press.
- Nowell, K. and Jackson, P. (1996). *Wild Cats: Status Survey and Conservation Action Plan*. World Conservation Union, Gland, Switzerland.
- Okello, M. (2005). An assessment of the large mammal component of the proposed wildlife sanctuary site in Maasai Kuku Group Ranch near Amboseli, Kenya. *South African Journal of Wildlife Research 35*, 63–76.
- Okello, M., Ole Seno, S., Nthiga, R. (2009). Reconciling people's livelihoods and environmental conservation in the rural landscapes in Kenya: Opportunities and challenges in the Amboseli landscapes. *Natural Resources Forum 33*(2), 123-133.
- Ottichilo, W., de Leeuw, K. J., Skidmore, A. K., et al. (2000). Population trends of large non-migratory wild herbivores and livestock in the Masai Mara ecosystem, Kenya, between 1977 and 1997. *African Journal of Ecology 38*, 202–216.
- Ogada, M., Woodroffe, R., Oguge, N. O., and Frank. L. G. (2003). Limiting depredation by African carnivores: The role of livestock husbandry. *ConservationBiology* 17(15), 21–1530.
- Packer, C. (2013). Conserving large carnivores: Dollars and fences. *Ecology Letters* 16(5), 635-641.
- Pangle, W. M., and Holekamp, K. E. (2010). Lethal and nonlethal anthropogenic effects on spotted hyenas in the Maasai Mara National Reserve. *Journal of Mammalogy* 91, 154–164.
- Robertshaw, P. (1991). Early Pastoralists of South Western Kenya. Nairobi: British Institute of East Africa.
- Ragan, L., Silver, D., Godfrey, K., Pollini J., Kipanoi., A. (2017). Quick case study report #7: Oldonyo-Nyokie group ranch, Kajiado County, Kenya. *Unpublished*.

- Reid, R. S. (2012). Savannas of our Birth: People, Wildlife, and Change in East Africa. Berkeley: University of California Press.
- Reid, R. S., Thornton, P. K. and Kruska, R. L. (2004). Loss and fragmentation of habitat for pastoral people and wildlife in East Africa: Concepts and issues. *South African Journal of Grass and Forage Science 21*, 171–18.
- Reed, D. N., Anderson, T. M., Dempewolf J. (2009). The spatial distribution of vegetation types in the Serengeti ecosystem: The influence of rainfall and topographic relief on vegetation patch characteristics. *Journal of Biogeography 36*, 770–782.
- Runyoro, V. A., Hofer, H., Chausi, E.B. and Moehlman, P. D. (1995). Long-term trends in the herbivore populations of the Ngorongoro Crater, Tanzania. In *Serengeti II: Dynamics, Management and Conservation of an Ecosystem*, ed. Sinclair, A.R. E. and Arcese, P. 146–168. Chicago: University of Chicago Press.
- Schroeder, R. A. (2008). Environmental justice and the market: The politics of sharing wildlife revenues in Tanzania. *Society and Natural Resources* 21, 583–596.
- Schuette, P. (2012). Factors Affecting the Distribution and Abundance of Carnivores and their Ungulate Prey Across a Communally Owned Rangeland in Kenya. PhD Diss., Montana University.
- Scoones, I. (1994). *Living with Uncertainty: New Directions in Pastoral Development in Africa*. London: Intermediate Technology Publications.
- Thirgood, S., Mlingwa, C., Gereta, E. (2008). Who pays for conservation? Current and future financing scenarios for the Serengeti ecosystem. In *Serengeti III: Human Impacts on Ecosystem Dynamics*, ed. Sinclair, A. R. E., Packer, C., Mduma, A. R. and Fryxell, J. M. 443–470. Chicago: University of Chicago Press.
- Thompson, D. M., Serneels, S., Kaelo, D., and Trench, P. C. (2009) Maasai Mara—Land privatization and wildlife decline: Can conservation pay its way? In *Staying Maasai: Livelihoods, Conservation, and Development in East African Rangelands*, ed. Homewood, K., Kristjanson, P., and Trench, P. 77–114. London: Springer.
- Tyrell, P., Russel, S., Western, D. (2017). Seasonal Movements of Wildlife and Livestock in a Heterogeneous Pastoral Landscape: Implications for Coexistence and Community Based Conservation. *Global Ecology and Conservation 12*, 59-72.
- Virani, M. Z., C. Kendall, P. Njoroge, and S. Thomsett. (2011). Major declines in the abundance of vultures and other scavenging raptors in and around the Maasai Mara ecosystem, Kenya. *Biological Conservation* 4, 746–752.
- Western, D., and Gichohi, H. (1993). Segregation effects and the impoverishment of savanna parks: the case for ecosystem viability analysis. *African Journal of Ecology 31*(4), 269–281.
- Western, D. (1994). Ecosystem conservation and rural development. In Natural Connections: Perspectives in Community-Based Conservation, ed. Western, D. and Wright, M. 15–52. Island Press, Washington.

- Woodroffe, R. and Frank, L. G. (2005). Lethal control of African lions (Panthera leo): local and regional population impacts. *Animal Conservation* 8(1), 91–98.
- Woodroffe, R., and Ginsberg, J. R. (1998). Edge effects and the extinction of populations inside protected areas. *Science* 280, 2126–2128.