The Gnu Normal:

Interactions Between Wildebeest, Maasai, and Conservation in Kenya

Submitted by Robin Rosetta Fiore to the University of Exeter

as a thesis for the degree of

Doctor of Philosophy in Anthrozoology

In September 2022

UNIVERSITY OF EXETER

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

Signed: Robin Rosetta Fiore

Abstract

The Serengeti-Maasai Mara ecosystem is a dynamic environment that is home to some of the last megafauna on earth, the world's largest mammalian migration, and a diversity of human subsistence strategies. This research focuses on the spread of the disease malignant catarrhal fever from wildebeest calves in the northern part of the ecosystem to cattle belonging to Maasai pastoralists and how subsequent loss of cattle and avoidance of diseased areas affects Maasai livelihoods, attitudes toward wildebeest and conservation, and the behavior of wildebeest in the area. Understanding the attitudes local Maasai hold toward wildebeest and conservation, and the consequences of those attitudes on conservation success and wildebeest behavior, is critical to successful conservation of the wildebeest and the ecosystem that depends on them.

To investigate the attitudes and behaviors of Maasai pastoralists toward wildebeest and conservation, an online survey of 114 Kenyan Maasai people was conducted using social media. In order to inform the interpretation of attitudes on conservation, an email survey of 16 conservation practitioners who had worked or were currently working in Africa was conducted. In order to determine possible differences in wildebeest behavior in Maasai versus non-Maasai inhabited areas, behavioral data (collected by the Snapshot Serengeti Project and analysed by citizen scientists) in Enonkishu Conservancy in Kenya (a Maasai area) and Serengeti National Park in Tanzania (where Maasai are largely excluded) were compared.

The results of the survey of Maasai people indicated high levels of disturbance and livelihood loss due to the presence of wildebeest infected with malignant catarrhal fever. Respondents reported broad dislike and avoidance of wildebeest that strained their livelihoods and a strong desire for a malignant catarrhal fever vaccine. The survey of conservation practitioners indicated a great desire to work with local people and a broad belief that respondents were currently doing so. However, the conservation practitioner survey indicated involvement of local people as mainly peripheral members of conservation research—as drivers or guides. The Maasai survey indicated a desire among Maasai respondents to be involved on a deeper level with conservation (e.g., as educators and members of the research team). The wildebeest behavioral data showed wildebeest in Enonkishu Conservancy had significantly lower rates of standing, resting, eating, and interacting and significantly higher rates of moving. Though further study is needed to determine the exact cause, it does indicate a difference in behavior between the two sites.

Though this study was limited in the sample sizes of the two surveys and in the multiple differences between the two sites used for the wildebeest behavioral analysis, it has helped expound on the conservation encounter between wildebeest, Maasai pastoralists, and conservation efforts in Kenya. These results suggest that more cooperation between local Maasai and conservation personnel is needed for more effective conservation, and that a vaccine for malignant catarrhal fever could help support Maasai livelihoods. This study has also indicated that Maasai presence could be affecting wildebeest behavior. This could be critical in investigating the degree that wildebeest may adapt to changing conditions, such as human encroachment and climate change.

Table of Contents

ILLUSTRATIONS

FIGURES

TABLES

Declaration

Though this thesis is the sole work of the author, grateful acknowledgement is made for the invaluable contribution of the University of Minnesota Lion Center and the Snapshot Safari Project.

This publication has relied on data provided by the camera network "Snapshot Safari" managed by the University of Minnesota Lion Center and hosted on Zooniverse. This publication was also made possible by the provision of data from Enonkishu Conservancy and Serengeti National Park.

I would also like to recognize the unnamed, but no less appreciated, thousands of citizen scientists who helped analyze the Snapshot Safari data. Without them, this research could not have been completed.

Dedication

For Sabre.

For all the lessons you taught me.

For all the patience you showed.

I will carry you in my heart. Forever.

Chapter 1: Introduction

1.1.0 Purpose of the Research

The week I spent in Serengeti National Park in 2019 was transformative. It was much more than the spectacular red sunsets, the hyena whoops in the nights, the iconic megafauna, the incredible bird diversity, and the migrating wildebeest numbering in the millions. I found something quite unexpected that wasn't in my field guide.

Leaving the park, our guide asked us not to take photos of any people we might encounter. I found it an odd request, although it is quite rude to take pictures of people without asking. Over the last week, we had seen almost no people, save the smiling and helpful staff at our tented camps.

As we crossed under a large sign declaring the edge of Serengeti National Park, we immediately saw the people our guide was referring to. The Maasai. Men and women in beautiful textiles and beaded adornments, herding their cattle, sheep, and goats over the visibly less nutrient rich plains outside the park. Over the next week, we visited several parks that they were not allowed to enter. I learned of land alienation after land alienation and started to feel a deep uneasiness about my time in East Africa. Was I, as a tourist here to see animals, contributing to the continued alienation of the Maasai from lands they had historically grazed and still needed? The purpose of my trip was to determine the animal species I wanted to focus on for this research on human-wildlife conflict, but by the time I left, my focus was on the Maasai. Instead of thinking about how to solve conflict to conserve animals, I was thinking about what conflict to solve to preserve Maasai communities and their ways of life. It was quite unexpected.

While there, I was told by my guide and by numerous tourism industry workers that the Maasai must be excluded from parks to preserve animals. I already knew of many conservation projects where communities worked with conservation to make it more effective. Why not here? These thoughts and questions shaped this research.

I have chosen to focus on the case study of human-wildlife conflict between the Maasai people in Kenya and white-bearded wildebeest (*Connochaetes taurinus*). The white-bearded wildebeest (hereafter wildebeest) is capable of transmitting a disease known as malignant catarrhal fever to cattle. Spread by wildebeest calves, primarily when the wildebeest migration is in Kenya, this disease is devastating. It causes conflict with the Maasai pastoralists by requiring them to avoid wildebeest while grazing their cattle or risk losing large numbers of cattle to this deadly disease.

The aims of this research are i) to understand the attitudes Maasai hold toward wildebeest and how those attitudes might affect their behavior toward wildebeest, ii) to understand how conservationists and local people view their collaborations, and iii) to explore whether human-wildlife conflict with the Maasai might be changing wildebeest behavior.

The objectives of this research are i) to conduct a survey of Maasai people in Kenya to understand their feelings and behaviors toward wildebeest and conservation work, ii) to conduct a survey of conservation workers to learn about their experiences and feelings toward working with local people across Africa, and iii) to compare the behavior of wildebeest in an area with Maasai activity to an area without Maasai activity to determine if human-wildlife conflict is having an effect on behavior.

The methods used to address these objectives evolved many times in response to the COVID-19 pandemic. Chapter 3 includes a lengthy explanation of the process by which I reached the final methodologies that were used. I had originally planned to travel to Kenya in the summer of 2020 in order to conduct the surveys of Maasai locals and make observations of wildebeest behavior. Due to COVID-19, no in-person methods were used at all, either by me or by any research assistants who could risk spreading the virus within their own communities or risk getting it themselves by traveling on my behalf (not even locally). Therefore, this research represents the first survey of Maasai people conducted entirely through social media, and the first time (that I am aware of) that online ethnographic methods have been applied to studying Maasai attitudes and beliefs.

In order to study wildebeest behavior without traveling to Kenya myself, I made use of a large-scale citizen science project known as Snapshot Safari. This project, managed by the University of Minnesota and hosted on the platform Zooniverse, is a camera trapping project with locations across Africa. Hundreds of thousands of pictures are generated of animals, which are then put online for citizen scientists to identify. These large data sets are available for scientific use. I requested the data for two locations: Serengeti National Park, where Maasai are prohibited and where there is relatively little Maasai incursion and low malignant catarrhal fever, and the Enonkishu Conservancy—a Maasai conservancy with high Maasai use and a high rate of malignant catarrhal fever during the wildebeest migration. Though the locations were some distance apart, these areas represented the best available data to compare an area of high Maasai usage and low Maasai usage. I am the first researcher to use these data sets to analyze wildebeest behavior and compare it between these two sites.

The adaptations required due to COVID-19 led me to novel methodologies, the analysis of previously unused data sets, and increased research originality. The main contribution of this thesis lies in analyzing the conflict between Maasai, wildebeest, and conservation from the perspective of all stake holders: the Maasai, the conservationists, and the wildebeest. I used a theoretical framework known as conservation social science, explained in depth in following sections. This framework deeply applies social sciences to conservation problems to analyze them more completely and offer solutions involving all parties, especially local people.

The conflict between Maasai and wildebeest creates an ideal situation for applying conservation social science. After years of practical work in conservation and conservation education, I have seen many conservation projects fail or make little headway due to a lack of understanding of, or involvement with, local communities. The most successful conservation happens when it solves the problems of local people, and when they are completely involved (demonstrated with numerous examples in Chapter 7). The Maasai/wildebeest case study is explored in this research as another example of a conservation problem that can only be solved with local involvement and by solving the issue of malignant catarrhal fever's effects. The strength of this case study is the clarity of the interconnectedness of all the actors. However, it is a challenge due to the extremely specific time and place of the conflict: distinct areas of Kenya during wildebeest migration when calves are contagious.

The remainder of this chapter is dedicated to background information on the Serengeti-Maasai Mara ecosystem, the Maasai, and wildebeest. Chapter 2 gives background information on the conservation encounter that is needed for a proper conservation social science analysis, including the history of conservation in Kenya that affects Maasai attitudes today.

The goal of this research is to elucidate the conservation encounter and the ways in which malignant catarrhal fever impacts the livelihoods of Maasai communities and wildebeest behavior. By illuminating these effects and showing how conservation is being inhibited by them, I hope to encourage the identification of a solution to the benefit of Maasai livelihoods and wildebeest conservation.

1.2.0 Defining Human-Wildlife Conflict

The research upon which this thesis is based focuses on one of the main causes of conflict between pastoral Maasai people of the Maasai Mara area of Kenya and white-bearded wildebeest (*Connochaetes taurinus*): malignant catarrhal fever virus, which is passed from wildebeest calves to domestic Zebu cattle (*Bos taurus indicus*). The study of human-wildlife conflict is gaining traction and popularity among anthropologists, conservationists, and governments (Messmer, 2000) as well as anthrozoologists and practitioners of other diverse disciplinary and professional backgrounds, but it is important to be clear on definitions at the outset, and consequently the general research questions which underpin the thesis, which ask: What is human-wildlife conflict? How is it defined? What are the contributing factors?

What can be done about it? These will be introduced before the specific case study of human-wildlife conflict among the Maasai, wildebeest, and conservation is explored.

Some formal definitions of human-wildlife conflict are relatively simple: “any situation where wildlife comes into conflict with humans over common resources” (Marchini, 2014; p. 189) or “human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife” (Madden, 2004; p. 248). Other definitions are long and multifaceted. Nyhus (2016; p. 145) outlines human-wildlife conflict as “conflict that occurs between people and wildlife; actions by humans or wildlife that have an adverse effect on the other; threats posed by wildlife to human life, economic security, or recreation; or the perception that wildlife threatens human safety, health, food, and property.” These similar definitions differ in the amount of detail provided and whether the focus is the anthropocentric effects or the effects on both parties. For the purposes of this project, I adopted a hybrid definition and described human-wildlife conflict as any situation in which the overlap in space usage between humans and animals results in negative impacts on either party. An important factor in all definitions is the ability of human-wildlife conflict to go in both directions. This is a reflection of the animal turn in the social sciences and the focus on animals as research subjects themselves (Ritvo, 2007). The decentering of humans as the sole subjects of research into human-animal conflicts reflects the animal turn and indicates the use of different methods and theories to study the conflict (Salzani, 2017). However, before going further into the specifics of this study, the concept of human-wildlife conflict must be explained and clarified in detail. Human-wildlife conflict is a concern often discussed in conservation terms but has deep effects on humans as well. These conflicts are therefore just as important in a social science context as a biological and conservation one and a resolution requires the application of the social sciences. Throughout this research, I will demonstrate that human-wildlife conflict cannot be solved from a conservation perspective only but requires a deeply human element for success.

The idea that humans and animals are in conflict, and causing ill effects on each other, is not a new one. For at least the last several centuries local cultures in Africa and Asia have chosen locations for their settlements based on avoidance of crop raiding elephants (Nelson et al., 2003). Human-wildlife conflict has the potential for extensive consequences for both humans and animals as well as entire ecosystems and overall biodiversity (Nyhus, 2016). This conflict can be direct or indirect.

Direct conflicts include humans being killed by animals or animals eating subsistence crops (Nyhus, 2016). A study in Mozambique covering 27 months from 2006 to 2008 showed 265 deaths due to wildlife (Dunham et al., 2010). Around Kibale National Park farmers lose an average of $74 over six months to elephant crop raiding (Mackenzie and Ahabyona, 2012). In Uganda, about 10% of maize crops around the southern edge of the Budongo Forest Reserve are lost to baboon crop raiding (Hill, 2000).

Indirect effects include lost opportunities for school or other work because crops must be guarded. Psychological effects from stress due to animal threats is another example (Nyhus, 2016). In India, farmers who must guard their crops at night from elephants suffer a significant increase in malaria exposure (Barau et al., 2013). During the day, crop guarding often falls on children since adults must do other work. This results in lower school attendance in elephant areas (Barau et al., 2013). In Namibia, women report constant fear and stress that crop raiding will make them unable to feed their children (Khumalo and Yung, 2015).

The effects on animals due to human-wildlife conflict can also be severe. Though some animals like racoons and squirrels and even some small predators like jackals adapt well to human presence, many do not (Ogutu et al., 2005). Large predators like lions and hyenas who tend to be persecuted by humans can experience severe outcomes. Lions in the Maasai Mara area of Kenya exist at such drastically low densities near Maasai ranches that local extinction is likely (Ogutu et al., 2005). Lions change their behavior around humans, moving away from settlements and even into areas of extremely high lion densities to avoid humans (Creel et al., 2013). Measures of glucocorticoids (stress hormones) are higher in lions near humans, even if prey densities are higher (Creel et al., 2013).

Hyenas are known to change aspects of their space use, social behavior, and activity patterns in human areas (Ogutu et al., 2005). Despite being a highly adaptable animal in both behavior and ecology, hyenas near humans stayed much closer to their den and kept to high grass areas (Kolowski and Holekamp, 2009). Hyenas in areas of Maasai livestock grazing display more vigilance, nursing their young under cover, compared with those in areas without livestock grazing (Pangle and Holekamp, 2010). Hyenas in areas of livestock grazing also have larger home ranges, travel farther, and exist in smaller groups—factors with potential energetic and survival costs (Boydston et al., 2003). Both lions and hyenas are far less active during the day when humans are present (Ogutu et al., 2005).

More than behavior and ecology can change as a result of human-wildlife conflict. Some animals experience the same sort of psychological effects observed in humans. Elephants who have witnessed the culling of family members display behaviors often associated with post-traumatic stress disorder in humans, including depression, aggression, increased startle responses, and asocial behavior (Bradshaw et al., 2005). In a famous incident in the 1990s, young male elephants who witnessed the culling of their families in Kruger National Park and were then translocated to Pilanesberg National Park, entered musth 10 years early and went on a killing rampage in Pilanesberg National Park that resulted in the deaths of nearly 49 white rhinoceros (Slotow and Van Dyk, 2001). This incident is generally attributed to the psychological trauma incurred by the young males who witnessed the culling (Bradshaw et al., 2005).

The type of human-wildlife conflict with the most severe economic impacts is from agricultural pests and insects, but small animals and common pests are not usually discussed in the context of human-wildlife conflict (Nyhus, 2016). Instead, this framework is normally focused on charismatic megafauna, or species that are widely liked by the public due to their size and need for conservation (Ducarme et al., 2013). Animals that are discussed within the framework of human-wildlife conflict are predominantly those that tend to elicit strong mixed emotions by different groups of people or in different situations (Marchini, 2014). This suggests that human-wildlife conflict is just as much about human conflicts and disagreements over the value of wildlife and how it should be managed, as it is about the situations themselves (Marchini, 2014). Human-wildlife conflict always involves some amount of human-human conflict, potentially between groups competing for resources or between people with different goals, e.g., conservationists and pastoralists (Madden, 2004). Therefore, part of mitigating human-wildlife conflict is dealing with those human conflicts and concerns.

The human dimension is critical in discussing human-wildlife conflict. Specifically, risk perception is extremely important when analyzing the extent of human-wildlife conflict (Nyhus, 2016). Humans may react negatively to animals when the perceived threat from them is greater or when people feel they have less ability to exert control over the animal (Madden, 2004). A good example is the constant media frenzy over sharks and shark attacks. Although the actual risk of a shark attack on a human is statistically low, the exposure these rare attacks receive in popular culture and the news often elicits a disproportionately large response (Peace, 2015). For those working in conservation and human-wildlife conflict, it is important to be aware that changing perceptions and emotions related to animals might be as important as damage mitigation. Human-wildlife conflict escalates when people feel animals are being prioritized over their needs (Madden, 2004). In Kenya, excluding pastoralists from certain areas leads to increases in negative feelings about wildlife policies. This people-versus-animals mindset harms conservation efforts (Okech, 2010). Okech (2010) found that the exclusion of pastoralists from areas designated for conservation and wildlife use (ongoing since colonization and discussed in more detail later) leads to a loss for pastoralists of valuable herding and agricultural land. This loss of livelihood leads to a questioning of state policies and conservation programs when locals bear the cost of conservation. Retaliatory killing of animals is seen in 82% of protected areas in East Africa as a consequence (Okech, 2010).

Human-wildlife conflict is driven by the expansion of humans into animal habitats and the congruent expansion of transportation methods, agriculture, land use, and other anthropogenic activities (Nyhus, 2016). Livestock predation and crop raiding are common types of conflict discussed in literature (Marchini, 2014). One type of conflict causing damage occurs between human transportation and wildlife. Animal collisions, like deer crashing with vehicles and birds impacting planes, cause extreme losses in both life and property (Nyhus, 2016). Illnesses and injuries caused by animals are also a component of human-wildlife conflict (Messmer, 2000).

It is worth noting that some conservationists and scientists are beginning to reject the term human-wildlife conflict. Since animals cannot consciously impede human goals, human-wildlife conflict might be more accurately thought of as the human perception that animals are a threat (Peterson et al., 2010). Others have argued that the word conflict forces us to focus only on negative impacts of animals and might discourage conservation actions focused on increasing positive interactions; therefore, the term should be human-wildlife interactions or human-wildlife coexistence (Frank, 2016). Though the terminology may indeed change in the future, for the purposes of this research, the term human-wildlife conflict will continue to be used here since it is still the common convention. Whatever we may call it, there is no doubt that human-wildlife conflict is increasing and represents one of the most critical conservation challenges to protected areas (Messmer, 2000; Madden, 2004).

1.2.1 Theoretical Framework

The primary goal of this research is to better inform conservation of the white-bearded wildebeest (*Connochaetes taurinus*) and the Serengeti-Maasai Mara ecosystem, and to help improve the livelihoods of Maasai living in Kenya. This is primarily a work of applied anthrozoology and conservation science. The theoretical framework must therefore assist in the framing of results as being of practical use to conservation. Traditional conservation philosophy has consisted of two separate ideas: anthropocentric conservation and biocentric conservation (Sanborn and Jung, 2021). Anthropocentric conservation theorizes that nature should be conserved for humans and conservation should focus on maintaining ecosystem services. Biocentric conservation theorizes that nature should be conserved for its own sake and that humans must often be excluded for conservation actions to be successful (Sanborn and Jung, 2021). Both of these ideologies developed from the idea that nature is an entity separate from humans, and neither has consistently delivered meaningful results for either conservation or social justice (Sanborn and Jung, 2021).

What is conservation? Defining this term is a critical first step in articulating how it should be done. However, this step is generally missed. In his seminal work, Michael Soulé (1985) sought to define the principles, fundamental intentions, and contributions of the relatively young field of conservation biology. Soulé lays out some critical aspects of what he defines as the crisis-discipline of conservation biology. Above all, he describes conservation biology as concerned with the long-term viability of whole systems (Soulé, 1985). Humans, of course, are part of those systems. Soulé acknowledges the dependence of conservation biology on the social sciences, and the inherent ethical issues this implies (1985). He was one of the first to lay out conservation biology as a specific discipline, and he is still relied upon today for guiding definitions and practices. However, his acknowledgement of conservation's reliance on social science is not always acknowledged nor acted upon. Despite general recognition among conservation scientists of a need for integration of social science, there is still a lag in the actual implementation of increasing social science involvement in conservation (Niemiec et al., 2021).

In recent years there has been a push toward a new approach to conservation that incorporates social science methods and theories into its methods, interpretations, and actions (Beck et al., 2021). Despite decades of conservation work, global biodiversity continues to plummet (Sanborn and Jung, 2021; Margules et al., 2020). The biology done by conservationists is not incorrect or flawed; it is the conservation interventions and actions that are failing to be effective in conserving biodiversity (Mascia et al., 2003). Why is this? Simply, it is because most conservation interventions rely on human decision making, with humans choosing to change their behavior (Mascia et al., 2003). Science and biology alone are not enough to convince people to change their behavior. Conservationists need to understand and consider the social dimensions of conservation actions; they need social science to be successful in order to avoid the failures the people versus nature mindset has caused, as pointed out by Sanborn and Jung in their analysis of historical conservation attempts (2021).

Most biology and traditional conservation science comes from a theoretical framework of post-positivism (Moon and Blackman, 2014). Conservation biologists are trained in the sciences and believe valid knowledge comes only from objective empirical research gained through the scientific method; they often do not even realize this is itself a theory of knowledge (Moon and Blackman, 2014). Post-positivism generates data on ecosystems, animal behavior, and the like, but it is not adequate to understand the whole picture of conservation encounters. It does not take into account human reasoning and decision making, which are the basis of conservation behavior (Moon and Blackman, 2014).

A new theoretical framework is therefore needed for successful conservation, one that deeply integrates all facets of social science and analyzes all human dimensions of the conservation encounter at hand. Bennet et al. (2017) coined the term “conservation social science” to describe the practice of doing conservation while deeply integrating social science philosophies and practices. In this research, I will use conservation social science as a theoretical framework for researching and analyzing the conservation encounter between wildebeest, Maasai, and conservation workers in Kenya. Conservation social science as a theoretical framework assumes that conservation and the sustainable use of resources is a confluence of socio-cultural, economic, and ecological factors (Muhumuza, Sanders, and Balkwill, 2013). Within this theoretical framework, in order to fully understand the factors leading to the need for conservation, the entire conservation situation should be analyzed, not just the biological situation surrounding the animals. This includes the history of conservation interventions, local livelihoods, and land alienations—critical for understanding this particular case study (Muhumuza, Sanders, and Balkwill, 2013).

Conservation social science, if it becomes widely practiced and used, has the potential to transform how conservation is done (Bennet and Roth, 2019). Traditional conservation has largely ignored human dimensions until the last few decades. This has led not only to ineffective conservation, but to exclusionary practices that have caused backlash against conservation (Bennet and Roth, 2019). Conservation social science should not, therefore, be used to justify current conservation practices. Nor should conservationists continue to cherry-pick the social science practices they consider useful for conservation, as is currently being done (Bennet and Roth, 2019). By using conservation social science as a theoretical framework, I hope to show how social science can be broadly implemented to benefit conservation and how social science and anthropological techniques and thinking can be deeply ingrained into conservation to change the status quo and transform the discipline entirely (Bennet and Roth, 2019). Interdisciplinary research is valuable, but just because a conservationist works with local people that does not mean they are doing social science (Redford, 2011).

Moon, Adams, and Cooke (2019) present three themes to help conservationists engage with social sciences. I believe these themes are deeply useful for researching within the conservation social science framework, and I will attempt to apply them throughout this research. These three themes are (Moon, Adams, and Cooke 2019; p.430-431):

1. The partiality of knowledge. We will never know the full picture, and it is important to make explicit what is not known.
2. Place is important. We learn different things in different places. This will be especially true here because this research "place" is virtual.
3. Aspects of the researcher affect what they can know and understand. The positionality of the researcher should be explicit.

The themes above clearly incorporate aspects of the social sciences in encouraging reflexivity (examining your own feelings and motives) and positionality (how your social and political context shapes your identity). They encourage the researcher to place themselves within the context of the research and not to assume they are able to access an objective truth about the conservation encounter. Moon, Adams, and Cooke (2019) also encourage the use of stories to shed light on the phenomenon studied. They argue that with social science, data is more than data; it is meaning, and stories shed light on that meaning (Moon, Adams, and Cooke, 2019). This has value within the context of conservation social science as a framework. Stories may help shed light on the aspects of the conservation encounter that I was, and was not, able to access, and consequently, I will use storytelling as a tool in later chapters. Van Dooren argues that storytelling can do "important ethical work" in the context of discussing conservation and animal extinction (Van Dooren, 2022; p. 92). Van Dooren uses storytelling as a tool to consider the extinction of unknown and scientifically undescribed species (land snails in Hawai'i) and to explore the significance of these extinctions to conservationists, taxonomists, and others (2022). By telling stories about the scientists studying the taxonomy of unknown species and their extinction, Van Dooren believes we can open previously unknown avenues into the study of species' losses (2022). For this research, storytelling might help explore possible meanings in the data that can help connect the conservation encounter to the lives of those involved.

There is one more theory critical to using conservation social science as a theoretical framework: the theory of planned behavior (Ajzen, 1991). The basis of this research consists of talking to people about their attitudes and feelings. The theory of planned behavior provides a guide for using attitudes and feelings to study behavior. This theory states that the intentions to perform a behavior can be predicted from attitudes toward the behavior, subjective norms, and perceived behavioral control (Ajzen, 1991). For instance, a study of undergraduate students in Hong Kong by Cheung, Chan, and Wong (1999) applied the theory of planned behavior to the study of recycling behavior. Cheung, Chan, and Wong administered a questionnaire to undergraduates to determine their attitudes toward wastepaper recycling and whether they intended to recycle. Once month later, their behavior was observed to determine if they were behaving consistently with how they reported they would behave. The study found that the student's behavior could be largely predicted by their attitudes toward recycling and their understanding of its importance. It is important to note that the theory of planned behavior includes perceived behavioral control as an important factor (Ajzen, 2020). Subjects must believe they have control over their behavior and that their behavior will have an effect on an outcome in order for attitude to predict behavior (Ajzen, 2020). The college students knew they had the ability to recycle, and that recycling could help reduce waste, which was an important predictor of whether they ended up doing so (Cheung, Chan, and Wong, 1999). That is salient here because if Maasai do not believe their actions (e.g., contacting wildlife officials) will result in any outcome, then attitudes may not predict behavior.

There is a considerable amount of research that supports the theory of planned behavior, and intentions have been found to account for considerable variance in actual behavior (Ajzen, 1991). The theory of planned behavior is closely related to the theory of reasoned action which suggests that intention is the best predictor of behavior

(Browne-Nunez et al., 2013). Both are used heavily in conservation research to attempt to predict and understand the ways humans act in relation to the environment and to understand their motivations (Miller, 2017). In this research, the theory that behavior can be predicted based on intentions will be foundational. This research is survey-based and relies on the self-reporting of intended behaviors as a proxy for actual behavior. The next section will discuss how attitude also factors into action. This is an important point to consider for wildebeest who garner strong attitudes among Maasai, which may lead to actions of conservation importance.

1.2.2 Ambivalence Toward Animals

Attitude is a critical component of human-wildlife conflict. As will be demonstrated later with badgers in the United Kingdom, the actual amount of conflict does not necessarily predict how severe the perception of that conflict will be (Naylor et al., 2014). People are more likely to tolerate animals they view positively, even if the actual amount of conflict they cause is greater than less favorably viewed animals. The spotted hyena (*Crocuta crocuta*, hereafter hyena) is a perfect example. Depending on the area and the surrounding culture, the hyena has an interesting ability to be either hated or extremely loved. This well-studied example is useful to consider before turning to wildebeest, an animal without this type of available literature.

In most of Africa (including East Africa where this research focuses), the hyena is a very negatively viewed animal (Western et al., 2019). Hyenas are regarded as greedy and ugly, and their strange calls and nocturnal behaviors have led to widespread fear and hatred of them (Goldman et al., 2010; Mponzi et al., 2014). While lions, honored as brave and beautiful, are the subject of ritual hunts when they take livestock, hyenas are regularly poisoned (Kissui, 2008). The Maasai fear hyenas and associate them with sorcery and witchcraft (Baynes-Rock, 2015). The tendency of hyenas to visit and utilize garbage dumps and refuse pits further repels people (Kolowski and Holekamp, 2007). This widespread disgust and intolerance to hyenas is turned completely around in Ethiopia, where hyenas are not only tolerated, but ascribed near human intelligence and reason (Baynes-Rock, 2013; p. 430).

In the city of Harar in Ethiopia, hyenas wander the streets at night alongside humans and are fed by butchers and “hyena men” who allow tourists to watch (Baynes-Rock, 2015; p. 28-33). Hyenas are treated almost like domesticated animals and opinions of them are positive across all ethnicities, age, sex, and religious classes (Baynes-Rock, 2015). In northern Ethiopia, the population is mostly orthodox Christian and there are severe restrictions on ingestion of certain animal parts. The inedible pieces are discarded in streets and in refuse pits, acting as disease vectors and insect attractants. Hyenas are valued as sanitation units, resulting in their status as a valuable contributor to society (Yirga, et al., 2012). In the Harar area there is a widespread belief in jinn—spirits that can harm and possess people (Baynes-Rock, 2015). The people there believe hyena can eat jinn, thus further acting as protectors. Having hyena around is therefore a huge benefit (Baynes-Rock, 2013). Farmers in the area may also value hyenas, as they do not damage crops and keep herbivores away (Baynes-Rock, 2013).

The favorable views of hyenas in Ethiopia have led to different perceptions of human-wildlife conflict. Hyenas do cause conflict in Ethiopia—they prey on livestock, causing economic losses and concern. Hyenas even attack and occasionally kill humans (Yirga and Bauer, 2010). Livestock must be enclosed in a well-built kraal (livestock enclosure) at night to avoid hyena predation (Yirga and Bauer, 2010). Farmers may have to hire herders or purchase dogs to keep hyenas away from livestock (Abay et al., 2010). Despite the economic cost, when livestock are taken it is considered the fault of the humans; they must not have fed the hyenas well (Baynes-Rock, 2015). Hyenas may be killed in retaliation for actual conflict events, but even then, humans are hesitant to retaliate. People fear retaliation by the hyena clan (Baynes-Rock, 2013). People will often try to reason with the hyenas before attacking them, employing men they believe can speak hyena language to act as diplomats with the hyena clan (Baynes-Rock, 2015).

Even hyena attacks on humans are blamed on the humans themselves, not the hyenas (Baynes-Rock, 2013). One case of hyena attacks described by Baynes-Rock (2013 and 2015) demonstrates this situation. In Kombolcha, a town outside of Harar, hyenas broke into a farmer's hut and ate some goats. The farmer poisoned a goat carcass and left it out, resulting in the deaths of several hyenas. Following this event, four children in the town were attacked by hyenas; one died. In most of Africa this would result in widespread killing and poisoning of hyenas, but this was not the case here. Many people wanted someone who spoke hyena language to negotiate with the tribe. The townspeople blamed the farmer who poisoned the hyena for the attacks on the children, even driving the farmer into hiding. The solution was to destroy the high grasses around the town so the hyenas could not hide and sneak up on children. This resolution proved very effective and demonstrates how conflict can be reduced without killing animals. One hyena was killed when it was spotted near the school during the day, but the townspeople in Harar claim hyenas are generally only killed if seen during the day—a sign the hyena has bad intentions.

This remarkable case shows how human responses can differ based on attitudes toward animals. Though the tolerance of hyenas is not absolute in Ethiopia—many farmers do not favor hyena conservation—their numbers are steady and there is no conservation concern, despite an almost complete absence of natural prey (Abay et al., 2010; Yirga et al., 2013). One of the main ideas of this research will be that changing attitudes can help conservation as much as changing the actual amount of conflict. The perceptions and attitudes of local people, in many ways, determine how well animals survive. Even an animal as widely disliked as the hyena (condemned not just in Africa, but in children's movies and western media as well) can survive with the right amount of tolerance. This research focuses on another animal that is not widely loved, the wildebeest. By exploring the attitudes toward wildebeest and the reasons behind those attitudes, I hope to suggest ways in which conservation can move forward with education as a main component. First, however, we must gain a better understanding of the environment in which this conservation encounter occurs.

1.3.0 The Serengeti-Maasai Mara Ecosystem

The Serengeti is perhaps the most romanticized environment on Earth. Countless books and movies, from *Out of Africa* to *The Ghost and the Darkness*, depict the classic western-held image of an essentialized and objectified Africa—flat, sun-parched grasslands of the Serengeti, dotted with the occasional tall acacia tree (*Vachellia tortilis*), and teeming with giraffe (*Giraffa tippelskirchi*) and zebra (*Equus quagga*). Though this romantic image is not an entirely falsified one, the real ecosystems of East Africa are far more varied and heterogenous than any movie or novel portrays. The image of unspoiled "wild Africa" held by so many fails to consider the inherent disequilibrium of the system, as well as the critical consequences of long-term use of the land by pastoralists (Cumming, 1982). This research attempts to understand an example of the conflicts that occur between the wildlife of East Africa and the pastoral cultures that have occupied the land as far back as 5,000 years ago (Wright, 2019). Such a discussion must begin with an understanding of the ecosystem itself and the complexities of existing in such a landscape.

What we generally refer to as the Serengeti is part of a larger ecosystem called the Serengeti Maasai-Mara ecosystem which spreads across Kenya and Tanzania (Reed et al., 2009). This World Heritage Site covers Serengeti National Park, Maasai Mara National Reserve, the Narok region to the north, Ngorongoro Conservation Area to the southeast, Loliondo Game Controlled Area to the east, Maswa Game Reserve to the southwest, and the Ikotonogo and Grumeti Game Controlled Areas to the northwest. This 24,000 square kilometer area goes from 34° to 36° east longitude and 1° to 2° south latitude (Reed et al., 2009). This somewhat strange conglomeration of disparate ecosystems and areas is defined as the area covered by the annual wildebeest migration (Ogutu et al., 2014). The Serengeti Maasai-Mara ecosystem will henceforth be referred to as the Serengeti for ease of readability, even though the Serengeti National Park itself is only approximately 14,800 square kilometers of the total ecosystem (Reed et al., 2009).

A savanna is an ecosystem with a continuous herbaceous layer but a discontinuous woody stratum (Sankaran et al., 2008). This tropical ecosystem is dominated by grasses and sedges. Savannas can include some woody cover and have strong seasonal fluctuations dependent on water availability (Cerling, 1992). This broad definition encompasses an area of vastly different microsystems and climates. Only 61% of the Serengeti ecosystem is the strict grassland we usually picture (Reed et al., 2009). The Serengeti savannas contain broad-leaved woodlands, acacia woodlands, wooded grasslands, semi-desert shrublands, and edaphic grasslands (Cumming, 1982). Savanna vegetation is very heterogenous over time and space and is subject to changes due to rainfall, nutrients, fire, herbivory, and interactions between plants (Gillson, 2004). Micro and local scales are subject to large changes within the savanna. Despite this, the composition of vegetation tends to remain fairly constant at the landscape scale (Gillson, 2004).

The soil of the Serengeti is mainly volcanic and rich in organic carbon and nutrients (Anderson et al., 2007). Annual species are rare compared to perennial species. Over 317 species of plants have been described in the Serengeti and are primarily herbaceous forbs, followed by grasses, shrubs, trees, and sedges (Anderson et al., 2007). Ecosystem wide, the most abundant grass is *Themeda triandra* (red oat grass) (Williams et al., 1998). Today C4 grasses (grasses that use a four-carbon compound in photosynthesis and are more drought resistant) dominate the ecosystem and are mainly in the following genera: *Andropogon*, *Aristida*, *Cenchrus*, *Chloris*, *Cymbopogon*, *Cynodon*, *Digitaria*, *Eragrostis*, *Eriochloa*, *Loudentia*, *Pennisetum*, *Setaria*, *Sporobolus*, and *Themida* (Cerling, 1992). Western grasslands are dominated by *Pennisetum mezianum* in particular, while eastern grasslands are dominated by *Cynodon dactylon* and *Digitaria eriantha* (Oearsall, 1956).

The current C4 dominated grassland seen in the Serengeti today was not always the primary ecosystem. Cerling (1992) found that though C4 vegetation was present by eight to nine million years ago, the C4 dominated grasslands of today likely did not develop until the Middle Pleistocene, making them only about one million years old in East Africa. This increase in C4 grasses that has taken place over the last ten million years indicates a gradual replacement of woodland by grassland.

Rainfall is the most important predictor of plant coverage and composition in the Serengeti (Sankaran et al., 2008). Rainfall is also extremely seasonal and varies across the Serengeti. The lowest rainfall is only 250 millimeters per year in the southern Serengeti plains and increases north-westerly to over 1000 millimeters per year (Anderson et al., 2007). The growing season associated with this gradient goes from only 70 days in the southeast to almost year-round in the northeast (Williams et al., 1998). The dryness of the southern grasslands is due to the rain shadow caused by the Ngorongoro Mountains (Wolanski et al., 1999). Most of the Serengeti experiences two rainy seasons. The long rains go from March to May, the short rains from November to December (Anderson et al., 2007). These rainy seasons are variable each year (Williams et al., 1998). Over the year small showers are more frequent than heavy rain (even during the long rains), but 53% of total annual rainfall comes from the rare large storms (Williams et al., 1998). Temperatures are lowest from May to August and highest from November to April (Ogutu et al., 2014). In the more arid regions of the Serengeti, woody cover is capped by rainfall. Below 650 millimeters of annual rainfall, it is the single determining factor for woody coverage. Above this threshold, fire and herbivory become more important factors (Reed et al., 2009).

Nutrient availability, through plants and in soils, is also patchy within the Serengeti. Soil quality is an important predictor of woody biomass, after precipitation and fire (Sankaran et al., 2008). Areas with more frequent fires have higher nutrient concentrations and higher quality forage available for animals over the long term, though growing seasons immediately after fires do have reduced forage (Maria van de Vijver, 1999). Another determinant of soil nutrient content is the presence of domestic livestock. Many Westerners believe that livestock grazing is one of the factors threatening the Serengeti, but this has not consistently been shown to be the case (Hodgson, 2011). Areas that have been used as cattle *bomas* (Kiswahili; a traditional type of livestock corral used by many pastoral groups in East Africa) have enriched soil nitrogen and phosphorous (Augustine, 2003). Abandoned *bomas* become nutrient enriched glades dominated by *Cynodon plectostachyus* and provide good forage for wild herbivores. These glades persist and do not revert to bushland (Augustine, 2003). By penning their animals at night, pastoralists create hotspots of soil fertility which result in high quality forage and increased heterogeneity of the landscape, and wildlife is further attracted to these areas (Marshall et al., 2018). Marshall et al. (2018) found that ancient hotspots created by pastoralists were persistent after three millennia and increased local biodiversity. They theorize that pastoralists may have great environmental importance to the ecosystem of the Serengeti.

Despite the lack of empirical evidence for significant damage by pastoralist people, who have occupied the Serengeti for a long period of time, popular opinion does not favor the presence of pastoralists in the Serengeti (Cassidy, 2012). The tendency for Westerners and even conservationists to consider the activities of local pastoral groups harmful to the Serengeti is widespread and has a real effect on relations between conservationists and pastoralists (Herskovits, 1926; Brown, 1971; Prins, 1992).

Domestic livestock are not a recent introduction to the Serengeti. They have been part of the ecosystem for at least 5,000 years (Wright, 2019). The Serengeti is not the wild ecosystem we consider it to be; its current state is very much shaped by pastoralists, and it would not be the same ecosystem without them (Little, 1996). The Lake Baringo Basin in northern Kenya is a swampy area cited as an example of how livestock overgrazing causes encroachment of woody grassland (Little, 1996). However, the likely cause of the degradation of the area is the extreme level of wildlife depletion caused by European hunting in the colonial era of the late nineteenth and twentieth centuries (Little, 1996). Wildlife depletion is a proven cause of bush encroachment. One of the most extreme examples is the conversion of grassland to heavily wooded savanna in only 20 years in Congo's Virunga National Park—caused by elephant poaching (Wolanski et al., 1999). Local pastoralist people around Lake Baringo have social taboos preventing them from overgrazing the swampy area around the lake. Using it for grazing at certain times of year is socially unacceptable and the offender is generally shunned (Little, 1996).

The belief that cattle overgrazing can cause bush encroachment or desertification of savannas does have some support. A high biomass of grazers can increase woody biomass and decrease grassland (Sankaran et al., 2008). Domestic animals can also decrease perennial grasses and palatable herbs, leading to bush encroachment (Cumming, 1982). Riginos and Young (2007) found that grasses substantially suppress sapling growth. Therefore, heavy grass depletion by herbivores could potentially lead to bush encroachment. However, at their research site in the Mpala Research Center in Kenya, Riginos and Young did not observe this result and theorized that cattle grazing was not heavy enough. In most areas of the Serengeti cattle grazing is rotated and carefully managed by the pastoralists themselves (Riginos and Young, 2007). Whether cattle grazing is the actual cause of bush encroachment is not definite and requires further investigation. This is beyond the scope of this work and will not be investigated here.

Another possible mechanism of grassland damage by domestic livestock grazing is through the depletion of mycorrhizal fungi (Gehring and Whitman, 1994). This mutualistic fungus is found in the roots of plants and increases nutrient uptake as well as protecting the plant from pathogens. Overgrazing by herbivores may cause plants to lose their mycorrhizal fungi (Gehring and Whitman, 1994). Mycorrhizal fungi are sometimes the only way a plant can germinate or obtain certain nutrients (Tsing, 2012). This loss could impact the whole ecosystem by decreasing the dominance of certain grasses. This relationship has not been seen in the Serengeti; Gehring and Whitman (1994) found some positive or neutral relationships between mycorrhizal fungi colonization and grazing. This implies that in the Serengeti grazing is not intense enough to harm mycorrhizal fungi, but instead has either a neutral or slightly beneficial effect.

No discussion of the Serengeti is complete without considering the dramatic effects that local, endemic fauna has on the ecosystem. The Serengeti is defined by the movements of animals and almost every aspect of the environment is shaped by them (Ogutu et al., 2014). The Serengeti is home to some of the last megafauna on earth;

their effects on the environment are dramatic. The Serengeti houses three main orders of large mammalian herbivores: Proboscidea (elephants), Perissodactyla (rhinos, zebra, ass), and Artiodactyla (hippos, giraffes, antelope) (Cumming, 1982). These herbivores range from the tiny three to four-kilogram Kirk's dik-dik (*Madoqua kirkii*) to the 2,500-kilogram elephant. Cumming (1982) classes herbivores into four main feeding types: concentrate feeders (browsers), mixed feeders preferring browse, mixed feeders preferring grasses, and roughage feeders (grazers). Though broad, these categories do capture the general preferences of most African herbivores. In moving from forested to open environments, the herbivores change from mainly small concentrate feeders to mainly large roughage feeders (Cumming, 1982). This trend demonstrates the dramatic effects that bush encroachment can have on the general composition of animals in the Serengeti.

The largest influences on savanna structure come from elephant (*Loxodonta africana*), hippopotamus (*Hippopotamus amphibius*), buffalo (*Syncerus caffer*), zebra (*Equaa quagga*), and wildebeest (*Connochaetes taurinus*) (Cumming, 1982). Elephants in particular have the power to drastically alter the ecosystem, earning them the popular moniker "ecosystem engineers" (Haynes, 2012). Elephants actively fell trees and their presence decreases woody biomass (Sankaran et al., 2008). As already mentioned, their absence can lead to a rapid conversion of grassland to forest (Wolanski et al., 1999). Elephants also trample vegetation and disturb surface soils, causing microenvironments and raising plant species diversity (Keesing, 2000). Hippopotamuses have an important effect on riverine areas; their grazing leads to a conversion of river areas to short grasslands (Cumming, 1982). The buffalo, wildebeest, and zebra migrations are the most dramatic on earth and keep the Serengeti ecosystem functioning by tilling and fertilizing soil. Cumming (1982) found that other large herbivores did not cause major changes to the vegetation structure.

Ungulate populations in the Serengeti are heavily influenced by rainfall patterns. Overall, populations increase with rainfall because the success of calves is directly tied to the amount of rainfall (Ogutu et al., 2008). Most ungulates time conception with one rainy season and the birth of calves with another (Ogutu et al., 2014). The climate and rainfall patterns of the Serengeti help determine the life history traits of the resident animals. Rainfall also drives the migration and dispersal of animals (Bartzke et al., 2018). The Great Migration of wildebeest, zebra, and buffalo herds across the Serengeti is driven by rainfall and food availability. One potential migration cue may be the salinity of water. As watering holes start to dry up, the water increases in salinity, possibly indicating to the animals that it is time to migrate (Wolanski et al., 1999). Rainfall also helps determine the nutrients in plants and soil available for large mammals, and it changes the composition of plant species (Anderson, 2008; Bartzke et al., 2018). 75% of wildebeest deaths in the Serengeti are caused by malnutrition, linked to rainfall (Bartzke et al., 2018). Climate change models predict the Serengeti will see higher wet season rainfall and lower dry season rainfall as global temperatures rise. Potential dramatic climate changes will exacerbate declines in animal populations. It is unknown exactly how this will affect plant species composition and nutrient availability (Anderson, 2008).

Rainfall is the most important factor for the carrying capacity of animals, defined as the maximum number of animals that can be in a given area without causing habitat degradation. Rainfall and soil nutrient levels account for 87% of carrying capacity variance (Fritz and Duncan, 1994). This issue has been heavily discussed in Serengeti conservation, mostly in the context of questioning whether the presence of livestock will decrease the carrying capacity of other species, as carrying capacity is limited at the community, rather than the species level (Fritz and Duncan, 1994). Eltringham (1990) did find that carrying capacity for wildlife is lowered when cattle are present, particularly capacity for animals such as zebra and buffalo whose feeding habits are similar to cattle. The specific impact on carrying capacity varies greatly with the number of cattle and the management practices. As far as wild animals go, species rich communities have higher carrying capacities since food resources are used more completely (Fritz and Duncan, 1994). Loss of specific species due to hunting or other pressures could lead to an overall lower carrying capacity of the Serengeti.

Since the Serengeti has such recognizable and charismatic megafauna, there is a tendency to believe these are the only animals shaping the ecosystem, but many small animals are also critical (Keesing, 2000). The small mammals helping to shape the Serengeti include rodents, insectivores (like moles), elephant shrews, and rabbits. Large ungulates, like elephants, cause microenvironments that increase the diversity of small mammals but also keep their numbers relatively low. However, as large ungulates decrease or are locally extirpated, small mammal populations explode. These small mammals can be responsible for significant crop damage and disease transfer (Keesing, 2000). Crop raiding and loss is often attributed to large visible animals like elephants, but if those large animals are poached, there is a real possibility for just as much crop damage from small mammals (Keesing, 2000). Primates in particular are responsible for extensive crop raiding; in Uganda 70% of all crop damage events near Budongo Forest Reserve were due to baboons (Hill, 2000). In Ethiopia, studies have found that most crop loss can be attributed to baboons and bush pigs (Gobosho, Hunde, and Mekonnen, 2015). Additionally, availability of food for ungulates is affected by small mammals. Test plot areas without small mammals had up to 50% more plant biomass (Keesing, 2000).

Another iconic species of the savannas of the Serengeti is not an animal at all, it is a tree. No safari scene is complete without a baobab tree—frequently described as an upside down tree—silhouetted against an orange and yellow sunset. Baobab trees (several species of deciduous tree in the genus *Adansonia*) are ingrained in local legends and culture, providing material for clothing, medicine, and shelter as well as food from the tubers, fruits, seeds, and flowers (Gebauer et al., 2002). Most baobab trees have thick branches and short trunks that can be ten to fourteen meters around. Trees can reach 25 meters in height and potentially live for hundreds or even thousands of years (Gebauer et al., 2002). The baobab is famous for its ability to store water in its trunk. It goes leafless for most of the year and can survive in areas with only 100 millimeters of annual rainfall. Below 100 millimeters, the trees are stunted (Gebauer et al., 2002). Only one of the species in the genus *Adansonia* is native to mainland Africa (*Adansonia digitata*). There are six species native to Madagascar and one to Australia (Gebauer et al., 2002).

Baobab trees have numerous uses for local human populations. The leaves of the baobab are a critical food source in central Africa (Bamalli et al., 2014). The leaves can be dried and stored for use during the dry season, and they are a good source of protein, as well as iron and several other vitamins (Gebauer et al., 2002; Bamalli et al., 2014). The fruit pulp may be the most useful part of the tree and can be used to make many different drinks, eaten fresh, or dried and stored (Gebauer et al., 2002). The seeds can be roasted and eaten or used as a thickening agent in soups. They are also highly useful for cosmetics and medicines. Various groups use the seed oils for soaps, cooking oils, or topical medication for wounds (Bamalli et al., 2014). Baobab trees can also be used as cattle feed, particularly during the dry season when little else is available. The fibers of the tree can be used for weaving ropes, clothes, baskets, and for making fishing line. All parts of the tree are utilized in traditional medicine to treat everything from dandruff and stomach aches to rotten teeth and urinary disease (Bamalli et al., 2014). There is also a growing global market for baobab as a "superfood," which is beginning to impact its availability to local communities.

The 1,000 to 9,000 liters of water stored in the trunk of the baobab can be a freshwater resource for humans, cattle, or wild animals (Gebauer et al., 2002). Elephants may pierce the tree with their tusks to gain access to water. The economic importance of the tree due to its uses by humans for food and medication cannot be overstated, and this iconic tree is a critical part of the Serengeti ecosystem. Despite this, it may soon be gone. In the past decade, nine of the thirteen oldest baobab trees in Africa have died (Sanchez, 2018). The likely culprit is climate change. Though they are well adapted to their low water environments, warming temperatures are either killing them or weakening them. Climate models predict only small percentages of habitat will remain suitable for baobabs in the future, and in some countries no habitat will remain at all (Sanchez, et al., 2011).

Pictures of sweeping grassland, peacefully grazing ungulates, and majestic baobab tress dominate Western popular images of Africa. The reality of the Serengeti Maasai-Mara ecosystem is that of an enormous and incredibly diverse landscape—inherently unstable and subject to large changes over time (Little, 1996). The humans who inhabit the landscape have been there for thousands of years, helping to shape the land. Despite its nature as a constantly changing entity, the Serengeti is in peril from human activity and climate change. There are threats that even this incredibly resilient landscape will not be able to tolerate.

This research will examine some of the ways that humans and animals interact within this environment and some of the ways in which human cultures and practices both conflict with local wildlife and have the potential to live in harmony with it. We shall now turn to the humans who inhabit this landscape. Though there are numerous cultures and peoples who occupy the Serengeti, this research focuses only on the Maasai. Briefly, there are four major language groups occupying the Serengeti, each represented by different ethnic groups. These are the Nilotic-speakers (the Maasai), the Khoison-speakers (the Hadzabe), Cushitic-speakers, and Bantu-speakers (represented by Ikoma, Natta, Kurya, Ishenyi, and Ngoreme ethnic groups) (Kideghesho, 2008). Most of the groups are agro-pastoralists, excepting the pastoralist Maasai and the hunter-gatherer Hadzabe (Kideghesho, 2008).

1.4 The Maasai

1.4.1 Who Is Maasai?

The Maasai are a loose confederation of Maa-speaking semi-nomadic pastoralists who have historically lived in an area of about 150,000 square kilometers across Kenya and Tanzania (McCabe, Leslie, and Deluca, 2010; Spear, 1993). The image of the Maasai in popular Western culture/imaginaries is a romantic image of red-clad warriors and women in multi-colored beaded necklaces (Bruner, 2001). The Maasai, however, are not a simple community to define. Being Maasai is not conferred at birth, nor is it an identity necessarily retained throughout life. To the Maasai, being Maasai has always been a state that is inconstant, meaning varying things in different times and places (Waller, 1993). In a world of variable identity, it is important to each Maasai to remain Maasai, and their actions in their current world of change and Westernization are geared toward remaining Maasai (Hodgson 2011; Little 1998; McCabe, Leslie, and DeLuca, 2010).

The Maasai identify themselves as “people of the cattle” (Spear, 1993, p. 120; Galaty, 1993). Speaking Maa alone does not make one Maasai. Many hunter-gatherer groups in the area, generally referred to by the Maasai as *dorobo* (a derogatory categorization meaning ones without cattle or denoting a mode of subsistence dominated by hunting and gathering), speak Maa, but are not considered Maasai and are looked down upon by the Maasai (Galaty, 1993). The Maasai assign a hierarchy to subsistence strategies, with themselves as pastoralists at the top, agricultural groups beneath them, and hunter-gatherers at the bottom (Cronk, 2002). If they obtain cattle, other groups may then be recognized as Maasai. They must also join a gendered

Maasai age set, so it may take a few generations to become fully Maasai (Galaty, 1993). The Kisongo and Arusha Maasai are Maa speakers that participate in Maasai age sets, intermarry with other groups of Maasai, and live adjacent to them. Yet, an ethnic line is maintained between the Kisongo and Arusha and other Maasai due to the agricultural nature of the Kisongo and Arusha (Galaty, 1993). Subsistence strategy is what makes one Maasai above all else (Waller, 1993).

1.4.2 Origins

Whilst being Maasai means many different things today and throughout history, the original Maa speakers did originate from a specific area. There is limited archaeological research on the history of East Africa (Siiriainen et al., 2009). The Maa way of reckoning time through age sets, coupled with a lack of study and understanding by scholars, means we know little about East African history until the arrival of colonialism (Siiriainen et al., 2009). What we do know has come mostly from linguistic analysis and oral histories. Oral history tells us there were two ancient pastoral cultures in Kenya: the Elmenteitan and the Savanna Pastoral Neolithic (Marshall, 1990). These groups are hard to connect to any modern groups, but they were likely established as livestock holding economies approximately 5,000 years ago (Wright, 2019). These two cultures were the first to adopt specialized pastoralism about 2,000 years ago (Marshall, 1990). Around 3,000 years ago, a critical climatic change took place in the Serengeti resulting in the bimodal rainfall pattern we see today (Marshall, 1990). With two wet seasons, cows were able to calve and produce milk for most of the year, creating a subsistence strategy based on milk, thus allowing specialized pastoralism for the two ancient pastoral cultures of the Serengeti (McCabe, Leslie, and Deluca, 2010; Marshall, 1990). Another change that made pure pastoralism possible was the introduction of *Bos indicus* to replace the *Bos taurus* cattle of East Africa. This species of cattle was introduced to East Africa around 3,000 years ago and is extremely hardy and better adapted to the fluctuating water and forage availability that characterizes the Serengeti (Marshall, 1990).

According to Maasai oral histories, the main ethnic communities from which the Maasai emerged were the Ilarinkon, Iloogolala, and Il Taaromodoni (Siiriainen et al., 2009). These groups may have been early Maa speakers. These were cattle keeping tribes who were defeated by the Laikipiak people sometime between 1600-1800 CE (Siiriainen et al., 2009). Maa is an eastern Nilotic language, giving us an idea of where the earliest Maa speakers originated (Spear, 1993). Maa-speaking people moved south to Kenya and Tanzania in waves from the area of the Sudan and upper Nile sometime before 1700 CE (Fratkin, 1979; Spear, 1993). The ancestors of the Maasai in the north likely mixed agro-pastoral and agricultural economies, keeping animals but also raising cereals like millet and sesame (Spear, 1993). As they moved into the Rift Valley and the areas of bimodal rainfall in the eighteenth and nineteenth centuries, the Maasai were able to abandon their mixed economies for a purely pastoral lifestyle (Spear, 1993; p. 2). The Maasai became highly specialized pastoralists focused on cattle, sheep, and goats with little to no supplementation from foraging, hunting, fishing, or agriculture (Marshall, 1990). This strategy only works within the economic context of the Serengeti, as Maasai rely on their hunter-gatherer and agricultural neighbors for trading and to supplement their diet (Marshall, 1990).

The first Maasai to enter the Mara plains were the Loitai, who entered the plains sometime prior to 1800 CE (Siiriainen et al., 2009). The Loitai were pushed west by the expanding Purko Maasai who had defeated and assimilated the Il Tatua people on the Mara plains (Siiriainen et al., 2009). In the 1870s and the 1880s in the north Serengeti, a critical historical event for the Maasai called the Iloikop Wars occurred (Spear, 1993). During these wars, the Purko Maasai and an alliance of other pastoral Maasai groups—mainly the Kisongo Maasai—defeated the Laikipiak and migrated into the Rift Valley (Siiriainen et al., 2009; Fratkin, 1979). The Iloikop Wars pushed agricultural Maa speaking groups to the periphery (Spear, 1993). The Iloikop Wars were essentially a battle for who could remain pastoralists. The defeated Laikipiak lost their stock and grazing lands and thus their identity as a pastoralist people distinct from the Maasai (Waller, 1993). After the Iloikop Wars, the Maasai were established as the dominant pastoralists in the Serengeti, and they remain so to this day. Colonialism and Westernization have drastically changed the livelihoods and culture of the Maasai in recent decades (Waller, 1993). However, the Maasai themselves claim to be true to their historic culture even today (personal communication with unnamed Maasai, 2019). The remainder of this section will review Maasai culture, as well as some of the changes they have experienced since colonialism.

1.4.3 Maasai Socio-Economic Systems and Culture

In this section I will present some aspects of Maasai culture and socio-economic structures. The Maasai are a mutable and ever-changing group, and it is important to respect that their cultural systems, beliefs, and presentations are not static. The Maasai are a loose association of tribal clusters scattered across the savanna grasslands of Kenya and Tanzania in an area often referred to as Maasailand (Fratkin, 1979). Each cluster shares a basic culture and belief system, but they are politically and economically autonomous from one another (Fratkin, 1979). The largest section of Maasailand belongs to the Kisongo Maasai who cross the Kenya/Tanzania border (Goldman et al., 2013). In terms of population, the agricultural Arusha Maasai are the largest Maasai population. Whether they are included as true Maasai, since they are not pastoralists, is debated by many, but they consider themselves fully Maasai (Spear, 1993). Traditional Maasai settlements are semi-permanent small villages. A village is composed of several families with their homes arranged in a circle around their stock holding areas. The entire settlement is placed within a thorn fence for protection (Marshall, 1990). This settlement is often referred to as a *boma* (Hodgson, 2011). Maasai settlements are occupied for an average of two years, but may be occupied for much longer, especially if agriculture has been adopted (Marshall, 1990).

Maasai societies have historically been polygamous. The smallest social unit is the house (*enkaji*) made up of one married woman and her children (this excludes the woman's husband). The next smallest unit is the family or *enkishomi* of a man with all his wives and dependents (McCabe, Leslie, and DeLuca, 2010). The family is responsible for the management of livestock. Several *enkishomi* together form a settlement unit called an *enkang*. Men are members of a clan or *olgilata*, and the clan forms the basic unit of aid and redistribution of livestock within an area. The largest Maasai social unit is the section, or *olosho*, made up of multiple settlements and clans that all share the same grazing area and resources (McCabe, Leslie, and DeLuca, 2010). A deeply held Maasai belief is that land belongs to all Maasai, and anyone may use it for grazing (Waller, 1993).

The Maasai are a monotheistic group who exhibit religion through ceremonies and garments (Spencer, 1993; Klumpp and Kratz, 1993). The traditional Maasai God has human attributes but is mostly respected as an abstract representation of extreme old age. Maasai therefore grow closer to God as they age (Spencer, 1993). Today many Maasai are adopting Christianity and attending Christian churches built by missionaries (Hodgson, 2011).

While the economic base of Maasai culture is the keeping of cattle, the social base is the age set (Spencer, 1993). The Maasai age system is a ritualized way for male Maasai to move through their lives as they age. There are female equivalents discussed later. Age sets are groups of men within a certain age range; these age sets move together through a series of age grades with different statuses as they age (Spencer, 1993). Age sets are named groups and Maasai communicate timescales and events by describing which age set was currently in the warrior phase (warriors will hereafter be referred to as *ilmurran*, the Maasai term for them) (McCabe, Leslie, and DeLuca, 2010). Men move through the grades together and progress from boy to junior warrior, senior warrior, junior elder, senior elder, and finally retired elder (McCabe, Leslie, and DeLuca, 2010). Boys become *ilmurran* when they are circumcised, often around age 15, though the age that age sets progress can fluctuate in times of social and environmental change and pressure (Spear, 1993). Each age grade lasts about 15 years and is marked by extensive ceremonies (Spencer, 1993). Ceremonies are led by prophets of the Loonkidongi Maasai family who advise and bless the age sets (Spencer and Waller, 2017). Two of the most important ceremonies are the *olgnesher* ceremony, in which *ilmurran* progress to elders, and the *eunoto* ceremony, in which *ilmurran* progress from junior to senior and are given new responsibilities (Fratkin, 1979).

Maasai boyhood is a time when boys learn to herd small stock, play at being *ilmurran*, and bond with their age set (Spencer, 1993). The elders determine when a new set of *ilmurran* will be initiated. When a new age set becomes *ilmurran* the elders organize lavish ceremonies, which include animal sacrifices and sharing of meat (Spencer, 1993). It is the responsibility of the elders to protect the ceremonies against sorcery and to ensure a successful ceremony. According to Spencer (1993), these ceremonies are rarely the lavish affairs they claim to be. There is often a disorganization to the planning, ending in a rather lackluster affair, but the extravagance of the actual affair matters far less than the ceremony as a way to mark the passage of time.

Ilmurran are a society unto themselves. They live in their own villages, called *manyatta*; they eat meat extensively and reject agricultural products, and constantly challenge the elders (Spear, 1993; Spencer, 1993). *Ilmurran* are fiercely loyal to one another and believe very strongly in equality of all men within an age set (Spencer, 1993). The *manyatta* are self-governing villages separate from the rest of Maasai society but generally located near villages (Spencer and Waller, 2017). The main job of the *ilmurran* is to protect villages from livestock-stealing raiders, from wild animals, and from any other threats such as warfare (Goldman et al., 2013). *Ilmurran* may also choose to raid neighbors for livestock or conduct warfare when appropriate (Spencer, 1993). These activities are done with the blessing and guidance of prophets (Fratkin, 1979). *Ilmurran* also conduct *olamayio*—a ritual hunt of a wild animal in response to a livestock threat. Though wild animals are not regularly hunted or eaten by Maasai, it is the duty of the *ilmurran* to protect the cattle from wild animals (Goldman et al., 2013). The most common animal hunted in *olamayio* are lions. This is in response to livestock killing(s) or a sighting close to villages and grazing land. Knowing how to hunt lions is one of the duties of the *ilmurran* (Goldman et al., 2013). When a lion hunt is successful, the *ilmurran* will host a large celebration and the entire age set will be honored. The first *ilmurran* to touch the lion is given the "lion name" and especially celebrated (Goldman et al., 2013). Lion hunting in the context of human-wildlife conflict will be discussed later.

After around 15 years as an *ilmurran*, men progress to elder status (Spencer, 1993). This is the point at which *ilmurran* generally marry, though elders will continue to obtain wives throughout their lives (Summer, 2006). Elders often try to delay the promotion of the *ilmurran* so they may continue to accrue wives and keep their political power. In this way, many scholars see the age set system as a constant struggle between the *ilmurran* looking for more political influence and the elders who do not wish to lose theirs (Spencer, 1993; Spear, 1993). Elders make decisions of marriage and politics for the entire settlement (Spencer, 1993). Senior elders acquire the additional responsibility of being firestick patrons—dominant elders who guide and attempt to control the *ilmurran* two age sets below them (Spencer, 1993). The firestick alliances are protected by prophets and help the *ilmurran* to be advised and successful (Spencer and Waller, 2017).

Throughout the age set progression, prophets are ever present and are a critical part of Maasai society. Most Maasai prophets come from a single family of Maasai, the Loonkidongi (Spencer and Waller, 2017). This family of Maasai are outsiders; they intermarry with other groups but often have their own settlements and obtain wealth and cattle by dealing in blessings and cures (Spencer and Waller, 2017). Prophets have extensive political influence and can cure misfortunes, protect against sorcery, perform healing, bless age sets, or deal out curses if cultural systems are not followed (Fratkin, 1979). Fear of sorcery is common among Maasai. Sorcerers are commonly thought to be lurking out in the bush and represent everything a Maasai should not be: isolate, selfish, and egocentric (Spencer, 1993). Elders are the age group most likely to be accused of sorcery. During elderhood, men lose the brotherhood of the *ilmurran* and become more interested in their own wealth and family, so the threat of being accused of sorcery may keep them from becoming too selfish (Spencer, 1993).

Maasai women do not have age sets, but have parallel social groupings to men, as they move from girls to wives and widows (Spencer, 1993). Though women are always dependent on men, they have more status and responsibility when they marry. They also have their own hierarchy (Spencer, 1993). Though male elders see women as subordinate, in many ways they are the center of the age grade system. They are the onlookers to ceremonies and assist in the progression of the *ilmurran*. The male age system is all about their changing relationships with women (Spencer, 1993). Women are also, in many ways, the keepers of morality among the Maasai. Wives and mothers are in a position to potentially mock and humiliate men who fall short of Maasai expectations (Spencer, 1993).

Girls in Maasai society are traditionally expected to behave as their fathers wish them to (Spencer, 1993). With modern schooling and diversified subsistence strategies and options, this is changing. They also have a relatively large degree of freedom compared to many other societies. Premarital and prepubescent sex is not only tolerated for both girls and boys, but is encouraged (Hodgson, 2011). Young women have *ilmurran* lovers before they are married and often take part in the meat-eating ceremonies performed by the *ilmurran* in the bush (Chieni and Spencer, 1993). Women do not necessarily give up their lovers when they are married. Christianity is affecting some of the sexual freedom Maasai women have had. Women are initiated into adulthood much the same way as men are, with circumcision (Ahmed et al., 2015). Though female circumcision was once the norm in Maasai culture, its use is in decline in contemporary Maasai society, due to education, activism by women and human rights groups, and Kenya's 2011 ban on female genital mutilation (Ahmed et al., 2015).

Maasai women shave their heads to indicate adulthood (Chieni and Spencer, 1993). They have usually married between the ages of 14-17, but today this age is rising and can fluctuate greatly with socio-economic conditions. Men generally marry between 25-35 (Hodgson, 1999). Traditionally men would not marry as *ilmurran*, but only as elders (Summer, 2006). Polygyny is widespread among the Maasai and men will marry throughout their lives, making marriage more of a process than a single life event (Summer, 2006). The resulting situation is that women can be anywhere from 10 to 40 years younger than their husbands (Hodgson, 1999). One of the most important cultural taboos among the Maasai is that a woman cannot marry a man in her father's age set. This avoidance is one of the aspects that identifies women as Maasai. It goes both ways, a man may not marry any women in his daughter's age set (Spencer, 1993). Divorce is extremely uncommon in Maasai society. Marriage binds together two entire families, not just individuals (Summer, 2006). However, women often run away from husbands who are poor providers or who are not behaving appropriately. They may not return, depending on changes in the man's behavior. There are also systems which allow women to complain to elders about their husband (Chieni and Spencer, 1993).

Childbearing is the major social duty of women, and a key marker of female gender identities. Childbirth is believed to be the event where God is closest, but only women may attend these events (Spencer, 1993). Women take part in elaborate fertility dances called *oloiroshi* that may occur over multiple days, and in several villages (Chieni and Spencer, 1993). The elders respect the importance and sacredness of these dances. While they dance, women are given gifts of fat, meat, money, and whatever else they ask for. They use the profits from their dances to brew beer, an activity only done by women (Chieni and Spencer, 1993). Miscarriages are seen as a failure and a woman who has miscarried may be beaten by other women (Chieni and Spencer, 1993).

The bond between mother and child is the basis of Maasai society and a mother will help her children, male and female, throughout their lives (Chieni and Spencer, 1993). Mothers will help their daughter in childbirth and will be highly honored by their sons-in-law and given gifts (Chieni and Spencer, 1993). For *ilmurran*, their mother is critical. Mothers of *ilmurran* often live in the *manyatta* and are highly honored there. *Ilmurran* may not leave the *manyatta* for another if their mother is living there, and kidnapping mothers is a way that rival groups of *ilmurran* may entice another into a fight. At the *eunoto* ceremony when the *ilmurran* become elders, their mothers will be the ones to ceremonially shave their heads (Chieni and Spencer, 1993). When women are married, the groom's family will pay a bride price of cattle to the bride's family. Bride prices were set by elders, with highly valued girls attracting higher bride prices, these fluctuated in times of socio-economic pressure. During the colonial era, bride prices became a key point of tension between male elders and younger men, and often fueled clashes, cattle-raiding and entry into colonial wage economies. These cattle are given to a women's sons as they become elders, with the youngest son getting whatever remains and the responsibility of caring for his mother in her old age (Chieni and Spencer, 1993).

Women are also responsible for the creation of the beaded adornments worn by Maasai and made so popular in tourist images and literature (Klumpp and Kratz, 1993). Beaded personal adornments is one of the ways Maasai visually indicate their Maasai-ness and beadwork is a woman's personal wealth. Glass beads, often imported, form the basis of beadwork along with chains, wires, leather, rubber, plastic, metal dangles and pins, buttons, and threads made of sinew, plastic, and nylon (Klumpp and Kratz, 1993). Women wear the majority of the beadwork, often sporting large dish-like necklaces, earrings, bracelets, and ankle and calf jewelry. Men wear smaller adornments, mainly around the neck. The particular arrangement of ornaments and their color demonstrates gender, age set, social status, and ceremonial involvement (Klumpp and Kratz, 1993). The particular combinations of colors and how adornments are worn creates a visual indicator of ethnic identity.

The Okiek are an ethnic group of hunter-gatherers and honey-gatherers who have lived near Maasai pastoralists for hundreds of years. Though the Maasai trade with them and share many aspects of culture with them, they see them as lower status people (Klumpp and Kratz, 1993). The Okiek also create beadwork which, to an outsider, is nearly identical to Maasai beadwork. The specific color combinations of this beadwork are one of the ways these groups differentiate themselves and create and demonstrate their ethnicity and identity (Klumpp and Kratz, 1993). Maasai women historically used mainly red, white, and black, though westernization has introduced new colors. Beadwork must also contain cuts between fields of colors, as continuous color is seen as having a purity and power that only belongs to God. Therefore, the first color cut is always a black line to show a respect for God—one of the ways Maasai demonstrate religion in their lives (Klumpp and Kratz, 1993).

1.4.4 Colonization and the Maasai

Colonization of East Africa began in the late 1800s and early 1900s, directly following a series of disasters there at about the same time. The Maasai were still recovering when colonization began. Successive outbreaks of bovine pleuropneumonia, rinderpest, and smallpox occurred during the late nineteenth century and were exacerbated by a severe drought (McCabe, Leslie, and DeLuca, 2010). These disasters led to a scattering of Maasai; depending on whether they were able to keep cattle or not, many temporarily sheltered with nearby hunter-gatherers or agriculturists (Waller, 1993). Colonial rule was established from 1895 and brought two significant changes for Maasai identities. Firstly, colonial authorities misconstrued ethnic identifications among colonized African populations and assumed that all Africans lived in discrete, static “tribes.” They therefore constructed tribal units through which to govern colonized populations, reifying previously fluid social identities among Maasai populations. Like other communities, the Maasai developed an outward facing “political tribalism” to engage with state structures and other communities, and an internal “moral ethnicity” through which the lived reality of “being Maasai” continued and evolved (Lonsdale, 1994). Secondly, colonial authorities tied specific tribes to particular areas of land, disrupting established relationships with land and nature, particularly in previously peripatetic or nomadic communities. One of the first things the new East African Protectorate administration sought to do was to create reserves for specific ethnic groups and establish boundaries between groups (Waller, 1993). This created a problem for the Maasai because specialized pastoral societies do not exist on their own but within a network of complementary hunting and gathering and agricultural economies (Waller, 1993).

The Arusha Maasai were an agricultural section of Maasai that traditionally lived in the highlands and traded with the pastoralist Maasai. The Arusha supplemented their diet with agricultural products and sheltered Maasai who had lost their cattle (Spear, 1993). The Kikuyu were a group of hunter-gatherers with close ties to the Maasai. Prior to colonialism, the Kikuyu and Maasai traded heavily and even intermarried. Their complementary economies helped both groups, and Maasai with no cattle took refuge with the Kikuyu in difficult times (Waller, 1993). After colonialism, ethnic identities were expected to be fixed, and this led to Arusha Maasai and Kikuyu attempts to move onto the plains so they could remain there, causing conflict (Spear, 1993; Waller, 1993).

The creation of ethnic reserves required the Maasai to define who was Maasai, something they had never done (Waller, 1993). The British colonists began restricting Maasai access to what they believed to be communal land for grazing. In 1904 and 1912, treaties were signed by small groups of Maasai, thus restricting them to the

Maasai Reserve (which spanned across the Kajiado and Narok Districts) (Campbell 1993; p. 260). A semi-nomadic pastoral society is based upon ranging extensively to ensure access to grazing land and water during all times of the year in an unpredictable environment. The communal nature of land meant that Maasai had always been free to graze in other Maasai sections and spread out in the wet season, preventing overuse of resources. Under colonial rule, the Maasai found they no longer had enough grazing land to properly make their economy function (Campbell, 1993). Access was further restricted as the administration began designating the best areas for individual farms and ranches. In 1945 the National Park Ordinance was passed, and the government began creating wildlife parks and reserves for use by animals, further restricting Maasai land access (Campbell, 1993).

The struggles of the Maasai to exist on smaller portions of land led to eviction of those seen as non-Maasai (Waller, 1993). During the 1930s, mass evictions and prosecutions took place, and individuals and groups had to prove their Maasai-ness and their right to be on Maasai land (Waller, 1993). Ethnic identities and pasts were claimed and created to avoid forced evictions, and some ethnic groups married into the Maasai to claim a right to stay (Cronk, 2002; Waller, 1993). In many cases, individual Maasai supported those sheltering with them in claiming Maasai identity. The Maasai do not see Maasai-ness as ingrained or immutable, and if a partnership proved advantageous, they were happy to let someone claim Maasai identity (Waller, 1993). The colonial administration created a situation in which claiming an ethnic identity was the only way to claim land (Little, 1998).

The Maasai were not the only ethnic group that the colonial administration tried to restrict to a particular area. The Mukogodo were an interesting case of the colonial government attempting to preserve a culture, but instead radically altering it (Cronk, 2002). The Mukogodo were traditionally a hunter-gatherer group living in rock shelters and subsisting on foraged and managed honey, plant foods, and wild animals (mainly small ones). The Maasai referred to the Mukogodo as *il-torrobo* (or *dorobo*), their somewhat derogatory word for hunter-gatherers (Cronk, 2002). The colonial administration saw this labeling of the Mukogodo as *dorobo* and inferred it to be an ethnic group of all hunter-gatherer groups. This is not a true ethnic group, as hunter-gatherers in Kenya speak different languages, have different cultures, and can be Maasai temporarily acting as *dorobo* because they have lost their cattle. Many *dorobo* groups aspire to become Maasai by acquiring cattle (Cronk, 2002). Despite this, the colonial administration established the Dorobo Reserve and evicted the Maasai from it. In the vacuum left by the Maasai, the Mukogodo saw an opportunity for advancement in the economic hierarchy. They began learning Maa, intermarrying with pastoralists to acquire cattle, and even adopted clitoridectomy to fit in with Maasai (Cronk, 2002). To the colonial government, the Mukogodo claimed their historical *dorobo* status to remain on their land, but in their dealings with pastoralists they began speaking Maa and claiming a Maasai identity. In the extremely short span of time between 1925 and 1936, the Mukogodo went from Cushitic speaking foragers to Maa speaking pastoralists, now referred to as the Mukogodo Maasai (Cronk, 2002).

As the twentieth century progressed, the Maasai began to recover from the disasters of the 1890s and reestablish their herds to previous sizes (Campbell, 1993).

The Maasai economy has always relied on boosting their herd sizes in good years so that losses would not be total during droughts (Campbell, 1993). However, the colonial administrators saw this increase in livestock as a pointless demonstration of wealth that would degrade the environment on the now severely restricted grazing lands (Campbell, 1993). This began the still persistent view of pastoralists as parasites on a fragile environment that would cause habitat degradation if left unchecked, a view created by colonial governments in an attempt to control and restrict the Maasai (Wright, 2019). Administrators began encouraging the Maasai to settle in one area and take up farming (Waller, 1993).

Decolonization led to the establishment of wildlife conservation areas. Some of these were controlled by communities, but by the late 1960s many of these became state controlled and alienated Maasai from their grazing lands (Matheka, 2008). Over the last four decades there has been an overall increase in agriculture among the Maasai (McCabe, Leslie, and DeLuca, 2010). The reasons for Maasai livelihood diversification are varied and depend on social and economic status. The reduction in rangelands due to the expansion of parks, reserves, and human occupation, loss of livestock from droughts and diseases, and increase in the human population has forced many poorer Maasai into agriculture. The increase in the market economy has led wealthier Maasai to adopt agriculture as a risk avoidance strategy in case of cattle loss or to make extra money (McCabe, Leslie, and DeLuca, 2010). Some men are even starting to farm large scale cash crops like flower seeds for exportation to other countries (Hodgson, 2011). In Tanzania the government has actively discouraged pastoral livelihoods through extensive land alienation, leading to competition for water and resources and impoverishment of many Maasai (Hodgson, 2011). Increased droughts due to climate change kill cattle, leading to further need for diversified livelihoods (Hodgson, 2011).

Agriculture has gendered differences among the Maasai. Men tend to farm for extra money, while women farm for subsistence (Hodgson, 1999). The Maasai tradition of women being responsible for feeding their children on their own has not changed, despite the changes in food production and economies. This, and other colonial and post-colonial developments have increased gender inequality among Maasai communities (Hodgson, 1999). Across Maasai society, cultural perceptions of agriculture are changing—viewing it as a benefit rather than as a degrading activity (Hodgson, 2011).

Agriculture is not the only way in which modern Maasai diversify their livelihoods and earn money. Tourism is a popular way for modern Maasai to make money (Bruner, 2001). Many men travel to large cities and towns to work in the tourism industry part of the year, then return to their homes and use their earnings to buy cattle (Hodgson, 2011). Other Maasai may work as part of traditional dances and cultural displays for tourism. Some, mostly men, even work in the sex industry, providing an exotic adventure for European women (Bruner, 2001). Due to the reputation of *ilmurran* as fearless warriors, Maasai men are highly valued as *askari* (watchmen and guards), particularly in Nairobi (Fratkin, 1993). *Ilmurran* have also started working in the army, in the police, and in the Game Department (Fratkin, 1993).

It is more difficult for women to diversify their livelihoods, as traveling far from home is not an option to those who must care for children. Many Maasai women sell small goods like salt and flour to other Maasai; they also sell their beadwork to tourists (Hodgson, 2011). Education for their children is also seen by Maasai as a key to a wealthier future (Hodgson, 2011). However, there is a low availability of quality schools in pastoralist districts. School costs money, which most parents do not have, and secondary schools tend to be farther away from home, resulting in poor opportunities for pastoral children to access a good education past the first couple years (Hodgson, 2011). Children who do attend school are required to do so in uniforms instead of traditional dress, alienating them from their culture and creating some ill feeling toward school among adult Maasai (Ahmed et al., 2015).

The Maasai are struggling to maintain their identity in a changing world. Though their overall belief is that they will prevail and remain Maasai, they identify threats as increased numbers of westerners and tourists, conservation, climate change with increased drought, changing land tenure systems, and introduction of formal education (Ahmed et al., 2015).

It is telling that one of the major threats Maasai see to their culture is conservation and the actions of conservationists. How can we hope to secure their help in our conservation efforts when we are a threat to who they are? One of the main goals of this work is to explore ways in which conservation can be done in the context of Maasai culture, not against it. Projects like the Lion Guardians and Living Walls, discussed later, are fantastic examples of how conservationists have successfully worked within a culture for conservation (Ahmed et al., 2015). Projects that adapt and integrate cultural practices within conservation efforts strengthen Maasai culture.

The Maasai have identified four aspects of their culture they believe are the most important: social connectedness, dress and ornaments, connections with wildlife and nature, and the culture of the *ilmurran* (Ahmed et al., 2015). If conservationists can offer solutions that help strengthen these specific aspects of culture, we can change our image from a threat to a benefit and help these people maintain their identity, while introducing successful conservation interventions. By analyzing conservation encounters using the conservation social science framework, opportunities to do so should be illuminated.

1.4.5 Attitudes Toward Wildlife

As more scientists and conservationists realize that successful conservation depends on the assistance and cooperation of local people, understanding the attitudes of those local people toward wildlife becomes increasingly important, particularly in instances of human-wildlife conflict (Goldman et al., 2010). Hazzah et al. (2013) found that the attitudes of local Maasai were critical to the success of nearby protected areas. Hazzah et al. (2017) found that the single most important predictor of lion killing in Maasai territories was attitudes toward lions. Many conservationists are now attempting to improve viewpoints about wildlife as a way to more successful conservation. Unfortunately, information on stances is generally lacking for most species (Browne-Nunez et al., 2013). This is especially true of non-charismatic animals like wildebeest. The more threatened charismatic megafauna, like elephants and lions, have been the focus of the most research on local attitudes, as will be discussed further below. By conducting surveys on wildebeest, I hope to broaden our knowledge of Maasai attitudes and perceptions. These attitudes and perceptions will help us understand Maasai behavior toward animals and contribute to working with Maasai communities on finding conservation solutions to human-wildlife conflict.

Pre-colonial Maasai society had a very strong conservation element (Waithaka, 2004). Traditional Maasai husbandry practices, grassland governance and rotation of livestock grazing, and aversion to hunting wild animals all allowed for long term coexistence of pastoralists and wildlife (Western et al., 2019). Wildlife was a gift from God and Maasai society valued wildlife. Casual killing of wildlife was unacceptable within Maasai culture, and ceremonial hunting was done at very low levels that did not threaten species numbers (Waithaka, 2004). It was believed that God cared for the wildlife the same way the Maasai cared for their livestock, and that Maasai and wildlife were meant to live together (Western et al., 2019). In traditional Maasai culture a story about the origin of elephants says they were once human; thus, they are usually respected (Kioko et al., 2015). As semi-nomadic pastoralists, human-wildlife conflict among the Maasai was traditionally low.

Modern changes like farming, increases in sedentary lifestyles, and participation in the cash economy are some factors causing the large amounts of human-wildlife conflict seen today among the Maasai (Waithaka, 2004). Even human-wildlife conflict that is not new, such as the depredation of livestock by wild carnivores, is being perceived very differently by the Maasai in the modern world (Hazzah et al., 2009). Traditionally Maasai communities were very tolerant toward predators, even when livestock were taken. The current intolerance may be more about how the Maasai perceive their own vulnerability to wildlife than the actual losses they have sustained

(Hazzah et al., 2009). The view that is common among Maasai today is that wildlife belongs to the government. They perceive less control over wildlife and thus resentment increases (Western et al., 2019). Changes in religion can also cause increases in negative feelings toward wildlife. Hazzah et al. (2009) found that Maasai attending Evangelical churches where man's dominion over nature was taught were less tolerant than those attending Roman Catholic churches where environmentalism was stressed.

With increases in farming, human-wildlife conflict has increased drastically. As Maasai diets change from dairy and blood to agricultural products like maize, rice, and wheat, they require more access to resources like land, water, and fuel, which brings them into increased conflict with wildlife (Waithaka, 2004). Agriculturists are more likely to favor the complete separation of wildlife from humans (Okello, 2005). Farming brings new species into conflict with humans, such as crop pests like baboons (*Papio anubis*), porcupine (*Hystrix cristata*), eland (*Taurotragus oryx*), and zebra (*Equus quagga*) (Western et al., 2019). Elephants, who have always been a problem due to their destructiveness and potential to be dangerous to humans, are now regarded as serious crop pests (Browne-Nunez et al., 2013). In Tanzania, 85% of surveyed Maasai claimed that if an elephant approached their home, they would repel it with fire or noise; 8% said they would seek safety or leave the area, 6% would attack it with spears or chase it with dogs or stones, and 1% would report it to officials (Kioko et al., 2015). Even those who are strict livestock keepers report increased issues. More and more Maasai are choosing to sell some livestock to participate in the cash economy. This sale livestock tends to be expensive breeds, causing even low-level predation to be more serious and less tolerated (Hazzah et al., 2009). Wildlife in the Maasai Mara is on the decline, with

81% of the wildebeest population lost between 1977 and 1997 (Waithaka, 2004). Lower wildlife numbers mean predators increasingly turn to livestock as a food source, thus increasing depredation (Waithaka, 2004). The rapid loss of wildlife and the erosion of traditional knowledge, values, and tolerance of wildlife means that studies on attitude are critical (Western et al., 2019). The Theory of Reasoned Action (developed by Martin Fishbein and Icek Ajzen in 1967) suggests that intention is the best predictor of behavior (Browne-Nunez et al., 2013). Beliefs and intentions help to predict and shape behavior; this has largely been the case when it comes to local attitudes and actions toward wildlife (Brown-Nunez et al., 2013).

Traditionally, negative interactions with wildlife have been seen as the cause of negative perceptions and behaviors (Broekhuis et al., 2018). Conservation has focused on minimizing those negative interactions by excluding wildlife from human areas or helping people develop coexistence strategies (Broekhuis et al., 2018). However, the development of specific attitudes toward wildlife are more complicated than simple cause and effect. Excluding animals from human areas can lead to increases in negative opinions, as well as having detrimental ecological effects by fragmenting habitat (Broekhuis et al., 2018). The perceived benefits of animals are critical toward shaping and changing attitudes, more so than actual amounts of human-wildlife conflict (Hazzah et al., 2013).

In Kenya some Maasai land has been turned into conservancies. These conservancies are made of land owned by Maasai that is “leased” by the government for wildlife purposes (Broekhuis et al., 2018). Landowners cannot cultivate or develop their land, but instead receive a monthly payment. Conservancy members feel that predators belong to their community rather than the government. They see a tangible benefit (in money) from the predators (Broekhuis et al., 2018). Though livestock depredation is as high as 3.5% in conservancies (most of East Africa has between 1 and 4.5%), conservancy members favor human/livestock coexistence with predators (Broekhuis et al., 2018; Lewis et al., 2016). Broekhuis et al. (2018) found in this instance that attitudes toward predators depended on the perceived community ownership of predators and the benefits derived from them, not on the actual costs of depredation. In conservancies where people benefit from predators, lion populations are not declining (Blackburn et al., 2016). Human-wildlife conflict and retaliatory killing is more important for the survival of lions than their environment; creating protected areas alone will not save wildlife if people living on the edges are in conflict with wildlife (Blackburn et al., 2016).

Protected areas in East Africa have traditionally excluded all human uses. However, since the protected areas are made of traditional grazing land, this has fostered many negative beliefs among the Maasai toward the protected areas and wildlife populations (Hazzah et al., 2013). Hazzah et al. (2013) investigated how access to protected areas might affect attitudes toward them. They found that allowing Maasai pastoralists' access to the protected area during a major drought increased positivity toward the protected area and wildlife. Retaliatory lion killing was reduced by a shift in outlook. The Maasai went from feeling excluded from the protected area and viewing the animals in it as belonging to the government, to feeling they benefitted from it (Hazzah et al., 2013). A lot of conservation work has focused on the reduction of the *olamayio*—the coming-of-age lion hunts by warriors. However, the retaliatory killing of lions by non-*ilmurran* Maasai (referred to as *olkiyioi*) is on the rise and is heavily influenced by negative attitudes toward lions (Hazzah et al., 2013). Retaliation killing can be done in secret, using poison that can rarely be traced to a perpetrator; this presents a major threat to lion populations (Hazzah et al., 2009). Hazzah et al. (2013) found that access to protected areas during times of crisis had a larger impact on attitudes toward lions and the likelihood of retaliatory killing than did proximity to protected areas, wealth, or experiences with human-wildlife conflict.

Another common land use program in Maasailand is the formation of group ranches—multiple Maasai own a plot of land, perhaps using it for cultivation (Okello, 2005). Interviews conducted by Okello (2005) on the Kuku Group Ranch determined that support for wildlife conservation was dependent on the benefits received from wildlife. Losses of crops and livestock to animals, lack of compensation for losses, and lack of community involvement in conservation fostered resentment toward wildlife and conservation. On the Kuku Group Ranch, people believed all the benefits of wildlife went to the government and the tourism operators, leaving them to shoulder the costs (Okello, 2005). This is likely true in many areas; Waithaka (2004) found that less than 1% of tourism revenue made it to the Maasai in some areas. This resentment can lead to retaliatory killing of wildlife (Okello, 2005). Cultivators on the group ranches preferred fencing and culling—strategies known to have negative effects on wildlife (Okello, 2005).

Most members of group ranches do not perceive any benefits of tourism (Browne-Nunez et al., 2013). Browne-Nunez et al. (2013) interviewed members of group ranches, asking if they were in favor of allowing elephants to live in the group ranches. Though some people said yes due to tourism benefits, most said no due to the costs and conflicts incurred from elephants and the danger to humans. 94% of group ranch members said elephants brought significant costs, including injury or death of humans, injury or death of livestock, damage to trees, crop losses, competition for water and grazing, and damage to property (Browne-Nunez et al., 2013). These attitudes could have serious consequences for animal conservation. In Kenya, 70% of elephant range lies outside of protected areas. Without landowners tolerating elephants there will not be enough habitat for them (Browne-Nunez et al., 2013). In Tsavo National Park, 6% of families reported a family member killed or injured by elephants, and they were cited as the most problematic animal for crop raiding (Kioko et al., 2006).

Western et al. (2019) found the Maasai stated the most problematic animals as large herbivores and large carnivores, with the most named problem being the threat of elephants to human safety. Western et al. (2019) also found that culture and aesthetics may affect how animals are viewed; species viewed as “ugly” like hyenas may be listed as more problematic. The animal viewed as most positive was the giraffe; the hyena was viewed the most negatively (Western et al., 2019). These cultural and aesthetic notions may have real effects on wildlife numbers and should be considered seriously in relation to conservation. Goldman et al. (2010) found mostly unmixed negative emotions toward “greedy” hyenas, who take more meat than they can eat, and toward elephants, who kill humans and livestock with seemingly no reason.

Lions are viewed with much more mixed feelings, depending on the situation (Goldman et al., 2010). Lions are respected and understood as simply looking for food when they take livestock; the Maasai consider them brave and beautiful. They are the favorite carnivore and present opportunities for prestige among the *ilmurran*. There is joy in the lion hunts and a potential for tourism. There are stories of lions protecting women and children from other animals (Goldman et al., 2010). However, lions are responsible for livestock depredation, and they are feared for their potential to harm humans, though much less so than rhino, elephants, and buffalo. The Maasai believe lions only kill when provoked. These feelings are complicated but important to conservation. It is possible that by focusing on ending *olamayio* (which is now illegal in Kenya) conservationists might be removing the very thing that fosters good feelings toward lions, therefore increasing the potential for *olkiyioi* (Goldman et al., 2010). Hazzah et al. (2017) found attitude to be the single strongest predictor of lion killing. The value of wildlife for the Maasai cannot just be economic. Conservationists must focus on encouraging cultural beliefs and values that increase positive attitudes toward wildlife, because those attitudes are crucial to the survival of endangered species (Brown-Nunez et al., 2013).

Because the Maasai and wildebeest are both understudied, and because wildebeest are vectors of a disease which has significant economic implications for Maasai pastoralists, this research focuses on wildebeest and the conflicts, attitudes, and actions the Maasai direct toward them.

1.5 Wildebeest (*Connochaetes taurinus mearnsi*)

1.5.1 Ecology

The wildebeest is the dominant animal in the Serengeti-Maasai Mara Ecosystem, and their movements define the limits of that ecosystem (Ogutu et al., 2014). Despite this, they are understudied, perhaps because their vast numbers make them a less unique and appealing subject. I have chosen wildebeest as a focus animal here for precisely this reason. Their dominance in the ecosystem means they have the potential to be an almost constant source of conflict. Their status as a disease reservoir for malignant catarrhal fever has the potential to invoke hatred from the Maasai and negative actions toward wildebeest (Bedelian et al., 2007); studying Maasai-wildebeest interactions is important because of its potential effects on wildebeest behavior and therefore wildebeest conservation.

Wildebeest belong to the Bovidae family along with domestic cattle, sheep, goats, buffalo, and other antelopes (Estes, 2014; p. 65). They belong to the tribe Alcelaphini, which contains four genera and seven species of the wildebeest, hartebeest, topis and several other antelopes (Estes, 2014; p. 65). There are two species of wildebeest: *Connochaetes gnou* (also called the black wildebeest) and *Connochaetes taurinus* (also called the blue wildebeest). My focus will be the blue wildebeest subspecies *Connochaetes taurinus mearnsi*, commonly known as the western white-bearded wildebeest. This subspecies is found in southern Kenya and Tanzania, with a range moving southwards into northern and eastern Namibia, Botswana, the Orange River in South Africa, and Mozambique (IUCN SSC Antelope Specialist Group, 2016). *C.t. mearnsi* is currently native to Angola, Botswana, Mozambique, Namibia, South Africa (where it overlaps in range with the black wildebeest), Swaziland, Tanzania, Kenya, Zambia, and Zimbabwe. It is extinct in Malawi (IUCN SSC Antelope Specialist Group, 2016). This subspecies makes up the Serengeti resident population and the famous migratory herd (Estes, 2014; p. 99). *C.t.mearnsi* (hereafter referred to simply as wildebeest) is listed as Least Concern by the IUCN and boasts a population of 1.55 million at last count in 2009, including 1.3 million in the migratory herd (IUCN SSC Antelope Specialist Group, 2016). It is the only subspecies with strong numbers, all others are in decline and persisting at low numbers (Estes, 2014; p. 99).

Wildebeest males stand 110-134 centimeters high at the shoulder and 107-123 for females. Males weigh between 170-242 kilograms, and females weigh 141-186 kilograms (Estes, 2014; p. 87). Wildebeest have relatively little sexual dimorphism, with both males and females sporting similar sized horns and females displaying a faux penile tuft (Estes, 2014; p. 87). Estes (2014) theorizes that in mixed herds that must constantly migrate, this reduces intolerance between males and facilitates young males remaining with their mothers longer and having better survival rates. Wildebeest have overdeveloped forequarters, making them good runners with strong endurance (Estes, 2014; p. 68). Wild wildebeest can live up to sixteen years, with averages of eight years for males and seven for females (Estes, 2014; p. 163). In zoos they may live into their early twenties (personal observation).

Figure 1: Western white-bearded wildebeest and calf (*Connochaetes taurinus mearnsi*) in Tanzania. Photo by author.

Wildebeest are not usually found above 7,000 feet in altitude. They are associated most with acacia savanna and are found in savannas with rainfall between 19 and 32 inches per year. They are a highly migratory species that disperses in the wet season and concentrates around permanent water in the dry season (Estes, 2014; p. 59). They avoid landscapes with too much cover and terrain that might hinder flight from predators (e.g., steep, rocky, wet) (Estes, 2014). Wildebeest are ruminants that spend as much time ruminating as they do grazing (Estes, 2014). As pure grazers, wildebeest prefer short to medium grass and are highly specialized on grass leaf (Estes, 2014; Owaga, 1975). They cannot eat materials as fibrous as hoofstock like zebra. This makes them relatively more sensitive to drought (Owaga, 1975). They must drink water every day or two and do not tend to stray more than 16-25 kilometers from their water source (Estes, 2014). The most important grass species throughout the year is red oat grass (*Themeda traiandra*), which represents 40% of the wildebeest diet during the wet season (Owaga, 1975). Other important wet season grasses include *Setaria sphacelate*, *Setaria trinervia*, and *Ischaemum afrum*. During the dry season *Digitaria macroblephara*, *Cynodon dactylum*, and *Harpachne schimperi* become important (Owaga, 1975). Food availability is the limiting factor for the migratory wildebeest population, which is too large for predation to control its size (Estes, 2014).

Wildebeest have a polygynous mating system in which males defend small territories in an attempt to control access to females (Estes, 2014). In the migratory herd, the males tend to lead migratory movements and reduce their competition, but as soon as movement stops, they will attempt to form and defend territories. Wildebeest show a strong tendency to associate with animals of like class: pregnant females with other pregnant females, females with calves together, bachelor males together, etc. (Estes and Estes, 1979). Males compete using their horns, but they only become violent during the rut. Males use preorbital scent glands to mark trees, the ground, and each other. Through thrashing and scent marking, wildebeest males destroy significant numbers of trees and help maintain preferred grassland. Only fires and elephants transform more woodland to grassland (Estes, 2014).

The male rut lasts for three weeks each year from May through June; this is the period of highest male competition and aggression. Challenges and head bashing occur to hold territories. Males will attempt to hold females in their territory and will flehmen test them for estrus, tasting the urine of the females with upper lip curled back to facilitate detection of pheromones by the vomeronasal organ (Estes, 2014). Females are relatively passive in mating, but if left alone, a female will mate with the same male multiple times during her 24-hour estrus period (Estes, 2014). The loud calling of the males during rut (the famous “gnu” sound their name is derived from) may help synchronize estrus in the females (Estes, 2014). Males start reproducing at four or five years old. Females may have their first calf as young as three and may have five or six during their lifetime (Estes, 2014; p. 163).

80% of calves are born during the three-week calving period in January and February (Estes, 1976). Calving grounds are not a consistent location each year but are always the best feeding grounds (Estes and Estes, 1979). Gestation is eight months long (Estes, 2014; p. 80). Labor takes an average of 66 minutes. However, wildebeest can pause labor for up to one hour to flee from predators (Estes and Estes, 1979). Calves are born in the morning so that they are stronger by nightfall when the greatest predator threat occurs. Calves can stand in an average of 7 minutes and suckle an average of 8.2 minutes after birth (Estes, 2014; Estes and Estes, 1979). Calves and mothers call to each other to avoid separation and mothers recognize their own calf by scent. There is no communal defense of calves (Estes, 2014). Calves will imprint on their mother within two to three days, but before then, they are vulnerable to separation as they may follow any moving object (Estes and Estes, 2014). The most significant predator of calves is hyenas (*Crocuta crocuta*). Wild dogs (*Lycaon pictus*) and cheetah (*Acinonyx jubatus*) may also attempt to prey on wildebeest calves, but lions have not been seen to do so. Mothers have a long flight distance and calves avoid predation by staying close to them (Estes and Estes, 1979). Wildebeest mothers have been seen attempting to fight hyenas by horning them. This is sometimes successful against a single hyena (Estes, 2014).

Calf survival depends on many factors, including rainfall, size of calf crop, calving ground location, and grouping pattern (Estes and Estes, 1979). The single greatest determinant of survival is the timing of birth (Estes, 2014). Breeding synchrony evolved in this animal as an adaptation to a highly migratory lifestyle. The number of calves in the immense migratory herd gluts the predators so they are unable to take more than a small percentage of calves. Calves born outside of the peak calving season have much lower survival (Estes, 2014). Calves are weaned at about nine months and then will often separate from their mother, though some (particularly females) will continue to follow their mother into the yearling phase even when she has another calf (Estes, 2014).

The most famous aspect of the wildebeest is their participation in the Great Migration. The circular migration takes the wildebeest from their dry season pasture in the northern Serengeti and Maasai Mara southwards to the southern Serengeti when the rains return (Boone, Thirgood, and Hopcraft, 2006). The spectacular sight of 1.3 million wildebeest on the move and crossing the Mara River, where many will perish from drowning and predators in suboptimal crossing sites, is one of the main tourist attractions of Africa (Estes, 2014). The round trip journey is 650 kilometers, with wildebeest averaging seven kilometers per day (Estes, 2014). This migration keeps the wildebeest in their preferred grazing of short and intermediate height grass (Wilmshurst et al., 1999). Boone, Thirgood, and Hopcraft (2006) modeled predictions of the migration and found that it was influenced 25% by rainfall and 75% by vegetation growth. Other factors that may influence when the wildebeest move include water quality, avoidance of disease and predators, and access to critical minerals (Boone, Thirgood, and Hopcraft, 2006).

Figure 2: The Great Migration of wildebeest moving toward the Mara River on the border of Kenya and Tanzania. Photo by author.

1.5.2 Activity Patterns

One of the goals of this research is to explore whether human-wildlife conflict is influencing wildebeest behavior. By comparing the behavior of wildebeest in a Maasai conservancy in Kenya and in Serengeti National Park in Tanzania (where Maasai are excluded), I hope to get an idea of whether conflict with Maasai is having an effect on wildebeest behavior. The current information on wildebeest activity patterns is sparse but summarized here.

Berry, Siegfried, and Crowe (1982) observed *C. taurinus* individuals in Etosha National Park in Namibia. Using focal animal scans, they found wildebeest spent 52.9% of their time resting, 32.0% grazing, 13.8% moving, 0.1% drinking seasonal water, 0.2% drinking perennial water, 0.1% suckling, and 0.9% in social encounters. They found that peaks and troughs of activity were linked to temperature and photoperiod. Ben-Shahar and Fairall (1987) studied *C. taurinus* in Pretoria, South Africa. During the winter, their research determined wildebeest spent 25.76% of their time grazing, 48.03% lying down, 18.69% standing, and 7.33% walking. In the summer, wildebeest spent 24.41% of their time grazing, 39.07% lying down, 24.06% standing, and 11.73% walking. Activity changed with temperature. The researchers also noted that females spent more time grazing than males, possibly due to higher energetic costs associated with pregnancy and lactation.

Vrahimis and Kok (1993) studied black wildebeest (*C. gnou*) in South Africa, but their results are still interesting to note here. They found black wildebeest spent 45.6% of their time lying down, 40.2% grazing, 11.7% standing, and 2.5% doing other activities (running, walking, fighting, playing). Interestingly, they found that males spent more time grazing than females, which is contrary to what Ben-Shahar and Fairall (1987) found.

The vast herd of wildebeest crossing the Serengeti may seem untouchable and enduring, but that is not necessarily the case. The rinderpest epidemic of the 1890s killed off 90% of the population. Wildebeest numbers plummeted to less than a quarter million. The population only started increasing again in 1962 when rinderpest was eradicated through inoculation of cattle (Estes, 2014). Though they are listed as Least Concern by the IUCN, threats against them are numerous and include the spread of settlement and livestock, loss of water resources, poaching for meat, loss of seasonal ranges, eradication programs to eliminate livestock diseases (like malignant catarrhal fever, discussed in the next section), and fencing (IUCN SSC Antelope Specialist Group, 2016). 20% of the Serengeti ecosystem is unprotected. This leaves wildebeest vulnerable (Estes, 2014).

1.5.3 Conflict Issues

Wildebeest can, as with any grazing animal, act as a crop pest. In the area around Maasai Mara National Reserve, wildebeest are ranked as the fifth most important crop raiding species (behind Cape buffalo, various antelope species, elephant, and monkey—specifically baboons) (Naughton-Treves and Treves, 2005). Though they are considered crop pests, the most important source of conflict between wildebeest and humans is malignant catarrhal fever.

Malignant catarrhal fever is a herpesvirus caused by alcelaphine herpesvirus-1 (A1HV-1) (Cleaveland et al., 2004). Malignant catarrhal fever is carried by *C. taurinus* and *C. gnou* naturally without causing disease (Hunt and Bilups, 1979). There is also a form of the disease that uses sheep as a reservoir, but the form utilizing wildebeest as the reservoir is the more prevalent and impactful form in Africa and the only one discussed here (Cleaveland et al., 2001). Malignant catarrhal fever is transmitted from wildebeest to cattle following the calving season and has the potential to be fatal to cattle (Bedelian et al., 2007). At this time there is no commercially available cure or treatment for malignant catarrhal fever. The only way to prevent infection in cattle is to keep cattle away from wildebeest following the calving season (Bedelian et al., 2007; Lankester et al., 2016).

The transmission of malignant catarrhal fever (MCF) from wildebeest to cattle is not fully understood. Though it is accepted by Maasai (and supported by science) that transmission is by calves in the first few months of life, details of the specific mechanisms are not known (Whitaker et al., 2011). The Maasai believe that MCF can be transmitted from wildebeest calves via placenta, fetal membranes, fetal fluids, or calf hair; all these transmission methods are not necessarily supported by science (Lankester et al., 2015a). Though the virus can be detected in around 50% of placenta, the virus load is extremely low, potentially too low to be a source of transmission (Lankester et al., 2015a). It is certain that the virus can be transmitted via nasal and ocular secretions of calves from one to three months old (Mushi, Rurangirwa, and Karstad, 1981). Calves have their peak virus load at one to two months old; antibodies start causing a decline after three months, and by six months it is likely they no longer transmit the virus (Lankester et al., 2015a; Mushi, Rurangirwa, and Karstad, 1981). It is possible that in close proximity, flies could carry nasal and ocular fluids from wildebeest calves to cattle and infect them, meaning that separation of cattle and wildebeest might not be entirely effective in preventing infection (Milo et al., 2015). In very close contact cattle may be infected via aerosolized nasal secretions produced by sneezes or snorts (Whitaker et al., 2011). Grazing cattle on pasture with wildebeest calves results in infection, indicating the consumption of ocular and nasal secretions also causes infection (Bedelian et al., 2007).

Incubation periods in cattle are also extremely variable—generally nine days to two to three months, but as long as ten months (Hunt and Bilups, 1979). In an outbreak amongst Ankole cattle at a United Kingdom zoo, three animals died. The wildebeest calved in March and April, and Ankole cows died in July, August, and November (Whitaker et al., 2011). All the cattle died within days of showing symptoms (Whitaker et al., 2011). Rweyemamu et al. (1974) saw all infected cattle die within 6-8 days of the first sign of infection.

Symptoms of MCF in cattle vary, but generally there is a sudden onset with a high fever (Plowright, 1986). It is an oncogenic virus that causes tumors in many organs and body parts (Hunt and Bilups, 1979). One of the main symptoms is blindness; in Zimbabwe MCF is referred to as wildebeest blindness (Milo et al., 2015). MCF can also cause inflammation of the mucosae of the respiratory and alimentary tract, ocular lesions, constipation, and neurological issues like tremors and seizures (Cleaveland et al., 2001). Once symptoms begin the virus is almost always fatal, though it is possible to have infection with no symptoms (Lankester et al., 2016).

MCF has significant effects on pastoral cultures and causes extreme negative feelings toward wildebeest; the Maasai word for MCF is *emoyian ooengati*, meaning disease of wildebeest (Cleaveland et al., 2001). Lankester et al. (2015b) found that among Maasai pastoralists in northern Tanzania, 90% of households moved an average of 82% of their cattle away from home to avoid possible infection from wildebeest. This drastically reduced the amount of milk and nutrients available to the family members staying at the *boma*. Cattle that moved away from the wildebeest (who occupy the best grazing areas) also had poorer body conditions from the long move and less nutritious grazing (Lankester et al., 2015b; Cleaveland et al., 2001).

There is a significant amount of work involved in moving cattle away from wildebeest areas, sometimes requiring additional herders (Bedelian et al., 2007). The cattle are at increased risk of lion predation when moving away from the *boma*. Additionally, the poorer pastures mean the cattle may be water and salt deprived, so farmers may have to purchase additional water, salt, and forage for their animals (Bedelian et al., 2007). In the Ngorongoro area, farmers have to regularly bring cattle back to normal grazing areas to provision them with salt, requiring even more labor and movement. Moving away from the short grass plains occupied by the wildebeest means moving to woodier areas (Cleaveland et al., 2001). This increases the exposure of cattle to tick-borne illnesses like East Coast Fever, another major cattle killer (Cleaveland et al., 2001). Cattle displaying signs of MCF are almost certainly going to die, so farmers either slaughter them for meat or attempt to sell them to slaughterhouses (Bedelian et al., 2007). However, since the slaughterhouses know the seller has few options, infected cattle only fetch 20-30% of the price of healthy cattle, leading to further economic losses (Cleaveland et al., 2001).

In Kenya, Tanzania, and Zimbabwe, malignant catarrhal fever is consistently ranked as one of the most important diseases of cattle (Bedelian et al., 2007; Cleaveland et al., 2001; Milo et al., 2015). In Tanzania, Maasai herders report losses of 50,000 to 150,000 Tanzanian shillings (around 21 to 65 US dollars) per case of MCF, with additional costs in lowered reproduction of the whole herd, since MCF mainly affects adult animals (Cleaveland et al., 2001). In Zimbabwe MCF is the most important source of animal loss in both the private and commercial sectors, with 44.2% of smallholders and 85.7% of commercial farmers reporting losses from 2012 to 2014 (Milo et al., 2015).

Pastoralists may use more extreme methods to avoid the costs of MCF. In Kenya, they may use dogs to chase wildebeest away or kill them illegally (Bedelian et al., 2007). In Tanzania, wildebeest may be chased or fences erected (Cleaveland et al., 2001). In all areas, the uncompensated losses due to MCF create tension and conflict around protected areas. Farmers want fences to keep the wildebeest in the parks and out of their farms, but this is rarely done due to costs, feasibility, and impacts on wildlife (Milo et al., 2015; Bedelian et al., 2007). Pastoralists above all want a vaccine for MCF, but unfortunately, MCF is not strongly addressed by the government in most areas (Cleaveland et al., 2001; Bedelian et al., 2007). Plowright (1986) declared MCF economically unimportant, though he did admit it could disrupt the grazing of nomadic pastoralists. Few large-scale attempts at a vaccine have been attempted. Recent years have seen more vaccine trials. Lankester et al. (2016) tested a potential vaccine in Tanzania. Though the vaccine did cause a reduction in infection rate by 56% in zebu cattle, the cases of fatal MCF were almost identical in the unvaccinated (4 cases) and the vaccinated (3 cases) cattle. Despite the insignificant reduction in fatal cases, the vaccine did show some promise.

MCF is a major source of tension and conflict on the borders of protected areas. Negative attitudes toward wildebeest may be causing unknown amounts of harassment. In addition to surveying Maasai on attitudes toward wildebeest in the Maasai Mara area—the area most prone to effects of MCF—I will be studying wildebeest behavior

(Cleaveland et al., 2001). By comparing behaviors captured by camera traps in a Maasai conservancy and Serengeti National Park, I intend to investigate whether human-wildlife conflict could be causing behavioral changes.

1.6.0 Structure of the Thesis

This thesis will address the following research questions:

•What attitudes and feelings do local Maasai people hold toward wildebeest and do those feelings affect their behavior toward wildebeest?

•How do Maasai and conservationists feel about working together for conservation? Do Maasai feel they are adequately involved in conservation work?

•Is wildebeest behavior altered in Maasai areas versus in areas where there is little Maasai activity?

Chapter 2 contains extensive background information on the conservation encounter. This is critical to the analysis of the interactions between stakeholders through a conservation social science framework, which is the theoretical framework adopted in the thesis.

Chapter 3 discusses the theoretical basis of the methodologies chosen for this study and outlines how they changed in response to the COVID-19 pandemic. The methodologies employed for each of three stakeholder groups (conservation scientists, Maasai, and wildebeest) are described. The chapter also includes a discussion of the ethics involved in social media research as being of particular concern for the revised approaches following the pandemic.

Chapter 4 addresses the issue of how human-wildlife conservation is viewed by conservation practitioners and how conservation practitioners view their interactions with local groups. It presents the results of the email-based survey of conservation practitioners throughout Africa. The results of this survey indicate conservation practitioners feel strongly that cooperation and work with local groups is essential to conservation but have some barriers regarding language and culture. The results also indicate that involvement by local groups is often in the form of drivers or informants. This finding suggests there is a disconnect in how Maasai wish to be involved with conservation (discussed in Chapter 5), as educators and team members, and how they are currently involved. This could be a potential barrier to meaningful cooperation.

Chapter 5 addresses the issue of how Maasai pastoralists in Kenya view wildebeest and malignant catarrhal fever and how they view conservationists and conservation work in their area. It presents the results of the internet-based survey of 114 Maasai in Kenya conducted through social media. The results of the survey indicate a broad understanding of malignant catarrhal fever and a wariness of its effects amongst all age, sex, livelihood, and location groupings of Maasai surveyed. The survey also indicated many problems caused by wildebeest presence, but revealed a general opinion that wildebeest would be welcome or tolerated were it not for malignant catarrhal fever. The survey also indicated an extremely high acceptance for a vaccine for malignant catarrhal fever if one were available. The survey indicated that Maasai view conservation generally in a positive light but wish to be more involved as team members and educators than they currently are. These findings indicate malignant catarrhal fever is a primary source of conflict with wildebeest for many Maasai. Were it ameliorated, through a vaccine for instance, many Maasai would feel their livelihoods were less threatened and conservation of wildebeest may be made easier. The results also indicate Maasai are eager to be involved in conservation work and are an essential resource for furthering effective conservation in the Serengeti Maasai-Mara ecosystem.

Chapter 6 addresses the potential behavioral responses of wildebeest to Maasai presence and possible harassment due to presence of malignant catarrhal fever. This chapter presents the results of the analysis of camera trapping data collected by the Snapshot Safari project and analyzed by citizen scientists via the Zooniverse platform. Camera trapping data from two locations, Serengeti National Park where Maasai presence is low and Enonkishu Conservancy where Maasai presence is high, are compared in Chapter 6 for rates of different wildebeest behaviors to determine if wildebeest are showing behaviors that could indicate more alertness when Maasai are present (such as more standing and less resting). The results indicate that wildebeest in Enonkishu Conservancy spend significantly more time moving and significantly less time standing and resting than wildebeest in Serengeti National Park. These results possibly indicate an increased need for wildebeest movement caused by Maasai persecution, e.g., chasing as reported in the surveys. However, as discussed in Chapter 6, there are uncontrolled variables that make comparing the data sets imperfect.

I combine the three research threads focusing on three stakeholder groups—scientist surveys, Maasai surveys, and wildebeest behavioral data—in Chapters 7 and 8. I discuss aspects of the interactions between stakeholders revealed by this research. In Chapter 7, I discuss how reflexivity can help conservation. By analyzing historical context and biases inherent in science we can better approach conservation problems and solutions cooperatively. Similarly, I also argue for more social science in conservation. Social science can help conservation give context to the historical, political, and economic surroundings of a conservation issue and find solutions that are practical and effective for conservationists, biodiversity, and local stakeholders. In Chapter 7, I give examples from Africa where social science has been deeply applied to find meaningful and effective solutions for conflict and conservation issues. As climate change increases the risk of biodiversity loss, these solutions and cooperation with local groups will become even more critical.

In Chapter 8, I close with a reminder of the complexity of this and every conservation encounter. In this particular interaction between wildebeest, conservationists, and Maasai pastoralists, a vaccine for malignant catarrhal fever could go a long way toward a resolution. I also reflect on the benefits of social media research for facilitating post research engagement with participants, and I end by recommending further research into Maasai attitudes and behavior, conservationist approaches to working with local stakeholders, and additional study into wildebeest behavioral changes in response to humans.

Chapter 2: Background to the Conservation Encounter

2.1.0 Disease as Human-Wildlife Conflict

Malignant catarrhal fever (MCF) is one example of the many diseases that cause conflict between humans and wildlife. Diseases with wildlife reservoirs have the potential to become a human health hazard by infecting humans or becoming a major economic issue by infecting livestock and other animals. The frequency and emergence of diseases with wildlife reservoirs is increasing (Rhyan and Spraker, 2010). As humans encroach repeatedly into wildlife habitat, and as transport of exotic animals and pets increases, the opportunity for close contact between humans and wildlife strengthens (Rhyan and Spraker, 2010). In the United States, 79% of animal diseases have a wildlife component, and 40% of those have the potential to be zoonotic (Miller, Farnsworth, and Malmberg, 2013). Wildlife diseases can become a conservation issue when they infect wildlife, and once wildlife becomes a reservoir, zoonotics become almost impossible to eradicate (Miller, Farnsworth, and Malmberg, 2013).

The extreme impact of zoonotic diseases has been soberingly demonstrated by the COVID-19 pandemic. At the time of writing (September 12th, 2022) global cases of the COVID-19 virus have surpassed 605 million, with over 6.4 million deaths, and cases are still increasing dramatically (World Health Organization, 2021). The virus was first detected in Wuhan, China in 2019 and may have come from the Hunan Market, where live exotic animals are kept and sold (Anderson et al., 2020). Though the exact origins and method of transmission to humans is not yet confirmed, genetic analysis of the virus suggests it originated in either bats or pangolins (Anderson et al., 2020; Shereen et al., 2020). How it jumped to humans is still being studied, but it likely began with consumption of bats or pangolins and mutated to allow human to human transmission (Shereen et al., 2020). The worldwide disruption to economy and everyday life caused by COVID-19 has brought a heightened awareness of the dangers of zoonotic diseases. As globalization increases, the impacts of future disease emergences could be just as serious (Anderson et al., 2020).

MCF is not the only disease in Africa with a wildlife reservoir. Theileriosis is present in buffalo but causes high mortality in cattle (Bengis, Kock, and Fischer, 2002). Cape buffalo (*Syncerus caffer*) can also carry foot and mouth disease and ear ticks (*Otobius megnini*), the vector for East Coast Fever (Chaminuka, McCrindle, and Volo, 2012). Buffalo and lions can carry tuberculosis and pass it to both cattle and humans (Chaminuka, McCrindle, and Volo, 2012). In areas of human-wildlife interface in Zimbabwe, brucellosis is endemic in domestic animals (Muma et al., 2016). In addition to cattle, small ruminants like goats and sheep are also susceptible to many different wildlife diseases (Billinis, 2013).

Bovine tuberculosis was introduced to Africa by European colonists in the late 18th century (Michel, 2002). Buffalo are now a maintenance host for bovine tuberculosis and can pass it to endangered wildlife, cattle, and, through the widespread consumption of unpasteurized milk, to humans (Michel, 2002). Tuberculosis is a pervasive human health issue across Africa, as well as a conservation and economic problem (Michel, 2002).

In many parts of Africa especially, there is a serious lack of effective and economically feasible methods for keeping livestock and wildlife apart (Miller, Farnsworth, and Malmberg, 2013). Fencing is expensive and not always effective

(Chaminuka, McCrindle, and Volo, 2012). As ecotourism spreads and becomes profitable, countries expand their wildlife areas and the interface between livestock and wildlife grows (Bengis, Kock, and Fischer, 2002). Diseases not only cost farmers, but present challenges to conservation and impede the formation of much needed Transfrontier Conservation Areas (de Garine-Wichatitsky et al., 2013).

Though I will be exploring how malignant catarrhal fever affects attitudes toward wildebeest, it is important to note that there are many wildlife diseases worldwide that cause conflict with—and strong feelings toward—wildlife. Below, I will discuss several diseases that travel between wildlife and livestock or captive animals. These examples will provide context for the problems faced in attempting to eradicate these types of diseases. They will also demonstrate the strong emotions that can be generated by livestock diseases and the severity of the conflict that can result. This will aid in the interpretation of the Maasai surveys, and the understanding of the feelings generated by malignant catarrhal fever. I have chosen the diseases below for their ability to have a strong impact on livelihoods, thus resulting in strong emotions.

2.1.1 Bovine Tuberculosis (bTB) in the United Kingdom

The European badger (*Meles meles*) is widely distributed across the United Kingdom and Ireland. Badgers have conflicted with humans in the UK for a long time. The Tudor Vermin Acts in 1532 and 1566 listed badgers as a vermin species that interfered with human activities and food production (Cassidy, 2017; p. 4). Badgers have the potential to be crop pests and interfere with the culturally significant practice of fox hunting by displacing foxes and decreasing fox populations (Cassidy, 2017). In 1971 the link was first made between badgers and outbreaks of bovine tuberculosis (*Mycobacterium bovis*) with the discovery of a bTB positive badger carcass on a farm (Cassidy, 2017; p. 4). Bovine tuberculosis is the most serious livestock disease in the UK and causes extreme economic losses to farmers (Wilson, Carter, and Delahey, 2011). It was also a major cause of human tuberculosis infections well into the 20th century (Cassidy, 2017). Since the 1970s when badgers were first implicated in outbreaks of bTB, there have been widespread culling programs in place to control it. These programs have been extremely controversial since they were first implemented (Cassidy, 2017).

The modes of transmission of bTB from badgers to cattle is complex and involves ingestion of grass contaminated with badger urine and feces (Campbell et al., 2020). Badgers have also been shown to visit farm buildings, especially at night, and contaminate food stores, troughs, and farm buildings with excrement (Garnett, Delahey, and Roper, 2002; Ward, Tolhurst, and Delahey, 2006). Though badgers avoid direct contact with cattle at pasture, they come closer to them in farm buildings, presenting the opportunity for direct infection (Bohm, Hutchings, and White, 2009; Garnett, Delahey, and Roper, 2002). Incomplete removal of badgers from an area does not reduce overall bTB outbreaks, but instead increases the incidence of bTB in a buffer area around the cull as the badgers spread more widely (Wilson, Carter, and Delahey, 2011; Menzies et al., 2021). There is an effective vaccine that can be administered to badgers via catch and release; however, there are several barriers to wide implementation including limited funding, low vaccine confidence by landowners, and low landowner participation in the scheme (Benton et al., 2020; p. 770).

Exclusion of badgers from farm buildings and food stores could reduce bTB, but farmers have proven averse to changing their husbandry methods and improving farm biosecurity, perhaps due to high costs or low confidence in the methods (Ward, Tolhurst, and Delahey, 2006). Maye and Chan (2020) also found low rates of biosecurity improvement, even when farmers acknowledged its importance. In addition to disease, badgers building setts (dens) can cause damage to farmland and buildings (Davison et al., 2011). A reliable vaccination is not yet available for cattle. An injectable vaccine is available for badgers and does reduce bTB incidence (Chambers et al., 2014). An oral vaccine is currently in development. In the course of ten years, England has spent over £500 million of tax money on the bTB "problem" (Jones, 2022). Though it has been proven that upgraded farming practices can better eliminate bTB than interference with badgers, the badgers are still largely blamed for the issue (Ward, Tollhurst, and Delahey, 2006).

The situation seems costly enough to warrant widespread support for badger culling, but this has not proven to be the case. Farmers favor culling of badgers, but the public does not (Naylor et al., 2014; Dicks et al., 2021). In a large-scale phone survey of UK citizens, Bennet and Willis (2008) found widespread understanding of the bTB issue and recognition of the need to control it, but also found broad opposition to the killing of badgers and an almost unanimous recognition of them as an important wildlife species. This is likely due in large part to popular attitudes toward badgers. The badger holds a unique place in the culture of the UK, appearing in countless stories and images (Cassidy, 2017). The 1908 novel *The Wind in the Willows* by Kenneth Grahame presented Mr. Badger as a brave and intelligent father figure—a representation many

British children grew up with (Cassidy, 2017; p. 11). Positive representations in books, television, and media contributed to the passing of the Badgers Act of 1973 that protected them. Further legislation in 1992 made it illegal to kill or injure badgers (Cassidy, 2017; p. 6).

Since 1877 the media has framed badgers as brave, clean, useful, and uniquely British animals who have been unfairly persecuted (Cassidy, 2017). In Wales, bTB causes significant economic and emotional costs to farmers as cows testing positive must be slaughtered, and subsequent restrictions are put on farms (Caplan, 2012). Despite this, government proposed badger culling in 2009 was met with extreme opposition from citizens and farmers. Activist groups were formed with the express goal of stopping the cull and local elections were affected by the positions of politicians on the cull (Caplan, 2012). Widespread propaganda and advertising helped reaffirm the positive image of badgers, resulting in the cancellation of the cull (Caplan, 2012). This cultural framework may have caused a destructive animal to become beloved. From a conservation standpoint, this is a critical example of how attitude—not just amount of conflict—affects actions. This is relevant to many examples of human-wildlife conflict in many African contexts, including the focus of the current project. If conservationists can find and strengthen cultural beliefs regarding positive associations with animals, they may be able to strengthen support for animal preservation and conservation without changing the actual amount of conflict (Cassidy, 2012; Kuriyan, 2004).

2.1.2 Encephalomyocarditis Virus (EMCV)

The encephalomyocarditis virus (EMCV) is an RNA virus in the family Picornaviradae, found worldwide and causing myocarditis (inflammation of the heart) and death by cardiac failure (Wells et al., 1989; Citino, 1995). EMCV can be found in humans and other primates, wild and domestic mammals of many types, birds, and arthropods. It was first isolated from rats, who are extremely resistant to morbidity/mortality from the virus for undetermined reasons (Citino, 1995). The epidemiology of EMCV is very poorly understood. Rodents are the primary reservoir hosts and infections seem to occur when other animals ingest rat feces, urine, or rat carcasses. The virulence of the disease depends on the strain and on the species infected, with some, such as humans, showing little sign of infection and some displaying sudden death with no promontory signs (Citino, 1995). Though an outbreak among wild elephants in 1993-1994 killed 64 elephants in Kruger National Park in South Africa, most outbreaks of EMCV occur in zoological settings (Citino, 1995).

In 1987, a zoo in Louisiana in the United States lost eight primates, a Thomson's gazelle (*Eudorcas thomsonii*), and a dromedary camel (*Camelus dromedarius*) to EMCV. Forty rodents on property were found to be carrying EMCV (Wells et al., 1989). Also in 1987, a zoo in Florida lost a 23-year-old male orangutan (*Pongo pygmaeus abelii*). A juvenile female in the group survived exposure with no evidence of disease (Citino et al., 1988). At this time, it was theorized that EMCV was mainly found in the southern US with outbreaks occurring during cooler weather (Wells et al., 1989; Citino et al., 1988). In 1988, the first outbreak occurred in an Australian zoo. A ring-tailed lemur (*Lemur catta*), a squirrel monkey (*Saimiri sciureus*), three mandrills (*Mandrillus* *sphinx*), a chimpanzee (*Pan troglodytes*), a pygmy hippopotamus (*Choeropsis liberiensis*), and two tree kangaroos (*Dendrolagus goodfellowi*) died. In 1991, a second outbreak killed a mandrill who had survived the first outbreak and displayed antibody titers, demonstrating that immunity to EMCV through past exposure is quickly lost (Reddacliff et al., 1977). In 2006-2007, an Italian zoo experienced an outbreak in which fifteen primates died. A second outbreak in 2008 killed another three. Both outbreaks were associated with increased rodent numbers at the zoo (Canelli et al., 2010).

EMCV is no longer a disease confined to the southeast US. It is a worldwide problem in zoos, and almost every zoo has rat extermination programs to combat it. The above cases are just the published examples of destructive outbreaks in zoos. My personal experiences working in zoos has shown that such outbreaks are common, impossible to predict, and difficult to combat. There is not a good understanding of EMCV among the general public, but its tendency to cause fatality in charismatic animals like elephants and non-human primates has the potential to create strong emotions in the public. Zoos are designed to foster a connection between humans and wild animals, and in doing so, bonds with individual zoo animals are often established (Clayton, Fraser, and Burgess, 2011; Roe, McConney, and Mansfield, 2014). The outcry over Harambe (a gorilla shot at the Cincinnati Zoo in Ohio when a small child fell into his enclosure) shows just how much the public can connect with high profile zoo animals (Chuck, 2016; Fieldstadt and Stelloh, 2016). If EMCV cases continue to increase, we could see a public hatred of rats and rodents increase. These animals are already widely disliked due to historical associations with disease, such as medieval plague (Belmain, 2015). The hatred of bats due to their perceived role in rabies transmission has drastically increased due to their theorized role in COVID-19 (Quammen, 2020). It doesn’t take much to escalate negative feelings, particularly when an animal is already disliked.

EMCV also transfers easily to domestic pigs and causes economic losses in the swine industry. Infections passed from rats to pigs causes piglet mortality and sow reproductive failure (Spyrou et al., 2004). EMCV was first found in domestic pigs in Europe in 1986 and has been on the rise ever since (Maurice et al., 2007). In a study of Belgian pig farms, 29 of 58 farms had outbreaks and the presence of mice increased the risk (Maurice et al., 2007). Wild boar in Europe have also been found to have EMCV antibodies and infection (Maurice et al., 2005). Outbreaks in domestic pigs have been found in Canada, the United States, Panama, Australia, Cuba, New Zealand, South Africa, Brazil, and many countries in Europe (Dea et al., 1991; Maurice et al. 2005; Spyrou et al., 2004). EMCV results in significant costs to the swine industry due to expensive test and slaughter programs and has the potential to become a serious economic issue.

There are also human health concerns with EMCV; infection has been linked to some neurological disorders in humans, raising concerns over its zoonotic potential (Citino et al., 1988). These concerns could increase as xenotransplantation of pig organs to humans becomes more common (Canelli et al., 2010).

EMCV is a poorly understood disease that is not yet a dominant concern in the public sphere. My experience in a zoo that faced an EMCV outbreak was dramatic. The ability of EMCV to cause sudden death with no warning makes it a terrifying prospect for zookeepers and managers. I have never seen so many rules, regulations, and practices change in a workplace so quickly. Almost overnight sanitization rules changed and entire buildings were emptied of animals for fear of EMCV infected rats being present. More than during COVID-19, fears over sanitation measures not being enough skyrocketed. Years later, lingering fears continue to cause suspicion and hatred of rats among animal keepers. This example demonstrates that negative feelings toward an animal can be lingering, even after threats from it are reduced or removed.

2.1.3 Rinderpest

Though rinderpest, or cattle plague, was declared officially eradicated in 2011, no review of impactful livestock diseases would be complete without discussing it (Tounkara, Nwankpa, and Bodjo, 2017). Rinderpest was caused by a morbillivirus in the family Paramyxoviridae (the same family as measles) and affected only cloven-hoofed animals (Kock et al., 2006). Infection occurred via inhalation of nasal, oral, or fecal secretions containing the virus. There was an eight-to-eleven-day incubation period, followed by a fever. Four to five days after the onset of the fever there was a mucosal phase followed by violent diarrhea for one to two days, and then either death or slow recovery (Morens et al., 2011). Mortality due to rinderpest was extremely high, up to 100% in a herd depending on the strain of the virus (Tounkara, Nwankpa, and Bodjo, 2017). Rinderpest is an ancient virus, present in Asia over 10,000 years ago; it probably originated with the first domestication of cattle. Throughout history, rinderpest has caused food shortages, starvation, economic loss, poverty, social unrest, and transport network disruptions. Rinderpest has constantly moved around the globe with trade and invading armies. It is not an exaggeration to say that rinderpest has helped weaken and topple empires (Tounkara, Nwankpa, and Bodjo, 2017).

Rinderpest was first introduced to Africa in 1841 via cattle imported into Egypt from Romania. The ensuing pandemic killed 75% of the cattle and buffalo in Egypt. In 1884 imported cattle from India introduced the virus to Ethiopia (Tounkara, Nwankpa, and Bodji, 2017). This introduction set off the Great African Pandemic that raged throughout the 1890s and left behind pockets of infection that continued to set off smaller pandemics throughout the 20th century (Roeder and Rich, 2009). By 1892 Ethiopia had lost 90% of its cattle, Uganda had lost 95%. The Great African Pandemic killed 80-90% of all cattle in sub-Saharan Africa (Tounkara, Nwankpa, and Bodjo, 2017). Maasailand was badly hit by the pandemic. The Maasai lost 90% of their cattle, and many were forced to shelter with agricultural neighbors, thereby losing their identity as cattle keepers. A large portion of the Maasai population starved to death. This weak state meant the Maasai presented little resistance to colonialism (Ofcansky, 1981). The 1890s pandemic killed one half to one third of the total human population in East Africa (Morens et al., 2011).

In addition to cattle, rinderpest also infected wild ungulates (Tambi et al., 1999). Buffalo were found to become sicker than cattle when infected with rinderpest, and the migratory wildebeest herd was decimated by it in the late 1800s and early 1900s (Kock, 2006). In the 1950s the migratory wildebeest herd was less than 300,000. After rinderpest was brought under widespread control in 1964 the herd increased rapidly to over 1.2 million by 1980 (Sinclair et al., 2007). Rinderpest infected a wide range of ungulates, including giraffe and eland, as well as the warthog, and the disease moved from cattle to wildlife and back again, causing infections to spread where wildlife moved (Roeder and Rich, 2009; Taylor and Watson, 1967).

The devastating effects of rinderpest prompted the establishment of the world's first veterinary school in Lyon, France in 1761, as well as many global health organizations such as the World Organization for Animal Health (Tounkara, Nwankpa, and Bodjo, 2017). The quest to reduce, and eventually eradicate, rinderpest helped pioneer methods in disease control and public health practices that are still in use—the World Organization for Animal Health developed a three-step path to disease eradication that is still used (Morens et al., 2011). The last recorded case of rinderpest was in Kenya in 2001, and the virus was officially declared eradicated in 2011 (Roeder and Rich, 2009). The path to world freedom from rinderpest was a long one. Unique aspects of the disease itself made this possible.

The first rinderpest vaccine was developed in the late 1890s. Research continued to produce better vaccines until the 1980s, when an effective and thermally stable vaccine with no side effects was finally developed (Roeder and Rich, 2009). Joint Project 15 was started in the 1960s and 70s to introduce widespread vaccination and rinderpest containment. Though it did reduce rinderpest across Africa, it failed to eliminate certain reservoirs, causing a resurgence of the virus in the 1980s (Roeder and Rich, 2009). The Pan-African Rinderpest Campaign (PARC) started in 1986 and included 35 participant countries with the goal of eradicating rinderpest. PARC was very effective in West and Central Africa, but less so in East Africa due to much larger populations of wildlife and cattle, making herd immunity more difficult to achieve (Tambi et al., 1999). Though the cost for just 10 countries involved in PARC was a pricey 51.6

million European currency units, rinderpest was so devastating in terms of reduced productivity that the project was declared cost effective (Tambi et al., 1999).

From 1994 to 2003 rinderpest was detected in wildlife in Kenya (in Tsavo, Nairobi, and Meru National Parks). Surveillance of wildlife was considered of major importance in monitoring rinderpest control efforts (Kock et al., 2006). Tsavo National Park saw a rinderpest outbreak in the mid-1990s among wildlife with undetermined origin (Kock, 2006). From 1999 to 2006, 32 African countries participated in the Pan African Programme for the Control of Epizootics, a program partially funded by the European Union. This program continued the goals of PARC and involved communities in rinderpest monitoring and control (Tounkara, Nwankpa, and Bodjo, 2017). Community members were recruited to be trained in vaccine delivery and to create networks to distribute vaccines. Community knowledge and participation proved crucial in surveillance for re-emerging infections (Roeder, Mariner, and Kock, 2013). The Pan African Programme ended in 2006 when there was no longer rinderpest circulating in domestic or wild populations (Tounkara, Nwankpa, and Bodjo, 2017). The eradication of rinderpest has been indicated as the most significant perturbation on the Serengeti-Maasai Mara ecosystem in recent history (Sinclair et al., 2007). The effects of the removal of so many wild ungulates caused whole ecosystem changes in the late 1890s, including drastic changes in plant composition. The eradication of rinderpest and the subsequent drastic increase in ungulates caused further changes that are still being studied (Morens et al., 2011).

The rinderpest virus itself had several characteristics that made it a good candidate for eradication:

1) All forms of the virus were one serotype; different strains did not require different vaccines (Roeder, 2011).

2) Rinderpest infected all animals in contact with it within a very short period of time (in three months it could move through a whole herd of buffalo, with every animal becoming infected and either dying or recovering) (Kock, 2006).

3) There was no reinfection and no carrier state; exposed animals had lifelong immunity (Kock, 2006; Roeder, 2011).

4) Finally, and perhaps most importantly, wildlife was not a reservoir (Kock, 2006). Though wildlife could become infected and transmit the virus back to cattle, wildlife alone could not maintain the virus without continued reinfections from cattle (Kock et al., 2006).

The above points meant that rinderpest could be eradicated by focusing efforts on control in domestic animals, where control was possible. For diseases that are maintained in wildlife, such as malignant catarrhal fever, eradication is likely impossible because vaccination of wild animals on a scale large enough is impossible. The history of rinderpest is one of both devastation and great success, but it is likely a story that will be difficult to repeat with other livestock diseases because it is rare that a virus has all four of the characteristics listed above.

2.1.4 East Coast Fever

East Coast Fever (ECF) has been one of the most important livestock diseases in Africa from the early 1900s until today, and it has had dramatic consequences for the

Maasai (Gachohi et al., 2012; Hughes, 2010). ECF is a disease caused by a protozoan parasite called *Theileria parva*, which is transmitted to cattle by the brown ear tick, *Rhipicephalus appendiculatus* (Muraguri et al., 1998; Gachohi et al., 2012). Symptoms of ECF in cattle include severe diarrhea, swelling of the lymph nodes, edema, nasal discharge, high fever, respiratory distress, and emaciation (Giblin, 1990; Kimaro et al., 2012). Mortality can be extremely high in cattle with no resistance, especially in calves (Gachohi et al., 2012). ECF causes 30-60% mortality annually of calves born in areas of Tanzania (Homewood et al., 2006).

Overall, one million cattle per year are killed by ECF in Kenya and Tanzania, causing drastic economic loss through morbidity, mortality, and costs of control (Gachohi et al., 2012). In Tanzania alone, $35 million per year is lost to cattle mortality and over $6 million is lost to lowered milk production due to ECF (Homewood et al., 2006).

East Coast Fever is a difficult disease to control because wild animals, particularly buffalo, serve as a reservoir for the disease (Lewis, 1943). Cows can become carriers of ECF with no clinical signs, and yet they are capable of infecting any ticks that attach to them. These ticks then carry the disease to other cows (Giblin, 1990). When *T.parva* is transmitted from buffalo, it has the potential to become a more virulent and deadly strain known as Corridor Disease, which is endemic to buffalo populations (Giblin, 1990).

Maasai living in the Maasai Mara of Kenya rank ECF fifth in high impact livestock diseases (after MCF, anthrax, foot and mouth disease, and bovine pleuropneumonia) (Nthiwa et al., 2019). But in some Maasai areas, ECF is the single most important cattle disease (Gachihi et al., 2012). The tendency for cattle to be more susceptible to ECF in drought conditions means that drought resistant sheep are becoming a more preferred livestock animal to keep, potentially compromising the Maasai identity as people of the cattle (Kimaro et al., 2012; Nthiwa et al., 2019). Livestock diseases like ECF and the risks they pose to the security of a pastoral lifestyle is also a major driver for Maasai adoption of cultivation (McCabe, 1997).

Unlike rinderpest, ECF existed in Maasailand as a native disease before encroachment by Europeans. However, it existed in a naturally enzootically stable state prior to the rinderpest epidemic and colonialism (Giblin, 1990). Native zebu cattle have much more immunity to ECF than imported *Bos taurus* cattle, indicating a long history with the disease (Nyangito et al., 1996). In the traditional Maasai system of risk averse pastoralism, ECF was controlled and avoided in a way that kept infections very low (McCabe, 1997). Seasonal movement of cattle in pre-colonial times meant cattle were exposed to ECF on a seasonal basis; occasional exposure to the disease built resistance in the population (Giblin, 1990). Traditional Maasai coping strategies included burning areas to lower the tick population, which also encouraged more growth of grasses (McCabe, 1997). Maasai have a thorough knowledge of ECF; their ability to accurately diagnose it is comparable to modern veterinarians (Kioko et al., 2015; Jacob, Farah, and Ekaya, 2004). The Maasai possess many traditional remedies for ECF that are moderately to highly effective (Kioko et al., 2015). Twenty-five different plant species are used to treat various types of tick-borne diseases. These plants are made into topical pastes, ointments, and solutions and then administered to cattle; these treatments are usually over 50% effective (Kioko et al., 2015).

The enzootic stability of ECF in Maasailand was interrupted by the rinderpest panzootic and colonialism in many ways (Giblin, 1990). The rinderpest pandemic killed so many Maasai cattle that widespread immunity to ECF was lost in the population. There were so few cattle that the seasonal parasite transmission usually found was lost; when it resumed, ECF epizootics resulted (Giblin, 1990). Restriction of Maasai movement by the colonial government prevented them from moving their cattle out of tick infected areas during heavy tick seasons, and restrictions on burning caused tick populations to increase (Gachihi et al., 2012; McCabe, 1997).

The loss of enzootic stability and the repeated ECF epizootics in the early 1900s had direct and devastating results for the Maasai people, not only through loss of cattle, but by colonial policy influenced by the disease (Hughes, 2010). The Maasai had already been moved out of much of their land, and in 1911-1913 the colonial government moved them a second time, from Laikipia to western Narok District (Hughes, 2010; p. 146). This move was largely motivated by the desire to free up ECF-free land in Laikipia for white settlers (Hughes, 2010; p. 146). Narok was much worse for the Maasai: scarce water, poor pasture, and a very high load of ECF and malaria. For the Maasai, who view cattle health and human health as one, the double exposure to severe human and cattle disease was devastating. In the south, Maasai were exposed to more buffalo who carry the ECF infected ticks (Hughes, 2010; p. 148). The second move to Narok was viewed by Maasai as a direct attempt to exterminate them, leading to suffering and hatred of the colonial government (Hughes, 2010; p. 148). The effects of this move are felt throughout Maasailand even today. Maasai herds are subject to far more disease than they were in their northern rangelands, leading to increased struggles and poverty. Human disease has also increased over historical levels (Hughes, 2010; p. 148).

Another major factor in the increase of ECF in modern times is the introduction of dipping in the 1960s as a way to prevent ECF (Giblin, 1990). Dipping cattle in acaricides to prevent ticks is effective, but only if maintained (Kioko et al., 2015; Giblin, 1990). If dipping is stopped, inconsistent, or if the dips are diluted, immunity is lost and drug-resistant strains of ECF can develop (Giblin, 1990). Lack of infrastructure and access to dips means it is not widely maintained (Muraguri et al., 1998). Irresponsible selling of antibiotics and acaricides to Maasai in the 1990s without instruction has led to abuse, drug resistant bacteria and ticks, and a worse ECF situation for the Maasai (Jacob, Farah, and Ekaya, 2004).

Modern Maasai use acaricides, pasture burning, hand picking of ticks, topical application of kerosene, and cow dung for tick control (Kioko et al., 2015). Vaccination is also an option for ECF control, but the vaccine incorporates a pathogenic strain of the virus, meaning animals must be vaccinated, treated, and monitored for 14 days after administration (Muraguri et al., 1998). Rates of vaccination are very low due to high cost, low access, and perceived efficacy of the vaccine (Kimaro et al., 2017). This results in more vaccination by wealthy cattle owners, whose cattle survive better, causing the poor and subsistence farmers to fall even further behind (Homewood et al., 2006). In Kenya, in 1996, it cost smallholder farms 40-170 Kenyan shillings per animal annually to control ticks, and 200-400 shillings per treatment if an animal became infected (Nyangito et al., 1996). This price has likely increased.

Unlike rinderpest, ECF is a continuing problem in Maasailand with a low probability of eradication. Like MCF, the restrictions posed on the Maasai in modern times, and the decline of traditional knowledge and ethnoveterinary practices, means ECF is a continuing source of conflict between Maasai, ticks, and the buffalo who carry them (Jacob, Farah, and Ekaya, 2004).

2.1.5 Trypanosomiasis

Unlike most of the other diseases featured in this review, trypanosomiasis is a major problem for human health as well as animal health. Trypanosomiasis is a disease caused by protozoan parasites in the genus *Trypanosoma* and transmitted by tsetse flies in the genus *Glossina* (Machila et al., 2003; Steverding, 2008). The protozoan parasites live in the blood and tissues of the hosts and cause African sleeping sickness in humans and African animal trypanosomiasis in animals (Steverding, 2008). The human version of the disease is relatively rare as it is only caused by *Trypanosoma brucei*, which is not carried by tsetse flies at high rates. Animals can be infected by *T. congolense* and *T.vivax* as well, which are extremely prevalent in the tsetse population (Ormerod, 1976). The human resistance to most types of trypanosomes indicates a long evolutionary history in which humans have become resistant to infection (Steverding, 2008; Giblin, 1990).

African sleeping sickness in humans has two main stages (Steverding, 2008). In the first, the trypanosomes are present in the blood and lymph system and people experience fever, headache, joint pain, and itching. In the second phase, the parasites move into the cerebrospinal fluid, causing confusion, disturbed sleep, sensory disturbances, extreme lethargy, coma, and potentially death (Steverding, 2008). Animals infected with trypanosomiasis (also called nagana disease) experience fever, listlessness, emaciation, hair loss, discharge from the eyes, oedema, anemia, paralysis, and potentially death. All mammals can become infected, and it is often fatal in domestic animals (Steverding, 2008).

Most wildlife in tsetse areas is resistant to trypanosome infection; animals carry the parasites but do not experience symptoms (Steverding, 2008). Unfortunately, this makes them an efficient and mobile reservoir for disease to infect domestic animals and humans (Steverding, 2008). There is a positive association between the amount of wildlife and the amount of trypanosomiasis. Protected areas increase the tsetse populations, causing further problems, and migratory animals like wildebeest and zebra spread the infection to all areas within the tsetse zone (Ngongola, 2020).

It is not an exaggeration to say that trypanosomiasis has affected all of human history (Steverding, 2008). As will be discussed later, it helped determine the spread of pastoralism throughout Africa (Smith, 1992). The tsetse belt is some 8 million square kilometers between 14 degrees North and 20 degrees South latitude. This is the area in which hominids likely evolved, representing an evolutionary relationship with these protozoan parasites pre-dating the evolution of *Homo sapiens* (Steverding, 2008). Prior to colonialism, transhumant populations were better able to control their exposure to trypanosomiasis. Seasonal movement allowed areas to be inhabited that are too risky today (Giblin, 1990). At the end of the 19th century, tsetse flies and trypanosomiasis existed at very low levels throughout Maasailand. By the 1960s a few pockets of infection became a widespread risk (Sindiga, 1984). This is likely due to the effects of colonialism. The rinderpest epidemic of the 1890s killed so many Maasai and cattle that areas previously heavily grazed were abandoned. Since cattle grazing can prevent bush encroachment, these formerly grazed areas became bush, a much better environment for tsetse flies (Sindiga, 1984). Confinement of the Maasai to small areas removed their ability to move based on tsetse levels (Nnko et al., 2017). These factors caused three large trypanosomiasis epidemics in the 20th century that killed hundreds of thousands of people in Africa (Steverding, 2008).

Trypanosomiasis levels today are still higher than in pre-colonial times, despite massive and expensive eradication efforts. Control efforts started in 1910 with human relocation and bush clearing and continue today with selective clearing and spraying (Ormerod, 1976). Farmers today cite trypanosomiasis as one of the major constraints to cattle production; it reduces cattle density by 37-70% and milk and meat off-take by about 50%. Cattle are treated with ectoparasiticide dips and trypanocidal drugs at great cost to cattle owners (Machila et al., 2003; Kimaro et al., 2018). Widespread misuse of the drugs is causing drug resistant strains of the parasites (Machila et al., 2003). This situation is compounded by the loss of most of the trypanosome resistant taurine cattle in the rinderpest epidemic of the 1890s (Stock and Gifford-Gonzalez, 2013). Those trypanotolerant cattle had a more innate mechanism to control parasite infection and were not as reliant on an antibody response as the now dominant zebu cattle (Naessens, Teale, and Sileghem, 2002).

Trypanosomiasis causes over 3 million animal deaths annually across the 37 tsetse infected countries in sub-Saharan Africa (Taylor, 1998). The annual cost of tyrpanosomiasis in Africa is over one billion US dollars (Naessens, Teale, and

Sileghem, 2002). Large scale tsetse eradication programs are unlikely to succeed and there are no effective vaccines (Steverding, 2008). Protection of wildlife increases the reservoir for disease, and climate change may increase tsetse populations (Sindiga, 1984). For the Maasai, the constraints on their movement that now exist do not permit them to use their traditional avoidance strategies (Nnko et al., 2017). This is one of the many factors leading to diversification of Maasai livelihoods. Large cattle losses due to trypanosomiasis lead more Maasai to turn to crops (Nnko et al., 2017). This is yet another disease with no immediate solution that is increasing as people come into more contact with wildlife.

2.1.6 Foot and Mouth Disease

Foot and mouth disease, unlike rinderpest, has an ancient association with buffalo in Africa and has been circulating for centuries (Vosloo et al., 2002). However, unlike the other diseases discussed here, foot and mouth disease has not traditionally been considered a disease of great concern to pastoralists due to its mild clinical presentation and low mortality (Thomson, Vosloo, and Bastos, 2003; Vosloo et al., 2002). The problems and costs associated with foot and mouth disease are a product of modern cattle trade and restrictions imposed to prevent spread (Thomson, Vosloo, and Bastos, 2003).

Foot and mouth disease is a virus with many different strains and serotypes (some unique to Africa) that can infect all cloven-hoofed animals (Thomson, Vosloo, and Bastos, 2003; Vosloo et al., 2002). It is spread primarily by contact with the oronasal secretions of infected animals and occasionally via airborne particles, urine, or feces. Symptoms are generally mild and include lesions on the feet and mouth, myocarditis, malaise, low appetite, pyrexia, lameness, and fever. Infected animals usually recover in one to two weeks, but rare acute cases can cause death by heart failure (Thompson, Vosloo, and Bastos, 2003). Immunity to foot and mouth post-infection lasts one to three years and cattle can become carriers of the disease for up to 42 months (Thomson, Vosloo, and Bastos, 2003; Vosloo et al., 2002). Sheep and goats can also become infected, but rarely develop clinical signs and almost never become carriers (Anderson, Doughty, and Anderson, 1976).

In Africa, foot and mouth is endemic in the buffalo population with individuals acting as maintenance hosts (Bruckner et al., 2002; Thomson, Vosloo, and Bastos, 2003). Most buffalo are infected at two to six months old and have high antibody levels by one year; however, most do not develop clinical signs (Sutmoller et al., 2000). Up to 60% of the buffalo in Kenya are carriers of foot and mouth (Anderson et al., 1979). In Kruger National Park, South Africa, where the problem has been most studied, buffalo cause yearly outbreaks of foot and mouth in the impala population, resulting in high mortality (Sutmoller et al., 2000; Thomson, Vosloo, and Bastos, 2003). These outbreaks usually occur from June to November when buffalo calves become infected and shed the virus. This is also when water is scarce and animals congregate around water sources (Boshoff et al., 2000). This same situation sometimes causes outbreaks in cattle, who may enter the protected areas seeking water (Miguel et al., 2017; Jori and Etter, 2016). Impala do not generally become foot and mouth carriers because they have a much lower antibody response than cattle or buffalo (Boshoff et al., 2000). Outbreaks in wild animals like impala can extend and amplify outbreaks that can spread to cattle. Growing wildlife populations across Africa increase the domestic-wildlife interface and increase the risk of domestic animal infection (Ward, Laffan, and Highfield, 2007).

Trade restrictions imposed on countries with circulating foot and mouth disease result in high revenue losses (Thomson, Vosloo, and Bastos, 2003). Many countries, including most of Europe, the Unites States, United Kingdom, Australia, and New Zealand, are foot and mouth free and have strict controls on animal products imported from carrier countries (Thomson, Vosloo, and Bastos, 2003). The costs to these countries before eradication of the disease were huge. In 2001, the United Kingdom spent over $15 billion on foot and mouth control and eradication efforts and the United States spent $14 billion (Ward, Laffan, and Highfield, 2007). The restrictions these countries have put in place in order to remain foot and mouth free mean the livestock and animal markets of the developed world are not available to countries in Africa with the disease, leading to continued economic loss (Vosloo et al., 2002). The status of wild buffalo as maintenance hosts means that eradication in Africa is likely impossible (Thomson, Vosloo, and Bastos, 2003).

Some African countries, primarily South Africa, have attempted to create foot and mouth free zones in order to have more access to worldwide livestock markets (Bruckner et al., 2002). Game proof fences erected around Kruger National Park and a buffer zone where cattle are vaccinated and their movements restricted were created to prevent infection. In the late 1900s, parts of South Africa were declared free from foot and mouth, but outbreaks started back up in the early 2000s due to cattle/buffalo contact (Bruckner et al., 2002). Since 2000 South Africa has experienced a foot and mouth outbreak yearly in cattle, indicating their controls are no longer working (Jori and Etter, 2016). There are many reasons for this decline in effectiveness: an increase in elephant populations has led to more fence damage around Kruger, increasingly dry conditions mean cattle enter Kruger more often for water and come in contact with buffalo, the buffalo and antelope populations are increasing, and infected antelope can occasionally jump the fences to infect cattle (Jori and Etter, 2016; Sutmoller et al., 2000).

Attempting to control foot and mouth with fencing is extremely expensive and has ecological consequences for animal movements; this has raised many objections (Sutmoller et al., 2000; Thomson, Vosloo, and Bastos, 2003). Keeping cattle and wildlife separate is a barrier to multi-use areas, such as those being attempted in Kenya (Vosloo et al., 2002). Though foot and mouth disease was not a major concern for traditional Maasai pastoralists, modernization and the diversification of livelihoods has caused it to become a disease with economic impact. Increasing wildlife populations and increasing contact between livestock and wildlife will only increase foot and mouth outbreaks. This presents a large economic problem to African countries hoping to join world livestock markets. Currently there does not seem to be any viable solution.

As the above examples demonstrate, disease is a major source of human-wildlife conflict and has impacts on human emotions (e.g., EMCV), economic stability and security, and the identity of Maasai and other groups. I have chosen to focus on disease, specifically malignant catarrhal fever, in a human-wildlife conflict context. MCF is interesting due to the restrictive, narrow impacts. Because it is only significantly transmitted to cattle by young wildebeest, the problems it causes are confined to a very specific time and place: the Maasai Mara area of Kenya during the wildebeest migration. Due to the predominance of the Maasai in this area, they are the only ethnic group heavily influenced. This restriction to the problem has led MCF to be classified as unimportant in the scheme of world health issues. But the problems it causes the Maasai are severe. My focus on this disease is an attempt to raise awareness for an issue that, while not widespread, is acutely serious for this group of people.

2.2.0 Cattle Domestication and the Origins of Pastoralism

In order to fully understand the conflict between pastoralists and wildlife it is necessary to briefly discuss the prehistoric domestication of cattle and the development of the pastoral lifestyle in East Africa. The unique confluence of pastoralists, disease, and megafauna in East Africa that has led to the Maasai/wildebeest conflict is heavily influenced by the history of cattle domestication and species introduction and the development of pastoral livelihoods. A full understanding of the current conflict must be situated in these histories.

East Africa is unique because pastoralist lifestyles existed before farming (Gifford-Gonzalez, 2005; Marshall and Hildebrand, 2002). In most of the rest of the world, specialized pastoralism developed secondarily to sedentary lifestyles and farming (Gifford-Gonzalez, 2005). In Africa, the first food producing societies were mobile herders who developed directly from hunter-gatherer societies (Marshall and Hildebrand, 2002). This unique situation means that food producing was ultimately the result of the domestication of animals; thus, I shall discuss the likely route domesticated animals (focusing on cattle) took into Africa, in order to better understand how pastoralism developed.

What is a domesticated animal? Animals like giraffes and elephants found in zoos are not domesticated simply by virtue of being under human care. Instead, domesticated plants and animals have been modified by humans through selective breeding and are identifiably different from their wild ancestors and wild relatives (Magee, MacHugh, and Edwards, 2014). Domestication requires two main stages: the separation of specific individuals from the wild populations, and active intervention by humans in the life cycles of the animals, thus leading to behavioral and physiological changes (Magee, MacHugh, and Edwards, 2014). Domestication is a process that continues into modern times; it is not a single moment in time or an invention (Gifford-Gonzalez and Hanotte, 2011). Modern cattle were domesticated from the wild aurochs (*Bos primigenius*), a large and aggressive wild bovid that roamed across Europe, North Africa, and Asia (Magee, MacHugh, and Edwards, 2014; McTavish et al., 2013). Most wild aurochs were locally extirpated by 2000 BP, but a small population survived in central Europe until medieval times. The last of the aurochs is thought to have gone extinct in 1627 (Bradley et al., 1996; McTavish et al., 2013).

Modern cattle are divided into two main types: zebu/indicine (humped cattle) and taurine (straight backed cattle). The split between these two types of cattle likely took place long before domestication began, as far back as 330,000 years BP (Ajmone-Marsan et al., 2010). Along with a third variant of aurochs in North Africa, there were likely three subspecies of ancient aurochs (Magee, MacHugh, and Edwards, 2014). The presence of two types of cattle derived from two subspecies of aurochs indicates there were two distinct domestication events: one in southwest Asia of taurine cattle, and one in the northern Indian subcontinent of indicine cattle (Stock and Gifford-Gonzalez, 2013). The exact timing and locations of the first domestications of cattle are extremely contentious. Different lines of archaeological and DNA evidence support many different theories, but I will present the ones that are currently the best supported.

The earliest archaeological evidence of cattle domestication occurs in the Fertile Crescent of southwest Asia and is of the taurine type (Ajmone-Marsan et al., 2010; Pitt et al., 2018; Scheu et al., 2015; Magee, MacHugh, and Edwards, 2014). In this area sedentism first began around the 12th-10th millennium BC. Plant cultivation started around the 10th millennium and animal husbandry around the mid-9th millennium (Scheu et al., 2015). Archaeological evidence of domesticated animals is definite by 8,800 to 8,300 BC (Ajmone-Marsan et al., 2010; Magee MacHugh, and Edwards, 2014). Smaller bone size is widely accepted as evidence of domestication because as more manageable animals are selected, the resulting poor captive diet decreases size (Magee, MacHugh, and Edwards, 2014). This area is also the likely origin of domesticated sheep, goats, and pigs, though they are not the focus here (Scheu et al., 2015). Indicine type cattle were domesticated separately in the Indus Valley around 1,500 years after the domestication of taurines (Ajmone-Marsan et al., 2010; Pitt et al., 2018). Taurine type cattle spread widely across the near East and Europe. By the 7th millennium BC, they were in Western Anatolia, by 6,400 BC they were in Greece (Scheu et al., 2015). They spread into Europe via southeastern Europe and the western Mediterranean (Scheu et al., 2015). By the 6th millennium BC, they were in western, central, and northern Europe, and by 3,000 BC they were in northeast Asia (Ajmone, Marsan et al., 2010). Mitochondrial DNA indicates that European cattle all came from this spread of near Eastern taurine cattle and that no domestication of European aurochs occurred, nor was there significant inbreeding between introduced domesticated cattle and wild aurochs (Edwards et al., 2007; Scheu et al., 2015).

The two major domestication events in the Fertile Crescent and Indus Valley are not heavily disputed. The major debate surrounding the domestication and spread of cattle is over the possibility of a third independent domestication event in Africa (Stock and Gifford-Gonzalez, 2013). This debate is currently unresolved but has major implications for African prehistory and so will be presented briefly here. The main argument is whether cattle were introduced to Africa from southwest Asia or whether cattle were domesticated independently in Northern Africa from wild aurochs of the North African variety (Stock and Gifford-Gonzalez, 2013). There are many lines of evidence for both theories.

Marshall and Hildebrand (2002) are proponents of the separate domestication of cattle in Africa. They propose that wild aurochs of the North African subspecies were domesticated by Saharan hunter-gatherers in the tenth millennium BP. Until 10,000 BP the Sahara was a fairly wet and consistent environment conducive to hunter-gatherers and likely not stressful enough to develop pastoralism as an alternate lifestyle (Smith, 1992). Around 9,500 years ago the Sahara became drier and more seasonal, creating a situation of food uncertainty (Marshall and Hildebrand, 2002). In this marginal and unpredictable environment, it was critical for hunter gatherers to be able to predict their access to food resources. With such high variability in rainfall, domesticating animals creates a more reliable access to food than domesticating plants (Marshall and

Hildebrand, 2002). Marshall and Hildebrand (2002) also argue that at this time society had developed a sense of ownership, allowing pastoralism to emerge and develop rituals requiring scheduled consumption of meat, necessitating predictable access.

The theory of independent domestication in Africa suffers from a lack of archaeological evidence (Bradley et al., 1996). It relies mainly on the sites of Nabta Playa and Bir Kiseiba that date to 9,000 BP and contain highly contested bovid remains (Bradley et al., 1998). If the bovid remains there are domesticated cattle, they would support independent domestication, but the bones are within the size range of wild aurochs and do not show any significant decrease in size, indicating they could be wild (Bradley et al., 1998; Smith, 2006). However, it has also been argued that the Sahara at that time would have been dry enough to be difficult for wild aurochs to survive on their own (Smith, 2006). Morphological changes in domesticated cattle take time, likely 30 generations or around 200 years (Magee, MacHugh, and Edwards, 2014). Mitochondrial DNA from modern cattle lends some support to African independent domestication (Beja-Pererira et al., 2006). However, the large portion of wild African auroch DNA in modern African taurine cattle can also be explained by interbreeding of wild aurochs with introduced domesticated cattle (Decker et al., 2014; Pitt et al., 2018).

Though the independent domestication theory does have some backing, there is currently more support for the introduction of taurine domesticated cattle from southwest Asia (Stock and Gifford-Gonzalez, 2013). The most likely route of introduction from southwest Asia is either the Nile Valley or the Horn of Africa (Stock and Gifford-Gonzalez, 2013). Evidence for domestic taurine cattle in Africa is definite by 6,530 BP at Capeletti, Algeria (Bradley et al., 1998). By 7,400 BP cattle bones found at African sites are much smaller than the Nabta Playa remains (Smith, 2006). The earliest cattle in Africa were taurine cattle, as evidenced by pictorial representations, skeletal evidence, and Dynastic Egyptian art depicting cattle with straight backs and lyre-shaped horns (Bradley et al., 1998; Gifford-Gonzalez and Hanotte, 2011). Domestic cattle and pastoralism spread across North Africa from 7,000 to 5,000 BP, into the Sudan by 6,000 BP, and into East Africa by 4,000 BP—becoming widespread there by 3,000 BP. It finally arrived in southern Africa by 2,000 BP (Marshall and Hildebrand, 2002). This spread of pastoralism is similar in time and space to the spread of Bantu languages in Africa. The two may be linked; Bantu speaking peoples may have spread the ideas of pastoralism as they migrated through Africa, or the idea could have spread with the language without any actual movement of people (Filippo et al., 2012). In most areas, hunter-gatherer cultures endured long after contact with pastoralists (Marshall and Hildebrand, 2002).

Zebu cattle were likely introduced to Africa starting around 2,000 BC through the Horn of Africa (Ajmone-Marsan et al., 2010; Gifford-Gonzalez and Hanotte, 2011). Zebu introductions became rapid starting after 700 AD (Ajmone-Marsan et al., 2010). The introduction of zebu resulted in hybridization rather than replacement, resulting in the south African sanga cattle that are commonly seen today (Hanotte et al., 2002; Ajmone-Marsan et al., 2010). Most African cattle today are zebu, or zebu hybrids, and their greater resistance to rinderpest allowed them to rapidly spread across Africa and replace much of the original taurine stock (Ajmone-Marsan et al., 2010; MacHugh et al., 1997, Gifford-Gonzalez and Hanotte, 2011). The decimation of the original taurine stock by the rinderpest epidemic of the late 1800s is one of the factors that makes genetic analysis of African cattle so challenging (Stock and Gifford-Gonzalez, 2013). But while the zebu are prized for their resistance to rinderpest, they have none of the resistance to tsetse born trypanosomiasis that the original taurine stock possessed. Their domestication has spread with the help of veterinary care (MacHugh et al., 1997). The critical role that disease has played in the spread of domesticated cattle and pastoralist lifestyles cannot be understated. We will now turn to a brief description of the origins of pastoralism and its spread in Africa.

2.3.0 The Spread of Pastoralism

As mentioned previously, sedentism and farming generally precede specialized pastoralism. As a result, the development of pastoralism is often discussed in terms of its growth out of agricultural communities. Mesoamerica has its own domestication events and timeline that is beyond the scope of this work. In the Old World, domestication of plants and animals is thought to have taken place largely in conjunction with one another (Bower, 1991; Lee and Bates, 1974). Early food producers aimed to control the predictability of access to food resources. Transplantation of plants is often thought to be the first step, done to increase their accessibility, with increases in yield coming later (Marshall and Hildebrand, 2002). Domesticated animals minimize the effects of environmental unpredictability by storing energy in live, mobile bodies. Animals can avoid many of the same disasters that lead to crop failure and allow more food security (Lee and Bates, 1974). Lee and Bates (1974) theorize that a specialized pastoral lifestyle developed from agricultural societies that practiced irrigation. Irrigation allows farming to spread to new environments not necessarily conducive to keeping domestic animals. This causes the population or household to split into those remaining sedentary to practice farming and those traveling to care for the animals. Thus, specialized pastoralists live in association with farming communities. This hypothesis is interesting in the context of African pastoralists. Though they did not develop from agricultural communities, they can rarely survive alone and generally need to associate with agricultural or hunter-gatherer communities to weather disasters (Waller, 1993).

The prevalence of pastoralism in Africa, and its development before farming, is likely due to the extremely seasonal and unpredictable nature of the environment in much of Africa (Gifford-Gonzalez, 2005). Pastoralism allows herds to shrink and expand during changes in environmental productivity. A focus on milk instead of meat allows energy to be produced by animals even in poor conditions. For this reason, it is likely that hunter-gatherers in Africa adopted some small stock before becoming specialized pastoralists (Gifford-Gonzalez, 2005). Before I discuss the possible development of pastoralism in Africa, I will introduce Tim Ingold's (1980) seminal work on reindeer pastoralism as well as more recent critiques of, and responses to, it (e.g., Armstrong Oma, 2010 and Howes, 2022) as the Skolt Lapps represent one of the only cultures outside of Africa that developed pastoralism directly from a hunter-gatherer lifestyle. Though somewhat dated, Ingold's study is critical to more recent work; it built the foundation for much of the research into the development of pastoralism.

The association between humans and reindeer (*Rangifer tarandus*, also called caribou) in the Arctic circle goes back nearly half a million years (Ingold, 1986). The unique reindeer keeping societies of the north developed directly from societies that hunted reindeer. These distinctive societies also represent one in which reindeer are kept in a relatively wild state, with no morphological differences from their wild counterparts (Ingold, 1986). The Arctic Circle is the only place where hunting and pastoralism occur in the same environment, focusing on the same animal (Ingold, 1980). Ingold explores how reindeer hunters became reindeer pastoralists, and then how some developed into reindeer ranchers in modern times.

Reindeer hunting societies are essentially predatory on the animals they rely on (Ingold, 1980). Traditional hunting societies such as the Skolt Lapps studied by Ingold (1980; p.11) do not significantly decrease reindeer populations and exist in equilibrium with them. Human hunters do not follow reindeer herds year around like wolves do, but instead attempt to find them periodically. When they are unsuccessful, they survive off stored reindeer meat. Unlike tropical hunter-gatherers who do a significant amount of foraging and do not kill more than they can immediately consume, Arctic hunters rely entirely on hunting and kill as much as they can for consumption and storage (Ingold, 1980). Reindeer hunting societies do possess some tame animals. These animals are not bred and are often obtained from wild stock. They are used for labor in moving hunting camps and as live decoys for luring reindeer prey. These tame animals have a status as quasi-persons. Though they will inevitably be eaten, either in times of scarcity or when their lives naturally end, they are treated more as family members than as consumables (Ingold, 1980).

Armstrong Oma (2010) disagrees with Ingold on this point. She sees the relationship between animals and humans in the hunter-gatherers as less trusting than in pastoralists. Armstrong Oma (2010) believes caring for animals requires the development of trust, and domestication requires formation of a social contract between animals and humans. Ingold (1996) clarifies his view of hunter-gatherers as one with no separation between mind and nature and in which the humans view themselves as entirely integrated into the natural world. Thus, their relationship with animals is less separated than with pastoralists.

Hunting bands survive hardship with a strong focus on sharing resources (Ingold, 1980). In a hunting society, animals belong to no one until they are dead. At this point, complex rules of ownership and redistribution come into play, thus ensuring everyone has some claim to the meat. In this way, everyone ends up with a portion, and the band as a whole survives. However, if tame animals are slaughtered during hard times, only the family that owned the animal has any claim to the meat. This is a good fallback resource if hunting fails and is the root of what Ingold (1980; p. 24) calls “carnivorous pastoralism.” Reindeer pastoralists practice carnivorous pastoralism. Ingold believes the major uncertainty for hunters in the Arctic is animal movement and whether hunters will be able to locate the animals when needed (1980; p. 56). Carnivorous pastoralists keep animals near them, thereby reducing that uncertainty. Milch pastoralism (Ingold, 1980; p. 25), the type practiced in East Africa and the primary focus of this research, centers on milk as an energy resource and does not require herds to be reduced or animals to be slaughtered for everyday subsistence. In milch pastoralism, putting labor into resources (e.g., breeding) allows increased yield and therefore increased human population. In contrast, carnivorous pastoralism does not produce an increased yield (over a hunting lifestyle). Ingold (1980) theorizes carnivorous pastoralism is not an ecological adaptation, but a social one. He proposes this further by pointing out that protecting herds from natural predators, like wolves, actually introduces disequilibrium to predator-prey relationships and is not a good long-term ecological adaptation.

Reindeer hunters did become pastoralists and Ingold (1980) suggests it was in response to a regional scarcity of prey. Thus, he believes the social relation of keeping tame animals in the hunting society developed into an ecological relation of herding animals in a pastoralist society. Hunting techniques became adapted to herding and animal husbandry. Animals obtain social significance at birth and ownership of meat is retained by the family, with no obligation to share (Ingold, 1980; p. 157). Once breeding develops, wealth can be accumulated, and social classes develop. Hunting bands fragment into small autonomous pastoral families. If animals are accumulated, they may become gifts, loans, or marriage payments to others, creating bonds of reciprocity. Labor may also be exchanged for milk or animals, creating avenues for animal-poor members to advance in a pastoralist economy (Ingold, 1980; p. 168). As in East Africa, unlucky reindeer pastoralists who lose their animals often must shelter with coastal communities of hunter-gatherers (Ingold, 1980).

Ingold may have ignored the possibility that tamed animals may have become domesticated through a process of enskilment (Losey et al., 2020). Losey et al. (2020) argue that since domestic reindeer are not physically different from wild reindeer, their domestication may have been more of a process of learning with humans than an intentional exertion of domination by humans. They point out that even animals bred as domesticates will not act like properly domesticated animals if not enskilled in the behaviors that go along with proper domesticated behavior. For example, reindeer need to be trained to corral calmly. Even if they are born into a domesticated herd, they must acquire this behavior by performing it repeatedly; it is not innate (Losey et al., 2020; p. 21). Additionally, humans who are not practiced in caring for domesticated animals may not be able to get animals to perform properly. If humans and reindeer entered into an ongoing process of learning and becoming within a particular landscape, domestication could have occurred through a process of enskilment of both animals and humans (Losey et al., 2020).

The situation proposed by Ingold (1980) demonstrates how a hunting economy can develop into a pastoral one without cultivation as a middle step. Though the type of pastoralism is different, reindeer pastoralism does resemble East African milch pastoralism. Ingold (1980) further describes how some pastoralists have developed into ranchers in modern times. He asserts that the main difference between hunting and pastoralism versus ranching is ownership of grazing land. In hunting and pastoralism, land is communally owned. Ranchers attempt to keep grazing land to themselves, allowing maximum herd growth. Ranchers focus on quality of stock over quantity because their focus is on producing animals for a market, not on maintaining a herd for subsistence. This is reminiscent of modern changes in East Africa.

The key takeaways from Ingold's (1980) discussion of reindeer pastoralism are the three main conditions he outlines for development of a pastoral society: herds must be followed, herds must be protected from their natural predators, and herds must be exploited selectively to allow for optimal growth in good conditions (Ingold, 1980).

Smith (1992) presents a situation for the development of pastoral ideas in Africa that is somewhat similar to Ingold's. Hunter-gatherers must have intimate knowledge of animals and there must be sufficiently stressful ecological conditions. Along with social conditions, including ideas of ownership, this situation can lead a gathering society to become a producing one. Food production takes more work and labor than gathering, so all these conditions must be met. Hunters in Africa may have manipulated some aspects of animal behavior and become full pastoralists, much as some gatherers translocate plants before becoming full agriculturists (Smith, 1992; Marshall and Hildebrand, 2002). In the conditions of the Sahara where water is seasonal, humans and wild bovids may have gathered at watering sites, leading to human control of herd movements and eventually to selective breeding (Smith, 1992). The idea of pastoralism and selective breeding may have already been present for small stock kept by hunter-gatherers (Gifford-Gonzalez, 2005).

It is also possible that the idea of pastoralism was not invented in Africa at all but imported to the continent with the initial domesticated cattle (Smith, 2006). Many have pointed out the rarity of going directly from hunting to pastoralism as evidence that the whole idea was imported, though Ingold proves that a direct hunting to pastoralism transition is not impossible (Smith 2006; Ingold, 1980). The continued presence of many hunter-gatherer groups throughout Africa suggests it would still have been a perfectly viable lifestyle. Smith (1992) points to the San (a hunter-gatherer people in Southern Africa) as one such example. He claims the conditions must not have been right or they could easily have domesticated eland (*Taurotragus oryx*) long ago. However, much of Smith’s (1992) argument relies on the “tractability” of eland as a reason they would be easy to domesticate. As someone who has worked with captive eland, I respectfully disagree on their tractability. Of course, there is also the distinct possibility that these remaining hunter-gatherer populations chose to remain so. One of the models of pastoralism suggests that hunter-gatherers were forced into it because they killed off all their megafauna prey (Hurn, 2012; p. 61.). There are many disadvantages to domestication, leading to its possible rejection by some groups.

Regardless of the method of pastoralism introduction to Africa, the pastoral lifestyle existed in the Sahara by 7400 BP (Smith, 2006). The initial pastoral development in North Africa took place in three periods. The Early Pastoral Period (7400-6400 BP) included mainly small groups of herders with cattle and small stock moving between the mountains and the plains. After a dry spell from 6400 to 6080 BP, the Middle Pastoral Period (6080-5000 BP) saw more predictable conditions and expansion of pastoralism, with freshwater lakes as focal points for communities. In the Later Pastoral Period (5000-3500 BP), weather conditions became more unpredictable; fewer cattle bones and more small stock bones appeared, and near the end, gardens and domestic grains were adopted (Smith, 2006). These three periods came with accompanying archaeological differences (e.g., in pottery styles), but that is beyond the scope of this discussion.

By the Late Pastoral Period, pastoralism started to spread out of North Africa as the rains moved south and the Sahara became drier (Smith, 2006). Around 4500 BP pastoralism spread into northern Kenya (Ranciaro et al., 2014). The earliest pastoralists in Kenya were the oldest food producers in East Africa and still had strong relationships with foragers (Bower, 1991). Specialized pastoralism developed around 3000 BP when the bimodal rainfall pattern developed (Smith, 1992). Bimodal rainfall allowed for year-round harvesting of milk. Combined with the ability to simply trade or steal grain from agricultural neighbors (who made it to East Africa around 3500 BP) pastoralists no longer needed to practice any other form of food production (Smith, 1992). Pastoralism took root in northern Kenya 1,000 years before it spread southwards to southern Kenya and Tanzania. This was largely due to diseases. Malignant catarrhal fever and East Coast Fever represented significant obstacles for pastoralists. These areas could not be occupied until cattle developed disease immunity (Gifford-Gonzalez, 2005). The tsetse boundary also played a major role in the spread of pastoralism. Tsetse flies require at least 500 mm of annual rainfall, creating a barrier to southward movement of pastoralism that could not be penetrated until cattle developed immunity or until it dried out enough for mass tsetse die off (Smith, 1992). It is unclear what route pastoralism took into southern Africa, but it was likely down the Atlantic coast (Smith, 1992). By 2000 BP pastoralists inhabited every part of Africa (Marshall and Hildebrand, 2002). The spread of pastoralism is still ongoing, and the remaining hunter-gatherers in Africa, such as the San, are slowly converting to pastoralism (Smith, 1992). As pastoralists become familiar with markets, herds are converted from means of production to commodities, thus transforming pastoralists to ranchers as described by Ingold, or causing a split in labor between men ranching for profit and women leading traditional subsistence lifestyles (Smith, 1992; Ingold, 1980).

The importance of pastoralism to the history of Africa can be seen in the DNA of modern African people. Pastoralism is a strong selective force for lactase persistence, the ability to digest lactose into adulthood (Ranciaro et al., 2014). Just one mutation exists in all Eurasian populations to allow lactase persistence (Stock and Gifford-Gonzalez, 2013). In Africa there are three unique mutations to allow lactase persistence

(Stock and Gifford-Gonzalez, 2013). This gene is so dominant that it is found in most hunter-gatherer societies with pastoralist neighbors (Ranciaro et al., 2014).

The major benefit of pastoralism lies in security within a variable and unpredictable environment. A pastoral economy allows herds to shrink and expand with ecological productivity and focuses on herd accumulation as the ultimate protection against disaster, disease, and poor climatic conditions (Gifford-Gonzalez, 2005, Ingold, 1980). But of course, pastoralism exists within an environment filled with undomesticated wildlife. Ingold's requirements that herds be protected from predators and outside forces, while being grazed on communal land and alongside wildlife, brings pastoralists into constant contact and conflict with surrounding wildlife.

2.4.0 Human-Wildlife Conflict in Pastoralist Societies

Pastoral societies are found worldwide. Everywhere they encounter the same conflicts with wildlife; depredation of domestic animals by wild carnivores (lions in Africa, wolves in the United States, tigers in Asia, etc.), crop loss and damage due to crop pests (wild ungulates and primates across Africa and Asia), restrictions on land use due to exclusion from protected areas, and competition with wildlife for land and water (Distefano, 2005). These conflicts are neither new nor localized; they are common to all pastoralists, including the Maasai.

Resource competition between pastoralists and their animals and wildlife occurs when there is a shared resource, that resource is limiting, and one user has a negative effect on the other users' access to the resource (Naimir-Fuller et al., 2012). Competition most often occurs over water, pasture, and salt licks (Naimir-Fuller et al., 2012). In the Indian Himalayas domestic sheep and goats limit pasture for wild ibex and exclude them from certain areas (Baychi, Mishra, and Bhatnagar, 2004). In the Horn of Africa insecure access to water and pasture brings pastoralists into protected areas, where they come into conflict and competition not just with wildlife, but with conservation wardens as well. This conflict can lead to violence (Mkutu, 2001). In Ethiopia, droughts cause domestic animals and wildlife to compete for water and pasture, causing conflict and negative feelings toward wildlife (Fentaw and Duba, 2017). In Tanzania, competition over pasture and water is the main form of human-wildlife conflict for pastoralists (Kiondo, Nachihangu, and Mgumia, 2019).

Resource competition appears to be a difficult conservation obstacle. However, much resource competition is perceived, not real. In India pastoralists believe their rangelands are overstocked with kiang (*Equus kiang*)—a large species of wild ass (Bhatnagar et al., 2006). Competition for grazing land with kiang interferes with pastoralists' ability to increase their herds and raise goats for the lucrative cashmere industry. However, studies have shown kiang consume hardly any of the available pasture and exist at levels well within their carrying capacity (Mishra et al., 2002). The perception of excessive amounts of kiang is a product of a sharp decline in their population in the previous decades, making their recovery seem like overstocking. On the landscape level, this conflict is not real but a perception by people living marginal and uncertain lifestyles. On the micro-scale level, certain pastures may be overgrazed by kiang and these localized conflicts can lead to decreased tolerance and a perception of overall conflict (Bhatnagar et al., 2006). These are the types of conflicts that have the potential to be solved with a combination of conservation actions and education. Easing small scale conflict may reduce the negative feelings toward kiang, and education on their uniqueness and importance can help increase positive feelings.

Perceived threats or conflicts with animals can have very real effects on people's tolerance of them. This is especially noticeable with large carnivores like wolves (Arbieu et al., 2019). People living near areas where wolves can be seen are far less tolerant of them, regardless of whether they are actually causing problems (Arbiea et al., 2019; Naughton-Treves, Grossberg, and Treves, 2003). This can have profound effects on wildlife management when decisions are subject to public votes.

Depredation of domestic animals occurs worldwide. In Ethiopia depredation by hyena (*Crocuta crocuta*) and jackal (*Canis simensis*) causes the most economic losses of any conflict issue (Fentaw and Duba, 2017). In the Himalayas, livestock losses to snow leopards (*Panthera uncia*) and wolves (*Canis hamalayensis*) lead to hunting of these already endangered species (Mishra, 2001). In the Gobi, wolves (*Canis lupus chanco*) prefer domestic livestock over the native prey species, a sheep called the argali, and wolves kill 1-4% of all livestock kept (Ekernas et al., 2016). Pastoralists then kill wolves to prevent livestock loss, even though wolves are culturally valued in the area. The Gobi is one example where conflict issues are interrupting the natural predator-prey dynamics. The presence of livestock causes a decrease in native prey species by resource competition, the wolves then select for livestock, and are then killed themselves (Ekernas et al., 2016). In Tibet, wolves and bears are persecuted for livestock depredation and destruction (Fox et al., 2002).

In the United States, depredation on domestic animals by wolves is a major political issue (Naughton-Treves, Grossberg, and Treves, 2003). Transhumant grazing is common in the arid western United States and ranching is often viewed as one of the most profitable uses of relatively unproductive land (Huntsinger, Syre, and Wulfhorst, 2012). Rancher-wildlife relations are determined by the Endangered Species Act, which restricts actions that can be taken on land with endangered species present. This perceived inconvenience has led to common killing and removing of species to avoid compliance with the law (Huntsinger, Syre, and Wulfhorst, 2012). In the Southwest, ranchers have hunted large predators like wolves to extinction. Small mammals perceived as pests (mainly prairie dogs) have been hunted to near extinction (Huntsinger, Syre, and Wulfhorst, 2012). Efforts by conservationists to protect and reintroduce wolves are met with a great deal of aggression and hostility from ranchers (Naughton-Treves, Grossberg, and Treves, 2003). Lobbying groups exist on both sides and the issue often becomes political. Growing up in the western US, I found that feelings about wolves and reintroductions could become quickly heated, even among people with few ranching ties. Ranchers view the Endangered Species Act and wolf reintroduction efforts as unnecessary interference by the federal government (Naughton-Treves, Grossberg, and Treves, 2003). This is also a common viewpoint in Africa, where protected areas and conservation measures are often met with hostility and viewed as attacks on certain groups (Kiondo, Nachihangu, and Mgumia, 2019).

Pastoralism and wildlife conservation are not inherently conflicting systems of land use. In sub-Saharan Africa, rangeland degradation has been assumed to be the result of overgrazing by pastoralists for more than a century (Naimir-Fuller et al., 2012). Current science suggests it is more likely the result of climate fluctuations in the inherently unstable Serengeti environment. Some grazing by livestock can actually increase overall biodiversity of rangelands and benefit wildlife (Naimir-Fuller et al., 2012).

The Tibetan plateau is inhabited by mobile pastoralists who live alongside endangered Tibetan antelope (*Pantholops hodgsonii*) and wild yaks (*Bos mutus*) (Fox et al., 2002). Like all pastoralists, those in Tibet work to increase their herds to minimize disaster losses, mostly due to heavy snowfall. Today, overstocking herds is even more critical for these pastoralists, now that hunting is illegal, thus removing their fallback option in the event of herd loss. Fox et al. (2002) argue that pastoral development is incompatible with conservation of antelope and yak in this area. However, they also admit that most antelope hunting is done by organized poachers, not locals, and that nomadic pastoralists have not impacted yak numbers (Fox, 2002; p. 23-24). They still do not advocate for protections of pastoralism, and claim pastoralists “exacerbate” declines in wildlife, despite direct evidence to the contrary (Fox et al., 2002). This is the kind of unproductive attitude that is still common.

Rather than dismiss pastoralism as incompatible with conservation, researchers should give pastoralists a voice to make their arguments if conservation is to be allowed to work (Naimir-Fuller et al., 2012; p. 18). When authorities and conservationists fail to address human-wildlife conflict, it can escalate into conflicts between humans about wildlife (Madden, 2008). This is the situation in parts of Uganda. Tourism to see gorillas (*Gorilla berengei berengei*) has led to habituated animals who cause extensive crop destruction for locals. Failure to address the issue has helped no one; humans lose crops and then kill gorillas in retaliation. The locals, the conservationists, and the gorillas all lose (Madden, 2008). Cooperation is the only way to success. A main goal in this research is to help both local Maasai and conservationists understand one another and work together effectively.

The following sections describe conflicts specific to the Maasai and some of the mitigation methods used in Africa to overcome major types of conflict.

2.4.1 Human-Wildlife Conflict Among the Maasai

The predators most likely to kill livestock in Kenya are spotted hyenas (*Crocuta crocuta*), lions (*Leo panthera*), leopards (*Panthera pardus*), and cheetahs (*Acinonyx jubatus*). However, hyenas, leopards, and cheetahs are more likely to kill goats and sheep, while lions are more likely to kill the more valued cattle (Hazzah et al., 2009). The same pattern is seen on the Maasai steppe in Tanzania (Kissui, 2008). Hyenas and leopards tend to attack animals in *bomas* at night, while lions tend to attack grazing animals during the day (Kissui, 2008). In both places, there is more depredation during the wet season, likely because there are more predators following the ungulates (Mponzi et al., 2014). Lions are hunted by the Maasai more than any other predator due to their killing of monetarily and culturally valuable cattle, the ease of tracking them, their tendency to hunt during the day, and the prestige brought by killing them (Kissui, 2008; Hazzah et al., 2009). Retaliation killings are becoming a serious problem for lions; their numbers are currently extremely low. The mortality in areas bordering protected areas could act as a population sink, negating the efficacy of the protected area (Kissui, 2008). Lions have thus been the subject of extensive research on human-wildlife conflict and possible mitigation methods (Hazzah et al., 2014; Schuette, Creel, and Christianson, 2013; Lichtenfeld, Trout, and Kisimir, 2015; Blackburn et al., 2016).

Elephants are another charismatic animal causing considerable conflict. The most common form of human-elephant conflict is crop raiding, which has been occurring in Africa and Asia for centuries. It used to be a major driving force in determining where villages and agriculture occurred (Nelson et al., 2003). Crop raiding usually occurs at night and at the end of the wet season when crops are maturing (Hoare, 1999). Maize is the crop most often consumed by elephants, but they have also been known to eat a huge variety of crops, including beans, wheat, potatoes, bananas, sugar cane, millet, pumpkins, spinach, onions, tomatoes, carrots, and orange and other fruit trees (Thouless, 1994). One of the problems with crop raiding is that it does not appear to be consistently linked to elephant population size, density, or crop quality. The only reliable constant is that bulls seem to do more crop raiding than cows (Hoare, 1999). This has led some scientists to believe that crop raiding depends heavily on the behavior of the individual bulls in the area (Hoare, 1999). Total elephant crop losses tend to be relatively low and are far exceeded by losses to other pests such as primates, suids, rodents, birds, and insects (Hoare, 2000; Perera, 2009). However, elephants tend to be discussed and disliked more by local people due to their ability to destroy vast numbers of crops in one incident and their potential to threaten human lives and safety (Hoare, 2000).

Crop raiding, and human-elephant conflict in general, are extremely widespread and occur everywhere humans and elephants overlap (Hoare, 2000). As humans expand, and as governments encourage pastoral people to settle down, more and more agriculture occurs in elephant areas. Additionally, elephant habitat is fragmented and lost, and elephants are forced into increasingly smaller protected areas (Nelson et al., 2003). In 1962 the human population in Kenya was 8.6 million. In 2019 it had increased to 52 million. As this trend continues, the problem will increase (Omondi et al., 2004). No mitigation methods have proven entirely effective, despite the variety of methods attempted. Perera (2009; p. 47-48) summarized the mitigation methods discussed by Nelson, Bidwell, and Sillero-Zubiri (2003) into the following categories:

- physical barriers such as fences (electric, non-electric, and living fences such as cactus fences) and trenches
- vigilance methods such as buffer zones of crops, watchtowers, string fences, and lights or fires
- deterrent methods such as buffers of unpalatable crops (chilis being common), noise (bee noises, alarm calls, or banging), fire and light, string fences with chili or other irritants applied, and nails and spikes
- repulsion methods, like noise and injuring or killing the elephants
- elephant drives back to protected areas
- capture with translocation
- culling and lethal methods
- compensation schemes
- land use planning

Though none of these mitigation methods have been reliably effective in all situations, the varied choices demonstrate the scale of the crop raiding issue.

Crop raiding is not the only way in which elephants come into conflict with humans. Elephants are known to raid and destroy grain stores when there are no crops in the fields (Hoare, 1999). Elephants can cause extensive property damage, including destroying fences, dams, animal drinking troughs, water tanks, and wells (Thouless, 1994). Another component of human-elephant conflict is the disruption to everyday human activities such as traveling to work and school, which can become a serious hazard when elephants are in the area (Sitati et al., 2003). Competition over water can frequently be the main source of human-elephant conflict for pastoral people. Elephants may chase cattle away from water and even be responsible for deaths of cattle and other livestock (Thouless, 1994). During the dry season when wells are dug for water, elephants may destroy them (Thouless, 1994). Over the years, the David Sheldrick Wildlife Trust in Nairobi has cared for several elephant orphans who have fallen down wells (David Sheldrick Wildlife Trust, 2019).

Perhaps the most serious way in which elephants impact humans is by directly causing human injury or even death. Deaths resulting from elephants have been reported for people herding their livestock, harvesting crops, collecting firewood, and traveling through the bush (Thouless, 1994). In the TransMara District, 35 cases of human death and injury by elephants were reported between 1986 and 2000 (Sitati et al., 2003). In Samburu districts, nine deaths and 13 injuries were reported over a four-year period (Thouless, 1994). Though the incidence of death and injury may not be extremely high, it can cause significant fear for local people and prevent them from traveling to certain areas or even sending their children to school (Sitati et al., 2003).

The many ways in which elephants and humans clash in overlapping areas makes human-elephant conflict an extremely difficult situation to manage. However, some successful mitigation projects have been attempted with elephants and other animals, and these will be discussed next as comparative points of reference for mitigating Maasai conflict with wildebeest.

2.4.2 Mitigation Methods and Elephants

One of the most common types of mitigation methods used to prevent elephant crop raiding is fencing. Several experiments have attempted to determine what types of fencing are most successful for keeping elephants out of farms. Electrified fences are generally considered effective, but they are expensive to create and maintain and are not effectively deployed in a widespread manner (King et al., 2011). Some studies have found that non-electrified barriers are rarely successful (Sitati and Walpole, 2006). Attempts to use non-electrified fencing methods are still being pursued.

One popular method of deterring elephants is the use of chili grease or chili oil rubbed on fences (Sitati and Walpole, 2006). Van Hagen (2019) tested metal strip fences, chili fences, acacia fences, and a combination metal strip/chili fence to determine the efficacy of different fencing types. Though chili fencing was more effective than plain acacia fencing, and the combination of metal and chili was even more effective, no fence was entirely successful (Van Hagen, 2019). Sitati and Walpole (2006) found that elephants did not want to cross ropes rubbed with chili, but they did find other ways into the farms. Chili washes away and must be replaced weekly, making it labor intensive and expensive. Sitati and Walpole (2006) also found a lack of faith among local people in any type of fencing. Locals believe elephants will habituate, and they want them removed or separated with electric fences. However, extensive electric fencing, even if it became financially feasible, presents many conservation issues.

Electric fences cut off the migration and dispersal routes that elephants need to find adequate amounts of food (King, 2015). This concentrates the elephants into increasingly smaller protected areas and causes severe damage to trees and shrubs in that area, and in the long term could cause increased conflict on the edges of the protected areas (King, 2015).

Researchers attempting to find more effective mitigation methods learned from the Lewaso Maasai about the aversion elephants have to African honeybees (*Apis mellifera scutellata*) (Vollrath and Douglas-Hamilton, 2002). African honeybees are very aggressive and prone to swarming; they can sting the inner trunk membranes and eyes of elephants with serious side effects. One bull elephant attacked by bees had his eyes swollen shut for 24 hours and required human intervention to recover (Vollrath and Douglas-Hamilton, 2002). Trees housing honeybee hives are protected from elephants and even trees with inactive hives are attacked less (Vollrath and Douglas-Hamilton, 2002). Elephants respond to bee sounds with head shaking and dusting behaviors to remove the bees (King et al., 2010). In experiments where elephants were played bee recordings, 16 out of 17 elephant families fled from their resting areas; the only group not to flee lacked an experienced matriarch (King et al., 2007).

The aversion elephants have to bees presents an interesting opportunity to create a new fencing type. King, Douglas-Hamilton, and Vollrath (2011) tested the possibility of using fences strung with beehives to protect farms. They found that they were much more effective than traditional thorn bush fences, with only one bull breaking through in two years—by pushing between two unoccupied beehives. The beehive fences are created by attaching thin wires between posts made of living trees. The wires are strung with beehives that swing when an elephant touches it, causing the bees to swarm (King et al., 2017). In Tsavo East 80% of elephants turned back from beehive fences (King et al., 2017). In Gorongosa National Park in Mozambique, beehive fences were far more effective than chili fences (Branco et al., 2009). Branco et al. (2009) theorized that non-harmful deterrent methods lead to quick elephant habituation, so the constant threat of bee stings might be required to prevent habituation. Though the initial startup cost of the beehive fencing is high, there is good buy in by community members (King et al., 2017). The farmers in Tsavo East were very motivated to maintain and repair their beehive fences, even when elephants were not in the area, due to the potential for economic gains (King et al., 2017). Honey production is a major benefit of this deterrent method. Farmers also indicated major benefits in being able to sleep inside their house rather than in the fields and in feeling safer from elephant injuries (King et al., 2009). Another drawback of beehive fences is bee stings—to humans and livestock. However, farmers believe the benefits outweigh the costs and there is a lot of positive feeling and a sense of community ownership involved in this project (King et al., 2009). Beehives might also be an effective way to protect certain endangered and valuable trees since trees with beehives are attacked far less than those without (Cook et al., 2018). Beehive fences as an example of the application of conservation social science will be discussed in Chapter 7.

Community involvement has been shown, repeatedly, to be critical for conservation. A project in Northern Kenya among the Samburu was aimed at using local beliefs to foster community engagement in elephant conservation (Kuriyan, 2004). Samburu have much conflict with elephants over water resources; elephants will chase and even kill cattle to scare them away from water. However, traditional Samburu culture respects elephants as beneficial ecosystem engineers who create dams and clear paths. Taboos exist against the killing of elephants and Samburu legends say elephants once lived among humans and are an ancient relative (Kuriyan, 2004). A publication on beliefs and legends was created for school children to reinforce these traditions and their associated positive feelings. Women were invited to bead elephant radio collars in their traditional style and help to radio collar the elephants. This project generated considerable interest among the local Samburu and helped generate a feeling of community ownership of the elephants (Kuriyan, 2004).

Cell phones are increasingly being used as a tool to reduce crop raiding by elephants (Graham et al., 2011). Early warning of elephants in the area is important for deterring crop raiding. The Kenya Wildlife Service (KWS) has programs to assist farmers in deterring crop raiding, but prior to cell phones the only way to communicate with them was via written messages or word of mouth, which failed to arrive in time. After cell phones were introduced, the KWS hired scouts to respond to farmers and report back quickly. Phones are helping to provide early elephant warnings and are assisting officials in effectively responding, thus improving relationships among farmers and government officials and reducing human-wildlife conflict with elephants (Graham et al., 2011).

The range of mitigation efforts for elephants are relevant to this study because many of them can be used on wildebeest, though on a smaller scale. Fencing is not generally considered an option for keeping wildebeest away, so some of the more creative solutions discussed for elephants are not an option.

2.4.3 Mitigation Methods and Lions

A popular program for reducing lion hunting is compensation schemes. In this conservation program, livestock owners are paid for the livestock lost to predators in an attempt to stop retaliation killing. Compensation schemes have many downfalls. Many are poorly designed and difficult to implement (Hazzah et al., 2014). They can also be very expensive (Bauer et al., 2017). Compensation schemes present the possibility of a moral hazard when people abuse the scheme for personal benefit or relax husbandry practices (Maclennan et al., 2009). Hazzah et al. (2009) found that in the high conflict area of the Mbirikani Group Ranch in Kenya compensation did not really change the likelihood that someone would kill a lion. Nor did it increase tolerance, though they believe it would in a low conflict area. However, they found that once compensation was implemented, if payments were missed or compensation stopped, it had the potential to seriously decrease tolerance (Hazzah et al., 2009). Bauer et al. (2017) found the same issue; when compensation programs stop, anger and an increase in retaliatory animal killings are the result.

There has been some success with compensation schemes. On a group ranch near Amboseli National Park, compensation did cause a decrease in lion killing (Maclennan et al., 2009). Total losses due to livestock depredation in the area was 2.31% per year, or around $69,193. The mean annual cost of the program to conserve a lion was a hefty $3,400 for compensation plus $2,800 for population monitoring (Maclennan et al., 2009). The Wildlife Pays Compensation Program in the Kuku Group Ranch in Kenya also saw significant decreases in lion killing, with a total yearly cost of $100,000 (Baier et al., 2017).

Hazzah et al. (2014) compared the efficacy of two lion conservation programs: the Predator Compensation Fund and Lion Guardians. Compensation may address economic losses due to predators, but 51% of lion killers claim they killed lions for cultural reasons (Hazzah et al., 2017). The top reason lions are hunted in Kenya is to demonstrate and reinforce the role of the *ilmurran* (Goldman et al., 2013). The Lion Guardians program works within that framework to reduce lion killing by training *ilmurran* to track and protect lions (Hazzah et al., 2014). Lion Guardians recruits *ilmurran* into a program to train them as wildlife trackers and protectors of livestock. Guardians monitor lion movements and numbers, and they gain prestige through their literacy, employment, and work with dangerous animals admired by the Maasai for their power (Dolreny et al., 2016). This reinforces the role of the *ilmurran*, while working within the culture to protect wildlife (Dolreny et al., 2016; Hazzah et al., 2014). The Guardians help to actively protect cattle by tracking predator movements and improving husbandry practices within their area, reducing the actual amounts of human-wildlife conflict (Dolreny et al., 2016; Hazzah et al., 2014).

The Lion Guardians program has led to significant decreases in lion killing and more tolerant attitudes (Dolreny et al., 2016). It is also cost effective and employs many community members (Hazzah et al., 2014). Though the Predator Compensation Fund also saw significant decreases in lion killing, it was complicated to run, expensive, and did not change attitudes toward wildlife (Hazzah et al., 2014). The Predator Compensation Fund reduced lion killing by 87-91%, the Lion Guardians program reduced lion killing by 99% (Hazzah et al., 2014). The Lion Guardians program also had the added benefit of increasing the data related to lion movements and accessing the repository of knowledge that local Maasai people have on wildlife (Dolreny et al., 2016). The Lion Guardians project will be discussed in Chapter 7 as an example of the application of conservation social science to improve conservation outcomes.

Depredation can also be reduced by altering herding practices. If more than one herder is present, depredation plummets from over 50% of herds being predated on to only 9.4% (Lyamuya et al., 2016). Helping local people hire additional herders could cause economic gains in fewer lost animals and reduce negative attitudes (Lyamuya et al., 2016). This could be particularly important for predators that attack grazing animals instead of attacking animals in *bomas*, like lions and wild dogs (*Lycaon pictus*) (Lyamuya et al., 2014). Wild dogs went extinct in the Serengeti in 1991 but are starting to return in small numbers. If these endangered predators are to recolonize and flourish in the Serengeti, they will need extensive conservation help (Lyamuya et al., 2014).

Modern technology can also be used as a tool to reduce human-wildlife conflict. Cell phones are increasingly being used to communicate warnings to others about the presence of predators and to communicate with authorities about possible dangers (Lewis et al., 2016). Phones have been shown to reduce the number and severity of human-wildlife conflict events (Lewis et al., 2016).

These mitigation methods are relevant here, as lions are causing the death of livestock just as disease from wildebeest is. Several of the above examples demonstrate the need for changing opinions, rather than actual conflict. This may prove to be the case, at least partially, with wildebeest.

2.4.4 Mitigation Methods and Baboons

Across Africa, and in other parts of the world, primates are considered one of the most common, destructive crop raiders (Sillero-Zubiri and Switzer, 2001). Primates make particularly effective crop-raiders for many reasons: their high intelligence ensures success at maneuvering around fences and barriers, they may wait for crops to be unguarded, and their adaptability makes them better able to adjust to human presence and encroachment. Their dietary range allows for ingestion of a wide variety of crops, and their divergent digits assist them in carrying food away from fields. A complex social organization makes cooperative raiding possible (particularly with chimpanzees), and heightened aggression makes it difficult to chase them away. Additionally, many primates are protected by wildlife laws (Sillero-Zubiri and Switzer, 2001).

Baboons are considered the most troublesome primate in many areas due to large groups, destructive feeding methods, and willingness to travel farther from protected areas and forest edges (Wallace and Hill, 2012). A study by Mwakatobe et al. (2014) on crop raiding around Serengeti National Park showed the expected pattern of overall crop raiding tapering off farther from the protected areas. However, baboon specific crop raiding actually increased, likely because baboons are willing to live farther away from protected areas, and there is less natural food for them there (Mwakatobe et al., 2014).

In Uganda, 96% of crop raiding is from primates, but the impact of crop-raiding can be difficult to quantify, as it can be locally devastating to individual farmers, even if overall losses across the landscape are low (Wallace and Hill, 2012; Sillero-Zubiri and Switzer, 2001). Around the Maasai Mara National Reserve a study into the costs of crop raiding revealed losses of $200 to $400 dollars a year per household, a huge amount of total income for subsistence level farmers (Sillero-Zubiri and Switzer, 2001).

Crop raiding has been increasing in recent decades. A shift in agricultural practices to monocultures results in resource rich patches that are hard for primates to resist. Recent conservation efforts mean some wildlife populations are recovering and increasing, while human populations are also increasing. The human-wildlife interface is growing, encroachment and fragmentation are creating more edge habitat, and crop guarding is reduced due to an increase in schooling and urbanization (Sillero-Zubiri and Switzer, 2001).

Shirley Strum (1987) had the unique opportunity to study how crop raiding behavior developed in a group of baboons who were not previously crop raiders. This behavior seems to start in droughts or bad years but can become fixed in a troop, making it almost impossible to eliminate. Though some troops only raid when alternative resources are low, others will make raiding their lifestyle. Transferring baboons, particularly males who tend to do more crop raiding, can bring the practice into new troops and spread the problem. Crop raiding causes long term changes in baboon life patterns, which include faster maturation of males and shorter interbirth intervals for females. Raiders have different activity budgets in all seasons; more calories can be consumed in a much shorter amount of time, thus allowing baboons more time for resting and socializing. Deterrent methods can be difficult to implement and maintain; they must significantly raise the costs of raiding for the animals in order to deter them because raiding is so profitable (Strum, 2010). In Nigeria, drastic changes were seen in raiding baboons, including increased vigilance, reduced vocalization, rapid foraging, and a tendency to carry food away (Warren, 2008). Baboons in Nigeria crop raid throughout the entire year and are extremely hard to deter, changing behavior and flight distance depending on the raiding situation (Warren, 2008). Though Strum observed males leading the initial crop raiding efforts, in troops where raiding is common all troop members raid, even females with infants (Strum, 1987; Warren, 2008).

Human foods are higher in carbohydrates and calories and lower in fiber than natural baboon foods, making them very appealing (Strum, 2010). In Kenya, raiding baboons had smaller home ranges and slept closer to human food. The vastly better nutritional content allowed them to spend all their time in edge habitats waiting for raiding opportunities (Strum, 2010). Maize is the most raided crop and is extremely high in protein compared to natural foods; it is eaten at every stage of growth (Naughton-Treves et al., 1998). Baboons destructive feeding on maize can destroy the whole plant, including the stem, thus necessitating complete replanting (Hill, 2000). In Uganda up to 10% of the entire maize crop across the landscape is lost in farms around the southern edge of the Budongo Forest Reserve, and since losses are higher closer to the forest, some farmers lose nearly all of their maize crop (Hill, 2000). Even when natural foods, like forest fruits, are abundant, some baboons will continue to raid for their now preferred human foods (Naughton-Treves et al., 1998). In Cape Town, South Africa baboons are a major pest species and will take advantage of any novel food source, including those presented by humans (Hurn, 2015). Hurn (2015; p. 157) describes them not only raiding fields of maize or mangoes but snatching fruit from bowls left in windows of homes.

Baboons and other primates are not just problems for farmers in rural areas. They are increasingly becoming urban pests (Fehlmann et al., 2017). Even rural baboons enter homes and huts out of curiosity or in search of food (Strum, 1987). In urban areas, baboons aggressively enter homes, cars, and commercial properties and take food directly from humans (Fehlmann et al., 2017). They also raid trash bins and landfills. The increase in urban baboon pests is a human health and safety issue, increasing the chances humans are injured or diseases are transmitted between humans and primates (Fehlmann et al., 2017). Tourist lodges that feed primates make the situation worse (Lee and Priston, 2005). High intelligence makes primates more likely to adjust to human presence quickly, so provisioning them for tourist entertainment becomes problematic. A reliance on human foods can lead to aggression, as is the case with many urban animals (Lee and Priston, 2005).

The perception of primates by humans is complicated due to their similarities to humans. Non-human primates walk a line between human-like creatures who should be intelligent enough to understand human rules, and animals who are simply acting in their best interests (Hill and Webber, 2010). In some areas of the world, primates are revered and treated as ancestors; in others, their similarity to humans makes then reviled and they are seen as agents of evil. In Madagascar, some lemurs, such as ruffed and ring-tailed lemurs, are taboo and thought to be kin, while aye-ayes are bad omens and must be killed (Hill and Webber, 2010; Lee and Priston, 2005). For many people in developed societies such as the United States, the human-like qualities of monkeys and apes can cause them to fall into the “uncanny valley” (Weber, 2018). First described in 1970 by Japanese roboticist Masahito Mori, the uncanny valley is the phenomenon whereby certain things that look almost human, but not quite, can cause repulsion in humans (Weber, 2018). I have seen this reaction in many zoo visitors. When faced with a gorilla, many people find their human-like faces unsettling.

One East African Bantu folk tale tells a story of a troop of baboons who are tired of stealing maize (Werner, 1915). The troop chooses one baboon, cuts off his tail, and sends him to live with humans. This baboon takes a human wife and cultivates food specifically for the baboon troop. In time the wife grows tired of cultivating for the baboons, and the husband agrees with her. The baboon troop fetches his tail and brings it to him, revealing his true identity to his wife, and forcing a return to the bush (Werner, 1915). This story reveals just how human-like the Bantu consider baboons to be; by merely cutting off their tails they can pass as human. Though there is no date attached to the origin of this story, it was already considered a folktale when it was told to Werner in 1915. This demonstrates that crop raiding by baboons is not a recent problem, but one that cultivating peoples in East Africa have struggled with for a long time.

Primates are more likely to be assigned human qualities like gluttony and greed when they crop raid (Hill and Webber, 2010). Destructive feeding by baboons is framed in negative human terms. Primate behavior often becomes framed in human morality, making their “bad” behavior much more highly condemned than in other species such as antelope (Hill and Webber, 2010). In Cape Town, baboons raid homes, picnics, and crops, leading human victims to feel the baboons are behaving badly (Hurn, 2015). But Hurn (2015) argues that from the perspective of the baboons, whose natural habitat has been destroyed, they are merely adapting to their new situation and taking advantage of the foraging options now available to them. In response, baboons are often attacked and even killed by humans who are in many ways responsible for their behavior, by destroying their habitat but also by deliberately feeding them in many cases (Hurn, 2015). Hurn argues that the baboons are more consistent in their behavior toward humans, and less deliberately harmful (2015).

Pre-colonial perceptions of primates were generally tolerant, but with the market economy encouraging crop overproduction for sale, losing surpluses becomes unacceptable and encourages intolerance (Lee and Priston, 2005). Attitudes toward primates are a function of the degree of human contact and perceived risks (Lee and Priston, 2005). The tolerance model put forth by Kansky, Kidd, and Knight (2016) proposes that the extent to which a person experiences a species determines their perceptions of costs and benefits of that species, which determines tolerance. They further propose that tangible costs do not explain tolerance fully, but that intangible costs and benefits are better predictors of tolerance.

In Uganda, baboons are seen as vindictive pests that destroy crops for fun, not for food (Hill, 2000). Baboons pillage in large numbers compared to other raiders and are not afraid of humans (Hill, 2000). Frequent crop raiding by baboons complicates the attitudes local people have toward conservation areas and programs. Locals sometimes believe conservation programs add to their subsistence struggles, and they do not benefit from them. They see wildlife authorities and conservationists as indifferent to their problems (Hill, 2000). This serves to alienate locals and reduce their support for conservation. Raising the tolerance of locals and their perceived benefits from conservation is just as important as reducing crop raiding, which is unlikely to ever be entirely eliminated (Sillero-Zubiri and Switzer, 2001).

Methods for preventing crop raiding by baboons are numerous and varied; no single mitigation method is entirely effective (Pahad, 2010). The attitudes of locals toward particular mitigation methods are also complex, and do not necessarily reflect the actual efficacy of the method (Hsiao et al., 2013). Guarding is a widespread practice and, though costly, is considered completely effective by farmers in Uganda (Hsiao et al., 2013). However, baboons are known to wait out guards or sneak into farms, and guarding does not always guarantee there will not be crop raiding (Strum, 2010). The costs to the farmer of constantly guarding crops or hiring someone to guard them can be high. An effective deterrent that prevents crop raiding must be sustainable, locally appropriate, cost effective, easily manipulated, and require minimal labor inputs (Hsaio et al., 2013). Successful methods must be supported and trusted by locals, otherwise they are not maintained and become ineffective in the long term (Hsaio et al., 2013). These are complex requirements, made even more difficult by the tendency of primates to become habituated to deterrent methods (Hill and Wallace, 2012).

Common deterrents used by farmers include dogs, wire fences, lights and alarm bells/noise, scent deterrents, chasing, fires, planting buffer zones of crops, bows and arrows, snares, throwing spears, and shooting (Hsiao et al., 2013; Pahad, 2010; Hill and Wallace, 2012; Warren, 2008; Hill, 2000; Hill, 2018). In Uganda, jatropha (*Jatropha curcus*) hedges meant to obscure the view of primates reduced visitation by baboons and guenons by 85% (Hill, 2018). Each deterrent comes with its own difficulties. Scent deterrents (often chili paste rubbed on fences) become less effective once the novelty wears off (Hill and Wallace, 2012). Many deterrents, including scents and fencing, simply transfer the raiding to nearby unprotected farms, thus failing to decrease the total amount of raiding (Hill and Wallace, 2012). In Uganda, various deterrent methods were tested by Hill and Wallace (2012) on farms near a forest edge. All farms with some deterrent methods (either paid guards, dogs, wire fences, lights, or bells/alarms) had some increase in crop yields. However, many farmers did not maintain the deterrents past the initial project. The farmers cited many issues for the long-term sustainability of their deterrents, including costs, damage from weather, labor to maintain, termite damage (e.g., to wooden fences), and theft of deterrents such as bells or lights. Most farmers continued to believe that guarding or injuring the animals were the most effective deterrents (Hsiao et al., 2013). While guards were successful in chasing baboons away, the animals often learned to wait out guards and simply returned later or to different areas (Warren, 2008; Sillero-Zubiri and Switzer, 2001).

Illegal hunting, trapping, and poisoning of crop raiding baboons is fairly common in Kenya and Uganda (Sillero-Zubiri and Switzer, 2001). Though farmers believe this to be effective, it comes with the risk of discovery and fines. In Uganda, 15% of farmers admitted to setting illegal traps for crop raiding primates (Naughton-Treves et al., 1998). In Nigeria, plant poisons like Gamalin 20 (an easily available pesticide) and battery acid may be hidden in baited fruit. When animals are poisoned, troops still return to continue raiding (Warren, 2008). In Uganda, farmers believe fencing is ineffective against climbing baboons, but fencing may still be used to protect crops from pigs (Hsiao et al., 2013). In Kenya, small fences are easily destroyed or bypassed, therefore requiring large fences that can cause serious ecological problems by blocking animal movements and migrations (Sillero-Zubiri and Switzer, 2001).

One novel management strategy being studied is taste aversion—teaching the baboons to associate human foods with bad smells, tastes, or illness. This has shown some promise (O'Brien and Hill, 2017; Strum, 2010). Lab tests on macaques by O'Brien and Hill (2017) tested the effectiveness of spent coffee grounds and neem and ocimum essential oils. They found the essential oils were somewhat aversive, but it may have been due to the novelty of the odor. Spent coffee grounds were found to be highly aversive and could have potential as a highly available and easily employed deterrent. Though taste aversion has shown promise, it is extremely labor intensive and expensive to employ, presents issues of habituation, and is likely impractical in most rural areas (Strum, 2010).

Baboons are a problem in rural areas where they crop raid, and they are also serious urban pests, particularly when human foods are the only source of food (Biquand et al., 1994). Commensal baboons have no predators and can quickly become numerous and problematic (Biquand et al., 1994). Hamadryas and chacma baboons are known to rely on garbage dumps and become adjusted to humans to the point where they will attempt to enter stores, homes, and cars to find food, causing injury and property damage to humans and resulting in the death of baboons (Biquand et al., 1994; Kaplan et al., 2011). In South Africa, over $1 million US per year is spent hiring guards to herd baboons away from trash sites. (Kaplan et al., 2011). Kaplan et al. (2011) tested whether artificial provisioning of natural foods in a forage patch would keep baboons away from urban areas. They found only marginal success with the patch alone, but when combined with fences restricting their access to urban areas, they did see a drop in raiding.

Another novel deterrent tested in South Africa is the use of reflective, rotating prisms to keep baboons out of cities (Kaplan and O'Riain, 2015). Though it would be relatively easy to maintain, no change in activity budgets or use of urban areas was seen when the prisms were present (Kaplan and O'Riain, 2015).

The complexities inherent in attempting to prevent raiding make it more and more likely that instead of stopping raiding, conservationists should focus on offsetting the costs of raiding. Shirley Strum found this to be by far the most effective strategy in increasing baboon tolerance and human-baboon coexistence (Strum, 1987; Strum, 2010). She developed a rural development project in cooperation with local people, hiring them as researchers to gather baboon information and warning farmers to the presence of the primates. The insights of locals combined with conservationist and scientist knowledge proved extremely valuable in learning about baboons and their relationships with humans. The development project fostered positive feelings in the community and helped the locals feel heard, in addition to providing employment (Strum, 1987; Strum, 2010).

Based on this literature review the Shirley Strum solution may be a viable option in many cases of human-wildlife conflict. Some conflict cases are too complex to be resolved completely, but by working with local people the situation could be greatly improved for both humans and animals. Compensation schemes have not proven to be that effective in promoting tolerance and positive feelings toward conservation and animals. By involving local people, we can promote ownership of animals and a conservation ethic. This is far more valuable than "buying" animal safety. By understanding local cultures and current and past attitudes we can find the positive aspects to human animal relations and help foster them in community conservation projects.

2.4.5 Human-Wildlife Conflict in the Future

There is every reason to believe that human-wildlife conflict will continue to increase. Group ranches were originally introduced by the Kenyan government to discourage communal ownership of lands. It has not been effective, and the government is now encouraging the division of group ranches into individual ranches (Seno and Shaw, 2002). The Maasai are mostly going along with this scheme because it guarantees their access to land, now the limiting resource, and prevents further land alienation. Though the Maasai indicate they wish livestock to remain their main source of subsistence, smaller parcels of land will likely lead to smaller herds since they have less grazing area and therefore more cultivation. The encroachment of cultivation is a significant threat to wildlife and the source of much human-wildlife conflict (Seno and Shaw, 2002).

By contrast, in Tanzania the Maasai are forbidden to cultivate land at anything higher than a subsistence level (Poole, 2015). The Maasai population in Tanzania find themselves able to access less and less grazing land; they were evicted from Serengeti National Park in 1959 and from Ngorongoro Crater in 1974. With fewer cattle per person and a larger population, they must move closer and closer to protected areas, coming into conflict with wildlife. Without being able to farm at higher than a subsistence level, they turn to other options like bush meat and illegal wire snares, which kill up to 200,000 animals per year (Poole, 2015). Human-wildlife conflict is already causing local extinctions of carnivores (Broekhuis et al., 2017). The extinction of wild dogs in the Serengeti is probably a result of rabies introduced from domestic animals. Canine distemper has also been linked to major declines in lion populations. However, domestic dogs can help protect livestock, and there are likely to be more of them in the future (Broekhuis et al., 2017). Better access to veterinary care for domestic animals is a possible way in which conservationists might reduce the human-wildlife conflict while also benefitting domestic dogs, without the disease transmitting drawback.

Tourism is one of the ways that wildlife is meant to benefit local people and make conflicts more bearable, but this is not a straightforward issue (Larkin, 2014). There is no unanimously agreed framework, in Kenya or anywhere, on how wildlife conservation, tourism, and indigenous rights should be developed together for everyone's benefit. Wildlife tourism (tourism based on humans interacting with or experiencing wildlife) does not always coexist harmoniously with conservation. In Maasai Mara National Park changes in land use to promote tourism has led to increased competition over land and resources and has led to declines in wildlife (Larkin, 2014). The encouragement by the Kenyan government for the Maasai to adopt agriculture and permanent settlements has reduced the land available to wildlife and exacerbated human-wildlife conflict. Human-wildlife conflict causes declines in wildlife and thus tourism. Most Maasai do not believe they receive many benefits from tourism, but they do shoulder the costs. This has led to the negative attitudes toward wildlife and conservation discussed earlier (Larkin, 2014). Wildlife managers and conservationists tend to lack training in social sciences. More collaboration is needed between social sciences like anthropology and wildlife scientists (Browne-Nunez and Jonker, 2008). The theoretical framework of conservation social science needs to be widely applied to conservation situations in order for more effective solutions to be devised.

Human-wildlife conflict, as defined earlier, affects both humans and wildlife. Though conservation tends to focus on the effects of conflict on population sizes, it can also influence animal behavior. In the Southern Rift Valley lions were found to avoid humans, use more closed habitats where humans were present, and move farther from permanent water sources to avoid humans (Schuette et al., 2013). In Kenya, lions on ranches spend more time in closed habitats, are more nocturnal, and spend more time concealed in bushes than lions in protected areas (Mogensen et al., 2011). Lions in human areas also respond less to prey calls (Ogutu, Bhola, and Reid, 2005). Hyenas in human areas alter their space use, social behavior, and activity patterns to avoid humans (Ogutu, Bhola, and Reid, 2005). Farmers organize events to scare baboons; dispersing them with loud noises can keep them out of areas for up to three weeks (Lewis et al., 2016). Conflict with humans is also causing behavioral changes in elephants. Though research on this is scarce, elephants in Tanzania have been shown to recognize Maasai sounds and language (Kioko et al., 2015). Elephants display fearful, aggressive, and defensive behaviors when exposed to olfactory and visual indications of Maasai. Elephant alarm calls and behavior are more urgent in response to these human stimuli than they are in response to bees, suggesting that humans are the greater threat (Soltis et al., 2014). These tantalizing hints at major behavioral changes due to human-wildlife conflict represent an important dimension of human-wildlife conflict that has barely been touched on by researchers. Understanding how conflict is changing the behavior of animals could be critical for developing future conservation strategies and will be explored in this research by analyzing wildebeest behavior in two locations: Maasai-occupied land in Kenya and Serengeti National Park where Maasai are excluded.

Every study conducted on livestock losses of the Maasai indicates that disease is responsible for significantly more livestock deaths than depredation (Kissui, 2008; Hazzah et al., 2009; Ogutu et al., 2005). Despite this, there is little discussion in the literature of how to prevent those deaths. Based on the greater livestock loss to disease, access to veterinary care could be a critical component of conservation in Maasai areas. If disease deaths can be prevented, it might make deaths due to depredation more tolerable. There is also a serious deficit of research on attitudes and conflicts regarding less charismatic animals. Extensive research on lions and elephants is available, but few other animals have been looked at by researchers. By choosing to focus on conflict involving wildebeest, a common, understudied ungulate that acts as a disease reservoir to the Maasai, I hope to broaden our knowledge on Maasai attitudes toward wildlife and human-wildlife conflict in general.

2.5.0 Scientists as Subjects

Anthropological analyses of conservation issues and multispecies ethnographies are becoming increasingly popular (Kiik, 2019). However, conservation writing does not usually give voice to the actual scientists and conservation practitioners involved with the issues (Kiik, 2019). Anthropology tends to focus on giving voice to the native groups and, more recently, the animals involved, rather than fellow scientists (Clifford, 1986; Kiik, 2018). Recent work is attempting to access conservation workers and scientists, something that has not traditionally been a part of anthropology (Candea, 2010; Moore, 2017). This research strives to illuminate that gap through the use of basic email surveys. As discussed in Wiles et al. (2006), researchers with intimate knowledge of research processes may have particular concerns about how their responses may be used in publications. By making the process as explicit and clear as possible (to the point of formality), I could ensure all participants fully understood the project and were willing to be involved. Surveys were sent to conservationists who had worked in Africa to give them a chance to communicate their thoughts about working with local people.

The history of conservation in Kenya has been characterized by a fundamental misunderstanding of the motivation of the Maasai people. That is, their core desire to remain pastoralists (Knowles and Collett, 1989). The lack of reflexivity inherent in most conservation work leads me to question whether this misunderstanding still remains (Kiik, 2019). Conservation scientists are trained to rid themselves of biases, instead of reflecting on how their biases effect their conclusions and perceptions of local cultures (Kiik, 2019).

The reflexive turn in anthropology has trained anthropologists, sometimes to extremes, to consider every way they place themselves within their research and how their biases and opinions affect their writings and conclusions (Davies, 1999). Questioning the effects of the observers' opinions, experiences, and lives on their observations is critical. Researchers do not just affect their own observations. The people and animals being observed are conscious beings that can and are affected by being watched and by the actions and aspects of the observers (Davies, 1999; Candea, 2010). Conservation science has not had the reflexive turn that anthropology has, but Davies (1999) argues that objectivity may be impossible without reflexivity. The only way to obtain any measure of objectivity may be by reflecting on the effects of the researcher on the subjects and then working to eliminate those effects (Davies, 1999).

When classical ethnography began to be heavily critiqued in the late 1960s, anthropologists asked if they were presenting a view of cultures distorted by their own perceptions, or if they were creating those cultures based on their own preconceptions and cultural expectations (Davies, 1999). This question is what drove the reflexive turn and the push to always situate the researcher or ethnographer within the research. If we hope to study cultures, we must reflect on how we produce the image of those cultures together with the objects of our research (Davies, 1999).

Is this relevant to biology and the study of animals? I would argue that it is. One need only look at how drastically our “knowledge” of primate behavior has shifted over the past 75 years to see how the biases and culture of the observer affect animal behavior studies (Strum and Fedigan, 1999). Decades ago, anthropologists and biologists set out to study primate behavior to learn about ourselves. But all we really did was project our own cultural and gender norms onto the animals we observed. Seventy-five years ago, baboon societies were centered around males. They were based on theories of male dominance hierarchies and aggression. Females were on the edge of the group, simply passive observers who were rarely discussed (Strum and Fedigan, 1999; Strum, 1990). Today, baboon societies are recognized as being based around females. Females form hierarchies not based on aggression, but on relationship building and non-aggressive competition. Males are on the periphery of the group and work hard to form affiliative relationships with females and babies (Strum and Fedigan, 1999; Strum, 1990). What brought about this dramatic shift in baboon societies? The answer of course, is nothing at all. Baboons have not changed; the biases of the observers have changed. It is bias that caused biologists to view baboons as male centered, chimpanzees as mindlessly violent, and countless other “facts” about animals that are not facts at all, but simply the preconceptions of the observers being transferred onto animal behavior.

The lack of reflexivity in biology and conservation science means that progress in recognizing these errors and biases is slow. I worry that conservationists will not see the built-in conservation practices of local cultures due to biases they do not know they have. The preconceptions that have affected views of animal behavior also affect views of human behavior. By discussing the history of conservation science in Kenya, I hope to illuminate some of the biases that may be affecting modern conservation, whether the individual scientists realize it or not. Considering the value-based nature of conservation policymaking, recognizing the motivations, biases, and interests of the conservationists will help elucidate the entire conservation encounter between wildebeest, Maasai, and conservationists. Reflexivity and positionality of researchers is a fundamental part of using and applying conservation social science as a theoretical framework. Throughout this research I have attempted to be as reflexive as possible myself. Encouraging reflexivity among other scientists is part of using conservation social science as a framework.

2.5.1 The Anthropology of Expertise

The anthropology of expertise is a recent field of anthropological inquiry (Boyer, 2008). Until the last few decades, expertise was considered something an individual possessed and was not deeply questioned. However, anthropology now considers expertise to be a performative expression of hierarchies and power relations (Carr, 2010; Sangren, 2007). Expertise cannot be considered a cache of knowledge an individual possesses. Rather, expertise is ideological. The performance of expertise through jargon and the expression of certain perspectives conveys authority (Carr, 2010). Expertise is also embodied (Suwa, 2008). The situated cognition theory posits that conceptual thoughts, perception, and bodily performance all work together to affect each other, and therefore develop in a coordinated manner, implying the development of expertise is both cognitive and embodied (Suwa, 2008).

The authority that we assign different experts involves the hierarchies we assign to different types of knowledge. Certain types of knowing and seeing the world are legitimized over others in our society and within academia (Carr, 2010). “Scientists,” which means different things at different times and to different people, are accustomed to acting and operating as though they are working in a free market of objective truths free of ideology (Sangren, 2007). Indeed, science relies on this ideal. The unwillingness of scientists to see that their work is built on ideology is one of the obstacles to working reflexively with them (Boyer, 2008). Questioning conservation scientists about their embedded biases and ideologies can result in anger when those subjects do not believe they have inherent ideologies that affect their work (Kiik, 2019).

As Kiik (2019) has argued, reflexively analyzing expertise is especially important when working with conservationists. Ethnographical work focused on conservationists that looks critically at the ideologies inherent in their work may help less powerful groups (such as native Maasai) understand the position of conservationists and how they can work with them more effectively (Kiik, 2019). Ethnography should not only be done to help privileged groups understand marginalized societies. Modern ethnography should study the familiar as much as the foreign (Pratt, 1986). Modern anthropology is not afraid to study within our own cultures, for instance in inner cities (Wallman et al., 1980). We should not be afraid to study a laboratory or research team as a culture. This has been done at low levels since the 1970s (Stephens and Lewis, 2017). During the 1970s and 1980s a handful of ethnographies focused on activities within the laboratory to answer questions on how scientists assert the legitimacy of their knowledge and how knowledge is built (Stephens and Lewis, 2017). Since then, ethnographies of scientists have moved beyond the laboratory and have extended the field site to conferences and other locations to answer such questions (Stephens and Lewis, 2017). When studying conservation encounters—interactions between animals, affected human groups, and scientists—all sides of the issue should be included (Kiik, 2019; Kiik, 2018). This is one of the main goals of this research: to represent Maasai voices through surveys, wildebeest through behavioral data, and scientists through surveys.

2.5.2 Who Counts as a Scientists and What Do We Consider Legitimate Ways of Knowing?

The terms scientist and expert do not mean the same thing in all contexts. With the rise of the internet, public values have changed, and a larger cross-section of people are now seen as having legitimate perspectives and even expertise (Suldovsky, Landrum, and Stroud, 2019). On the other hand, the recognition of imposter syndrome (an inability to internalize academic success) shows that people traditionally seen as experts may not consider or believe themselves to be so (Watson and Betts, 2010).

Perhaps one of the best places to consider who counts as a scientist or expert and who does not is in the field of cryptozoology—the study of animals undescribed by science (Hurn, 2017). Despite the fact that cryptids once included such animals as okapi, Komodo dragons, coelocanths, and dugongs, which we have discovered and know to be real, the very thought of cryptozoology engenders scorn and laughter in large parts of the scientific community (Forth, 2021; Mullis, 2019).

Justin Mullis (2019) belittles cryptozoologists by pointing out that they publish for a popular audience instead of for experts, despite this being a major critique of science. He also accuses cryptozoologist of “eschewing the rigors of science” and “lacking even the most rudimentary knowledge of those fields” (Mullis, 2019; p. 247). This completely ignores such prominent cryptozoologists as Henry Bauer, professor of chemistry, peer reviewed author, and Loss Ness monster believer. Dr. John Bindernagel was a prominent Canadian wildlife biologist who spent decades searching for Bigfoot. The list goes on, but not one is mentioned by Mullis. He further dismisses the whole discipline by pointing out that Bernard Heuvelmans, often called the father of cryptozoology, was inspired to become a zoologist in the first place by stories by Arthur Conan Doyle and Jules Verne (Mullis, 2019). We conveniently skate over the fact that the great Jane Goodall was inspired to study animals by a stuffed toy.

The point Mullis demonstrates is that scientists themselves are often the harshest in deciding who is allowed to be called an expert. The disdain for and dismissal of cryptozoology by so many proves this; Mullis is far from alone. In 2014, while attending the International Society of Primatology conference in Hanoi, Vietnam, I heard the fascinating local legend of Cu Rua, the sacred turtle of Hoan Kiem lake. It was described as an immense turtle the size of a car, that watched over the city for hundreds of years, taking offerings left by locals in a small temple in the lake. Like most arrogant Westerners, I looked at the tiny and polluted lake and knew that no such turtle existed, despite the guarantees of locals, who knew far better than me, that it did. The turtle can be found on several websites for cryptids even today. I was embarrassed and humbled when it washed up dead in 2016. The 200-kilogram turtle was a species of giant softshell turtle that may have had only four individuals left on the planet. My arrogance, because I was a scientist, led to my dismissal of local knowledge and an assumption that I knew better than people living in the area.

Are animals like the Jersey Devil, Bigfoot, and the Loch Ness Monster real? Are they flesh and blood? Does it matter? As Hurn points out, the people around them are shaped by their interactions with them, and the knowledge of cryptids, and their existence within our culture is shaped by us (Hurn, 2017). In this way, they become real, regardless of whether they are actually out there (Hurn, 2017). So, doesn’t this make the search for them a legitimate endeavor? Most anthropologists couldn’t help but agree, but it still does not seem to make cryptozoology a legitimate way of knowing in the eyes of most.

I do not have a definitive answer for who is considered an expert and when, except that it is fluid and depends on the time and place. The same person is an expert in one context and not in another. Someone can be considered a valuable expert in an online blog about Bigfoot, and a quack at an academic conference. Perhaps we ourselves decide when we are experts by how we present ourselves. For my purposes, I considered anyone who had participated in conservation research in Africa—as a student, a primary researcher, an assistant, a field tech, or an observer—someone who might have valuable insight on the experience.

2.5.3 Biases and Issues with Reflexivity

There are problems in attempting to include conservationists in anthropological analysis. In addition to limited time and difficulty in contacting people who may be in Africa one week and the Unites States the next, it can generally be challenging for anthropologists to “study up” (Kiik, 2019; p. 410; Nader, 1972). Access is an issue, even for relative insiders (Boyer, 2008). Researchers understand how the process works. This can lead them to be more cautious and wary of participation out of concern for how they may be presented in the published product (Wiles et al., 2006). Lack of anonymity can also be a concern for researchers, as any lengthy discussion of their research means it will likely be identifiable by peers (Wiles et al., 2006). Anthropologists also face the additional obstacle of appearance to other scientists. Anthropologists are often seen as allies of local people, and researchers may reject anthropologists or even use them to gain access to, or the trust of, locals (Kiik, 2019). A relativist perspective is nearly impossible when studying elements of our own society and activities, particularly for those (like me) who are actively involved in conservation (Sangren, 2007).

Reflexively studying within our own or closely related disciplines is blocked by the unspoken etiquette of science (Sangren, 2007). Ethnography must include some critique, if only to expose how knowledge cannot be separated from ideology. Critique of our own professional communities and fellow experts, represents a break in the etiquette of academic life that causes discomfort (Sangren, 2007). Researching other researchers requires a politeness that traditional anthropology does not, and anthropologists may struggle to achieve that politeness (Sangren, 2007). Certain questions may be forbidden when talking with peers (Boyer, 2008).

Conservation is itself a political process that, in many cases, attempts to transform people's ideas and internal worlds (Kiik, 2019). It is also a social process, though conservationists are reluctant to admit this because, as Candea (2010) points out, this would interfere with the view of science as objective. They prefer to see themselves as apolitical technical experts (Kiik, 2019). Many of them are driven by a very personal love of nature and animals. In an academic sphere, this personal interest may lead them to overcompensate in trying to seem calm and rational (Kiik, 2019). Conservationists are not trained to reflect on their emotions or biases, but to act as though they do not exist (Kiik, 2019). A study conducted by Robyn Wilson (2008) even investigated the ways emotion might affect conservation decision making, and how it could be compensated for to ensure decisions were made in a focused way, thus relying more on experts than on emotion. In 2011 the journal *Pacific Conservation Biology* published an article entitled "How Can We Ensure That Conservation Policies Are Based on Science, Not Emotion?" (Shine, 2011). Clearly the goal of conservation is to take emotion out of the equation as much as possible. What these articles do not ask, is how to analyze where the emotions come from and how they affect all aspects of science.

In my experience, those who study animals are especially cautious to avoid the appearance of attachment or of influencing the behavior of their subjects. In a way, the very idea of objective research of animals in the wild breaks down if reflected on too closely because, as Candea (2010) describes, the process of watching animals and habituating them changes their behavior. Most wild research subjects are at least habituated, but habituation makes them a participant in human life and brings them into specific social relations with humans (Candea, 2010). Any in-depth study of wild animals must begin with, at the very least, convincing those animals that you are not a threat. As Barbara Smuts describes for her work with baboons in East Africa, this brings the researcher into an entirely different relationship with the animals and makes you a participant in their lives (Smuts, 2001). Researchers often do not want to admit to changing the animals in any way by their presence, rather insisting they are merely part of the environment in order to present their research as objective truth, free from human interference (Candea, 2010). This is the position ethnography challenges. Conservationists want to see animals as research subjects, but ethnographers see them as significant actors and agents in the conservation encounter (Candea, 2010; Kiik, 2018). Ethnographers may even challenge the conservation narratives and common beliefs of researchers, creating further discomfort (Kiik, 2018).

The work of Marcus Baynes-Rock (2015) with hyenas in Ethiopia is especially illustrative of the way animals can become actors in human societies and in ethnographies. Briefly discussed in Chapter 1, the hyenas of Harar, Ethiopia, are not hated in the way that hyenas are despised across most of Africa. The dominant local culture believes hyenas have the ability to get rid of evil spirits. Thus, hyenas are tolerated and fed by “hyena men,” whose sole purpose is to feed hyenas and keep them around the city. The hyenas in Harar have become somewhat tame and walk the streets of the city unafraid of humans and of interacting with them when needed (Baynes-Rock, 2015). Candea (2010), Smuts (2001), and many others would argue that any animal that no longer fears humans as a predator has become an active agent alongside human society.

The result of all this presents a great difficulty in including the researchers and experts in the discussion. Lisa Jean Moore, in her impressive sociological study of horseshoe crabs and those that research them, had to become a researcher herself in order to properly integrate the view of the researcher into the issue (2017). Moore spent four years working closely with scientists and attending their conferences in order to properly include them in the discussion. This is clearly not practical for the majority of projects, but some attempt at including researchers should still be made. Boyer (2008) offered several suggestions for increasing the ability to engage with experts, including engaging the non-professional, analyzing the process by which experts become experts, operating reflexively, challenging the rationalist core, and humanizing the expert (Boyer, 2008; p. 44-45). In order to challenge the rationalist core, Boyer suggests paying closer attention to the experts’ aesthetics, desires, sentiments, and aspirations. These are issues which may be less rational but are no less important. To humanize the expert, Boyer recommends looking at the expert as a whole person, not merely as the product of their expertise. Thus, we can better understand them in all contexts (Boyer, 2008; p. 45).

2.6.0 The History of Conservation in Kenya

In order to fully understand the mindset of conservation scientists and Maasai engagement with conservation, we must understand the history of conservation in Kenya. The modern scientists and researchers trying to conserve Kenya's wildlife have been shaped, whether they realize it or not, by the history and development of land and fauna preservation in Kenya.

The general view of the Maasai by the early colonists, and still held by many conservationists today, is of a people at odds with conservation efforts (Knowles and Collett, 1989; Matheka, 2008a). The historical trend of conservation in Kenya (and many former colonies) has been one of alienation of land and resources from native people, largely based on the idea that the effectiveness of wildlife conservation is constrained by forms of land use other than Western forms (Akama, 1998; Lado, 1992). The earliest colonists viewed the Maasai as a warlike people with an unreasonable abhorrence for crops and agriculture (Knowles and Collett, 1989; p. 434). To the colonists, any non-agricultural people were automatically inferior (Knowles and Collett, 1989). White colonists believed they brought peace and order to the land. Settlers, starting in 1905, claimed large areas of land that they were allowed to fence and clear of all wildlife (Knowles and Collett, 1989; Steinhart, 1989). This was only made possible by the first of the Maasai Moves in 1904 and 1905 that began forcing the Maasai from the Central Rift Valley (Waller, 1976).

The Maasai, for their part, engaged strategically with European colonists to preserve, defend, or expand their sovereignty. During the period of "pacification," alliances were adopted with British forces in an attempt by Maasai communities to gain an upper hand over their neighbors and replenish cattle stocks lost to disease (Knowles and Collett, 1989). Maasai responses to colonization have been shaped by the long-term goal of remaining pastoralists. The continual failure of the colonial government to recognize that fact led to extreme frustration and a lack of understanding about why their so-called modernization methods were not working on the Maasai (Knowles and Collett, 1989). The Maasai made treaties with the colonial government in 1904 and 1911 with the express intention of retreating from colonial involvement as much as possible (Waller, 1976). They made the minimum concessions possible to colonial rule, while keeping their society internally intact (Waller, 1976).

Many of the issues the colonial government encountered with the Maasai were seen as the result of the *ilmurran* system (discussed previously), resulting in an attempt to ban it along with the associated rituals and symbols (Knowles and Collett, 1989). This interference with the *ilmurran* actually caused more issues and conflict between the Maasai and wild carnivores, as well as causing mistrust of the colonial government and education (Matheka, 2005; Knowles and Collett, 1989).

The early settlers and white visitors to Kenya killed animals in massive numbers: for land clearance, extensive hunting safaris, ivory acquisition, and sport (Steinhart, 1989; Chongwa, 2012). White hunters were romanticized in the colonial imagination and local African hunters (whose impact on wildlife was comparatively minor) were condemned as destructive of wildlife (Steinhart, 1989). This view of the native subsistence hunters as the problem has plagued conservation through the modern day (Akama, 1998). By 1900 affluent people from Europe and America, called “pioneer naturalists,” began to put pressure on governments to preserve natural areas in frontier territories (Akama, 1998). These calls led to the formation of the Society for the Preservation of the Fauna of the Empire in 1903. This group was mainly based in England, and their goal was to sensitize the public to the need for the conservation of frontier areas and to encourage the government to act on this need (Akama, 1998). These early efforts at conservation were mostly focused on “preserving” land and wildlife so hunting and recreation could continue (Chongwa, 2012).

2.6.1 Game Reserves and National Parks

A London conference in 1910 led to the formation of the first two game reserves in Kenya: the 14,000 square mile Northern Game Reserve and the 10,000 square mile Southern Game Reserve (Matheka, 2005; Matheka, 2008a). These game reserves included local African people like the Maasai, Samburu, Turkana, and others and endeavored to protect both wildlife and native cultures. African communities were expected to live harmoniously with wildlife and the state did not expect conflict (Matheka, 2005). By 1920, however, competition within the reserves for water, pasture, and salt licks, as well as issues with wild carnivore depredation of cattle, became serious (Matheka, 2005). There were also issues with diseases of humans and cattle. The Maasai were constrained within the reserves and unable to move away from areas with disease. In 1926, the Narok District Commissioner noted the presence of an unknown wildebeest disease—what turned out to be malignant catarrhal fever. In the 1920s, a debate started about whether conservation was becoming a detriment to the preservation of pastoralism, but many argued the issue was not serious, and nothing was done (Matheka, 2005). When the reserves became too crowded, people were moved to other areas where wildlife was abundant. The problems continued (Matheka, 2008b).

In the 1920s the Game Department was established, made up largely of hunters concerned with profits (Steinhart, 1989). Limited wild animal control within the reserves, directed at addressing animal threats to human life, was started (Matheka, 2005). In 1928, two game officers were recruited to respond to wild animal complaints. Problem animals were poisoned, shot, and confined to designated areas. These animal control measures were inadequate for the Maasai who continued to lose livestock (Matheka, 2005). In the 1930s, the myriad of problems in the reserves were blamed on the overstocking of cattle by native peoples. The colonial government tried to cull cattle but were met with severe resistance by the Samburu. In 1938, they hired a hunter to cull some game animals instead, in part to reduce the spread of malignant catarrhal fever (though it was not yet recognized as such) (Matheka, 2005).

In 1939, a major turning point occurred with the establishment of the Game Policy Committee, tasked with investigating wildlife conservation (Matheka, 2005; Akama, 1998). Recommendations by this committee led to the establishment of national parks following the Second World War, and areas were opened up for tourism. This was the first theoretical non-consumptive use of wildlife (Matheka, 2005; Steinhart, 1989). At the time, the idea of anything other than hunting was revolutionary. Today, however, there is uncertainty over whether wildlife watching is truly non-consumptive. The whole idea of whether humans can truly exploit nature for their own enjoyment without jeopardizing it in some way is questionable (Yudina and Grimwood, 2016). Wildlife tourism revolves around selling the animals as a resource for enjoyment, essentially objectifying them and turning them into a consumable for the tourist (Burns, 2015).

The idea of national parks as total sanctuaries free of humans came from the United States and Yellowstone National Park, the first such areas in the world (Steinhart, 1989). The Kenya National Park system was championed by Mervyn Cowie and was not subject to government interference or settler opinions but was governed by trustees and based on game preservation (Steinhart, 1989).

In 1946 Nairobi National Park became Kenya's first National Park, followed by Amboseli in 1947, Tsavo in 1948, and Mt. Kenya in 1949 (Akama, 1998). These new parks excluded humans and were focused on developing tourism and wildlife protection (Akama, 1998; Matheka, 2005). The original vision was that these parks would be established with accompanying park adjuncts that would allow for some human use and be established with permission from local people. But by this point land alienation was too great a fear among the local cultures. National Reserves were formed instead, starting in 1948 (Matheka, 2005).

By 1947 there were so many tourists in Amboseli that it was starting to disturb game and cause degradation (Matheka, 2005). This started a conflict with the Maasai, as the issues were again blamed on overstocking of cattle (Matheka, 2005). Throughout the history of Kenyan conservation, native cultures have been blamed for wildlife destruction, deforestation, and soil erosion when they were actually caused by land alienation, European settlement issues, and confinement of pastoral people (Akama, 1998). Colonial and state governments have continually tried to force Africans to abandon traditional land use practices and subsistence hunting, despite a lack of evidence tying them to environmental degradation (Akama, 1998; Kiage, 2013; Fortunata et al., 2011; Melubo, 2020).

In 1948 the Mara was proclaimed a national reserve. This area had little human use due to tsetse flies, so it was thought to be the perfect human-exclusion area. Once again, the colonial government demonstrated a lack of understanding of Maasai needs. The Mara is a critical resource during certain seasons and the Maasai heavily resisted their exclusion (Matheka, 2005). Further disagreements with the Maasai created difficulty in declaring the Ngong hills a conservation area. This caused a rethinking of how wildlife conservation was being done. Should lands be leased from the Maasai? Conservationists were finally realizing they could not be successful without local cooperation, so they decided on a revenue sharing scheme with the Maasai. By 1951 tourist revenue was supposed to be shared with the Maasai (Matheka, 2005). Around this time poaching became a major issue within the reserves, not only by foreigners but also by native Maasai, Kikuyu, and Akamba (Matheka, 2005). Locals viewed game as the property of the government and wanted compensation when wildlife caused problems and economic losses. When no such compensation was forthcoming, many turned to poaching to offset their losses (Matheka, 2008b).

2.6.2 The Maasai and Conservation

From 1953 to 1955, the East African Royal Commission was established to consider how to improve the standard of living for the growing population. They decided that conservation should not stand in the way of “proper” land usage—that was, land use for development and growing crops. At the same time, conservationists insisted that

Maasai were incapable of coexisting with wildlife, though some recognized that most of the burden of wildlife protection fell on the Maasai (Matheka, 2005). Calls started for greater benefits to Maasai, and as part of wider Africanization reforms, in 1956 a Maasai person was finally included in the Game Policy Committee. In 1958 the Committee recommended that national reserves become game reserves, with game to be controlled by the government, but with human activities also promoted (Matheka, 2005). It is worth noting here that between 1952 and 1960 much of southern and western Kenya was involved in the Mau Mau rebellion. Though the British government viewed this bloody conflict as a refusal of Africans to modernize, it was largely driven by land alienation (Newsinger, 1981). The rebellion mainly involved the Kikuyu, but it still had effects on Maasai communities (Newsinger, 1981).

From 1958 through 1968 the goal of conservationists shifted toward integrating conservation into other activities and gaining local cooperation (Matheka, 2008b). In 1959 African District Councils led by locals started declaring their own game reserves and began earning revenue from hunting licenses (Matheka, 2005). The general assumptions among international conservation groups were that African locals and leaders were opposed to conservation. This resulted in hostility and a patronizing role by conservation actors (Matheka, 2008b). As independence loomed, conservationists realized local cooperation was vital if a conservation future was to be secured in Kenya (Matheka, 2008a). For Africans, the reserves set up by the District Councils were a way to prevent land alienation. Local Africans feared that, post-independence, larger ethnic groups would take over and continue stealing land just as the colonial government had (Matheka, 2008a). Governments offering money for land only increased these fears among the Maasai. The run up to independence was rife with tensions between different ethnic groups who feared what conservation and the new government would do (Matheka, 2008a).

Kenya became independent on December 12, 1963. Independent African governments have largely favored conservation as they see the benefits in tourism, including Kenya (Matheka, 2008b). However, independent Kenya is rife with corruption and suffers from the same issues as colonial Kenya—forgotten and disenfranchised locals. By 1966 the government decided conservation should not be community based but centralized, and game reserves were turned into national reserves. Today, most park and reserve revenues go to local authorities or the state. Most local people are still not seeing any benefit from conservation, but are shouldering the costs (Matheka, 2008a). This situation does not promote cooperation with conservation efforts.

Corruption has become endemic in Kenya. The institutions meant to support good law and governance and keep democracy running, the checks and balances as we call them in the United States, have been purposely undermined or weakened in favor of centralizing power with the president and a few top officials (Hope, 2014). According to Hope (2014; p. 508), the corruption is so pervasive that citizens have adapted to it as it has enveloped all levels of government, including those in charge of conservation. Bribes are needed to get anything done, and theft and embezzlement are rampant, meaning conservation funds meant for communities never arrive (p. 503). Funds meant to offset the costs of conservation do not get to the Maasai, bad feelings continue, and the situation does not improve (Hope, 2014).

Conservation today is still mainly based on law enforcement and human exclusion from parks and protected areas. Animals, but not whole ecosystems, are protected (Akama, 1998). However, many animal populations are declining in Kenya. Parks do not work without the cooperation of surrounding communities. In Kenya there is a serious lack of involvement of pastoralists in state conservation programs. They should be incorporated into decision making, encouraged to see the benefits of conservation, and allowed to utilize resources sustainably. Reestablishing a sense of ownership is the only way to encourage involvement with conservation (Akama, 1998).

The colonial legacy is deeply ingrained in modern conservation and is not something that will be easily separated any time soon (Garland, 2008). The animals of Africa and their associated imagery have been co-opted so thoroughly by the west that giraffes and elephants are as familiar to American and British children as foxes and skunks. We grow up seeing them in zoos and are surrounded by their imagery in picture books, on clothes, and in games (Garland, 2015). We feel we are close to them, and that they are a resource for all humankind. But those animals live in Africa, and it is Africans who bear the reality and responsibility for their conservation (Garland, 2015). Despite this, conservation organizations are mainly western-run with western members (e.g., the International Union for the Conservation of Nature, Frankfurt Zoological Society, and World Wildlife Fund) (Akama et al., 2011). The control that these western organizations have reinforces structural inequities and maintains the power of developed countries over underdeveloped countries. Disadvantaged groups in Kenya are sometimes pressured into unfair and exploitive situations by tourism operators who threaten to withhold tourism funds if communities do not cooperate and adhere to tourist friendly guidelines (Akama et al., 2011). The lasting legacy of colonialism in conservation is an appropriation of African wildlife for ourselves, with a lack of recognition of the actual ownership. The burden of conserving wildlife falls on the African people (Garland, 2015).

A traditional sentiment is that by preserving animals, conservation promotes tourism, and tourism benefits local people with money. But, in Kenya at least, this does not seem to be true. Local communities rarely see the benefits of tourism, and indeed it is often little more than neocolonialism (Akama et al., 2011). Tourism promotes western styles of conservation and excludes communities from wildlife management. Wildlife tourism is a huge part of Kenya's economy, the third largest contributor to GDP after agriculture and manufacturing. This is used to justify many actions, such as banning traditional subsistence hunting (Akama et al., 2011).

I do not see anything in conservation literature about strengthening the ability of the Maasai to remain pastoralists. And yet, throughout history, it has proven to be a primary goal and motivation for Maasai communities (Kiik, 2019). Many times, when the Maasai have opposed the formation of a park or protected area, or formed a treaty with the colonial government, it was to further their long-term goal of remaining pastoralists (Kiik, 2019; Matheka, 2008a; Matheka, 2005). Conservationists, missionaries, and governments continue their attempts to bring education, agriculture, and other modern technology to the Maasai, failing to recognize they do not always lack access to those things. They have consciously rejected them in favor of remaining pastoralists (Ahmed et al., 2015).

While in Kenya in 2019, prior to embarking on the research for this PhD, I spent a day with a Maasai *ilmurran* who worked as a tour guide in Nairobi for part of the year. For three months a year he traveled to Nairobi, used a laptop at work, texted on a cell phone, posted on social media, shopped at the mall, and ate fast food. When I asked him why he took the job, he told me it was a great way of making extra money so that he could buy more cattle when he went home to the Maasai Mara. “The Maasai will remain as we are,” he told me proudly (anonymous Maasai, 2019). This man saw everything the modern world had to offer; he simply preferred his way of living. Part of the point of this research is to explore whether conservation scientists have considered this possibility. If they understand that the major motivation of Maasai communities is to remain pastoralists and strengthen their culture, I believe it will help them work with them in a more meaningful way.

Chapter 3: Methodology

3.1.0 The Pre-COVID Plan

Being able to adapt and change is a key part of good anthropology. All projects grow and develop from their original ideas and plans. This project, when originally conceived, focused on elephants, rhinos, giraffes, lions, and baboons. As I learned more about human-wildlife conflict in Kenya and took an initial exploratory trip to the area in 2019, I honed my ideas of what conflicts needed more research and where interesting contributions could be made. This is a natural and expected part of the research process (Lune and Berg, 2017; Kothari, 2004). However, on the 30th of December 2019 an event happened that would affect this research in ways that were both unexpected and entirely unprecedented; the first case of the virus that would become known as COVID-19 was reported to the World Health Organization (ProMed, 2019).

What happened next was something no one could have planned for. The virus ripped across the planet, killing millions, forcing the closure of doors and borders, and devastating world economies. The effects COVID-19 has had on the planet are well-documented and ongoing, but a discussion of the effects on this research is essential.

This research began as a traditional anthropological project; a multispecies ethnography sited in the Narok district of Kenya just north of the Maasai Mara. The field site would have been in and around the Maasai Naboisho Conservancy, an area highly affected by the annual wildebeest migration and exposed to high levels of the disease malignant catarrhal fever. I intended to hire local Maasai guides to lead me into villages where, with the help of a translator, I would ask broad, open-ended questions about wildebeest, conservation, and livelihoods. I would also conduct focus groups with the help of village councils. This would be supplemented by observing wildebeest behavior both within the conservancy near Maasai villages and outside the conservancy near tourist lodges. I would create simple activity budgets that could be compared for potential differences caused by hostility from Maasai. As a final way to round out the research, I would interview any conservationists in the area about their experiences working with locals.

By the time COVID-19 struck, this research was planned out in detail. Flights and lodges were booked and paid for, and local guides had been hired. Gear was purchased and suitcases were packed for the summer 2020 field season. My research permits were approved by the Kenyan government. I was informed on April 3, 2020 that my ethics application would be delayed due to the impossibility of travel at that time. From then until June 2020 everything was put on hold as we waited to see when travel would be allowed. No one really thought the situation would continue for so long.

As I waited, I decided to make the smallest portion of my research—talking with conservationists about their experiences working with locals—an online only endeavor so I could make progress. This required adaptation. I decided to open the survey to scientists and conservationists working all over Africa, not just in Kenya. This was the first of many changes. Once it became clear I would not be traveling in the summer of 2020, I then spent several months trying to determine the feasibility of delaying my fieldwork an entire year so it could still be done when the wildebeest were in Kenya (July to September each year) or whether it would be better to delay fieldwork just a couple months and scrap the wildebeest behavioral component of the research entirely.

Of course, that quickly became an entirely moot point as travel in 2021 started to look equally unlikely and ill advised. In December of 2020 it became clear I would need to either find a way to do my project without fieldwork or find a new project.

In retrospect, I may have chosen the harder path. I stayed with the project I had become dedicated to, and I found a way to do it from my computer chair. This new methodology was not my first choice. It was not my second choice. It was the only choice, given current conditions. The COVID-19 pandemic has taken so much away from so many. For me, it took away the tried-and-true methods of anthropology. It took away the comfort of doing something hundreds of people had done before. Some of the methods I have ended up utilizing represent pure experimentation as I attempted to do anthropology in brand-new ways. Some of it worked, some of it did not. It was all worth doing, however, because this will not be the last pandemic, nor the last time we must find ways to do anthropology from an office. As diseases and climate change become larger problems, there will be other times when we cannot travel, and anthropologists will have to find novel research alternatives. This is my attempt at a new type of anthropological methodology. Rather than “armchair anthropology” this is “computer chair anthropology” (Sera-Shriar, 2013: p. 3).

3.2.0 Scientist/Conservationist Surveys

As already discussed in Chapter 2, scientists and experts may have reservations about participating in social science research and be wary of how their research may be presented in publications (Wiles et al., 2006). I endeavored to make the process of surveying conservation practitioners extremely clear and free of misunderstandings.

I generally followed the methodology of Wiles et al. (2006)—approaching people via email with a Word document of questions and a consent form as a type of non-probability-based convenience sampling (Fricker, 2016). Wiles et al. (2006) point out the difficulty in getting at the private thoughts of researchers. Those who are familiar with the processes of research are aware of how they may be presented and are therefore extra cautious in presenting a more public account of their research. The email surveying method does not solve this issue. Wiles et al. (2006) also caution the researcher against prior knowledge of those they are interviewing; any personal or professional information about survey respondents is not information that should be used in the analysis because consent has not been explicitly given regarding that information.

The survey questions were simple and concise but designed to be relatively broad and invite longer answers; this is why a Word document was sent rather than a Qualtrics form that presents a small box that makes long answers challenging. The first three questions gathered information about the project itself, the extent to which the project involved local people, and how much the researchers came into contact with local people. Questions four through eight were the main questions of interest. These questions were designed to gather data to complement the Maasai survey: successes and challenges working with locals, how locals might benefit from the projects, how the researchers might like to involve locals more, and how they felt about involving locals in conservation research. The final two questions were attempts to snowball the research (a list of all questions can be found in section 4.2.0). By designing the bulk of the survey to inform and match up with the Maasai survey, I hoped to elucidate the conservation encounter as a whole, rather than simply gathering a separate set of data. Though none of the surveyed researchers worked on this particular conservation issue, it is still helpful to know the broad trends that conservationists and scientists consider successes, challenges, and assistance to local people. This allows a point of comparison with what the Maasai believe about those same issues.

Because the initial pool of potential respondents was so low, no formal pilot was conducted as it would have taken potential respondents out of the final pool. However, questions were thoroughly discussed and modified with the help of two researchers who have worked in Africa; I deemed them too close to me personally to allow them to participate in the final survey.

As I discussed in Chapter 2, gaining access to experts and professionals can be extremely difficult. The knowledge of experts is often considered confidential or privileged, by others and by themselves, and can make responses difficult to acquire (Christopoulos, 2009). Restricting the survey to only those conservationists working in Kenya with the Maasai would likely have resulted in only one or two responses, so I chose to open it up to anyone working on animal or conservation research in Africa. The general challenges and successes these projects experienced were relevant to many different types of conservation projects and were an interesting point of comparison for this conservation encounter.

3.3.0 Maasai Surveys

In the original version of this research, I would have traveled around the Naboisho Conservancy to different Maasai villages. My local guides would have made formal introductions and we would have approached people as they shopped, worked, and relaxed in public places. I would have conducted semi-structured interviews to determine their attitudes toward wildebeest and conservation. My goal was to interview 20 to 40 people. This was the main part of my research and what I intended to spend the most time on. In many ways, this is the most traditional sort of anthropology, and this form of spontaneous, semi-structured interview has long been at the center of the ethnography (Evans-Pritchard, 1962; Mead, 1928). Once travel became impossible, my backup plan was to conduct almost exactly the same research, but without being personally present. I intended to hire the same research assistants. They would travel around their own villages with an audio recorder and conduct interviews for me. I would lose the ability to ask follow-up questions, but with a well-crafted set of interview questions I believed this would still be viable.

As COVID reached the rural parts of Kenya, even this backup plan became impossible. I could not ask research assistants to travel around villages and risk spreading COVID-19 in their own communities. It then became evident that only internet surveying methods would be viable. This began to enter the realm of quantitative rather than qualitative surveying and started to resemble sociology more than anthropology. I attempted to seek help by hiring a marketing company to conduct online surveys for me. However, of the eight companies I contacted, all but one said the Maasai were an impossible population to reach via the internet. The one company who said they would try quoted an extremely high price and promised only 20 to 40 survey responses. These companies were not local to Kenya but were Western-based marketing companies.

That is how I ended up with my methodology. What follows represents my fourth choice for conducting this research, my last-ditch effort to access a population I was determined to reach. The marketing companies were wrong. The Maasai are indeed accessible via the internet and social media.

Though the professional marketing companies I contacted said they could not reach the Maasai because they are a hard-to-reach population, several researchers have pointed out the advantage of using social media to reach traditionally inaccessible populations (Baltar and Brunet, 2012; Topolovec-Vranic and Natarajan, 2016; Dalsgaard, 2016). Topolovec-Vranic and Natarajan (2016) studied the use of social media for recruiting people for medical research studies. They analyzed 30 different studies and found that in 12 cases social media was the most effective strategy. Interestingly, in 6 out of 8 studies of traditionally remote populations, social media was the best strategy, indicating that social media might work best when the population is hard-to-reach (Topolovec-Vranic and Natarajan, 2016). Chambers, Bliss, and Rambur (2020) analyzed whether a Facebook advertisement was a better survey recruitment method than traditional snowballing (where early survey respondents recommend more respondents). They found snowballing to be more effective among a population of nurses (Chambers, Bliss, and Rambur, 2020). All of these studies provided appealing ideas that I considered when disseminating my survey.

3.3.1 Doing Anthropology Online

Almost since its inception, the internet has become an area of fascination and potential study for anthropologists (Abidin and de Seta, 2020; Crichton and Kinash, 2003). Anthropology online uses many names, including media ethnography, virtual anthropology, virtual ethnography, digital ethnography, social media ethnography, and netnography, though the last refers mainly to using anthropological methods for market research and in understanding consumer behavior (Abidim and de Seta, 2020; Kozinets, 2009). The term digital ethnography is perhaps the most widely used and the one I will use here to refer to ethnographic research about, on, and through digital media (Abidin and de Seta, 2020).

The amount of digital ethnography available is vast, and I will not review it all here. Those wishing to dive deeply into the world of ethnographic research online will find entire ethnographies of players of online games (e.g., Boellstorff, 2005) and volumes of methodologies on conducting digital ethnographies (e.g., Hine, 2000). I will, however, briefly review some of what is relevant to this research.

My main reason for not doing a deep dive into digital ethnography and its associated methods is that I do not believe this research is truly representative of digital ethnography. The focus of most digital ethnography is online social interactions, subculture, and community, that is, the social space of the internet itself (Steinmetz, 2012). The offline lives of participants are contextual, but not generally the primary focus of the digital ethnography (Steinmetz, 2012). In this research, the opposite is true. Interactions occurred online, but the primary focus was the real world, the behaviors and opinions of participants when they are offline—their lived experiences. In this way, this research should be thought of less as digital ethnography and more as doing anthropology online. I used many of the methods and much of the advice of digital ethnography (especially when it came to ethics), but the primary goal was not to study how the Maasai use the internet, but to recruit them for a survey that would hopefully be representative of their thoughts and opinions on a conservation issue salient to their offline lives. I will, therefore, discuss those parts of digital ethnography I found most useful in conducting this research.

Much early digital ethnography was primarily content analysis, where information was gathered from the internet and research was done in a covert, rather than overt way (Murthy, 2008). Any digital ethnography can cross over into content analysis if the ethnographer is not participating; blurring methodologies, and creating ethical issues (Steinmetz, 2012). I was very aware of the ethical issue of lurking during the course of this research. Traditional ethnography is based in participant observation. In person, this may not require much participation as your presence alone alerts people that you are doing research, but online, simply being present can often mean you are invisible (Góralska, 2020). Entering Maasai Facebook groups as an outsider, I did not want to lurk in virtual places that were not intended for me, and I did not want to collect data without express permission. Content analysis of posts and comments was therefore not something I conducted. Power relations do not disappear online (Murthy, 2008). Differences in race, gender, sexuality, and disability still exist and can cause inequalities (Murthy, 2008). The Maasai are a vulnerable population, and I was careful not to invade their virtual spaces.

The question of space, of what the field site is, becomes challenging when moving online. Where originally my research would be very clearly bounded within one Maasai conservancy, I now had no clear way to define it. In digital ethnography, the field site is created by the ethnographer and can be thought of as a network, rather than a location (de Seta, 2020). The field is determined by the connectivity of participants and the interactions between online people, groups, and entities (Steinmetz, 2012). However, physical location still matters. People engage with the internet from somewhere (an office in Delaware or an internet café in Nairobi), and their physical context and material reality influences their online behavior (Steinmetz, 2012). The field site is not just online, it is also in the various places the participants are located when they access the internet (Hine, 2016). The field site is also not determined ahead of time; the research brings it into being and in some ways, the ethnographer must decide how to bound it as it is being created (Hine, 2016). In my case, the field site became not only all the locations in Kenya inhabited by Maasai, but all the areas they were located when they interacted with me online. Interactions also occurred with non-Maasai and Maasai living outside of Kenya at the time they interacted with me, further expanding the field site.

Though some have argued that online methods are no substitute for in-person field work, they do have many benefits (Abidin and de Seta, 2020). The internet can facilitate communication by overcoming barriers of time zones and geography, and participants are not limited to those who are geographically available to the researcher (Crichton and Kinash, 2003). This was a major benefit to me, as I was able to access a more diverse audience. Interactions are also able to be asynchronous (Crichton and Kinash, 2003). Again, this was another benefit as those who may not have been present during normal field hours were still able to participate in the research.

Though refusal rates for surveys are higher online than in person, there is evidence that the data collected is more intimate and personal (Góralska, 2020; Murthy, 2008). This increased intimacy and increase in personal information given could be due to the blurred lines between researcher and participant that exist on the internet (Driscoll and Gregg, 2010). When the researcher exists in the same virtual spaces as the participant, they may start their research already having “gone native” and be more accepted and less of an outsider (Driscoll and Gregg, 2010). These benefits come with major drawbacks, such as the absence of visual and bodily cues (Crichton and Kinash, 2003). More shortcomings of doing anthropology online will be discussed later in this chapter and in Chapter 5.

Conducting research online to investigate offline beliefs and attitudes rests on the assumption that online behavior is not entirely separate from offline behavior. This assumption may seem obvious, but it is an assumption, nonetheless. Digital ethnography frames this assumption in the question of whether the internet is a culture of its own, or a cultural artefact (Hine, 2000). The answer, of course, is that it is a little bit of both. The internet may create a space where behaviors change (see the later discussion on the disinhibition effect) (Lapidot-Lefler and Barak, 2012), but overall, the internet is shaped by its users and their culture and social context (Hine, 2000). The internet means different things to different people and is shaped by their expectations of how it should be used and the online expression of their culture (Hine, 2000).

Online anthropology is a field of blurry boundaries, mixed research strategies, and novel ethical dilemmas (discussed at length later) (Góralska, 2020). The key to success, perhaps, lies in reflexivity (Steinmetz, 2012). Methodology is fluid and created for each project as it goes, so reflecting on the choices made in the design, practice, and analysis of the project at all stages is vital to good online anthropology (Abidin and de Seta, 2020). I have attempted to include reflexivity at each stage of this project in an effort to make my intentions, biases, positionality, and assumptions explicit.

3.3.2 Designing the Online Survey

Designing an online survey is quite different than designing an in-person survey. There can be no follow-up questions and there is a much greater risk that respondents will abandon the survey before completion (Manfreda, Batagelj, and Vehovar, 2002). All these issues increase when the survey respondents are from a different culture and are completing the survey in a language other than their first language (although my survey was also translated into Swahili). Andres (2012) provides four guiding principles to keep in mind when writing survey questions (p. 7-8):

1. Ask questions the respondents are able to answer.
2. Make sure each question has only one thought or idea.
3. Choose your words carefully.
4. Provide instructions on how to answer each question.

These basic principles have been incorporated into my online survey. Andres (2012) also advises closed-ended questions be followed by open-ended questions to allow respondents to explain their answers. I incorporated many yes/no questions into my survey to allow low literacy and low ability English/Swahili speakers to participate. I then followed them with open-ended “explain your answer” type questions that were non-forced to allow respondents to expand on their ideas. Fowler and Cosenza (2009) also points out that some open-ended questions are needed to allow respondents to fully express themselves.

Andres (2012) advises against long questions, hypothetical questions, and ranking questions, which can all be frustrating and increase abandonment of the survey. None of these question types were used in my survey. All questions were short, succinct, and referred to concrete opinions or facts. Nardi (2013) advises against framing questions as “I” statements; they may feel too personal. This was avoided in my survey. Nardi (2013) also offers advice about the order in which questions should be asked: the most important and interesting concepts should come first, demographic questions should be last, and questions should be ordered in such a way so that early questions cannot bias later questions. I followed this format in my survey by starting with questions on wildebeest, then conservation, then demographic questions. I did not want the questions about conservation in the area to potentially dispose people to dilute their frustrations on wildebeest conflicts.

Fowler and Cosenza (2009) discuss the most important aspects of survey questions: they must be reliable and valid. Questions must provide consistent measures and correspond to what they intend to measure (Fowler and Cosenza, 2009). Fowler and Cosenza (2009) caution against agree-disagree statements as these may mean different things to different people, and some people may simply not feel comfortable disagreeing. Fowler and Cosenza (2009) also advise simple questions if the survey is going to be administered in multiple languages. Complex questions may translate slightly differently across languages and lead to questions having slightly different meanings. In my survey I attempted to make questions as simple and clear as possible to ensure the questions would mean the same thing in English and Swahili. I also took the advice of Manfreda, Batagelj, and Vehovar (2002) and made my survey relatively short, consisting of a single page to avoid survey abandonment. This summary represents some of the most important research on survey design, the result of which is the final survey I disseminated via social media. The full survey can be found in Appendix 1.

3.3.3 Conducting Social Media Research

There are many ways to disseminate a survey: in person, by phone, by email, by letter, and by social media. Digital survey distribution implies that people are administering the survey to themselves, rather than being guided. Though self-administered surveys can have the disadvantage of abandonment and possible lack of clarity, they have several advantages. Self-administered surveys may be vastly better for sensitive topics that people do not feel comfortable discussing in person (Andres, 2012). It is also less likely that the researcher might affect the outcome of the survey if it is self-administered (Nardi, 2013). This may have been advantageous in this situation because my position as a woman and an outsider could have affected in-person responses.

The self-administered survey may have had a major advantage in bypassing traditional Maasai etiquette. The Maasai are an extremely polite culture, and when I visited Kenya and Tanzania in 2019, I was told multiple times by Maasai that as a visitor I was a “gift,” and it was their job to ensure I was comfortable. I expected issues with in-person surveys because of this cultural aspect. I was concerned that I would have respondents telling me what I wanted to hear in order to remain polite and help me feel comfortable. Clearly, an English-speaking white woman is an outsider, but over the internet, I hoped to lose that identity and garner more honest responses. Judging by some of the interactions I had online— discussed in detail later—I believe much of the traditional politeness of the Maasai did not carry over to the internet. The online disinhibition effect, the increased tendency of people to lower behavior inhibitions online and post verbal attacks, insults, profanity, or even violence is one most people are familiar with on a basic level (Lapidot-Lefler and Barak, 2012). This effect has been observed in Israeli students (Lapidot-Lefler, 2012), Dutch and German adults on Facebook (Grote, 2012), German middle schoolers (Wachs and Wright, 2018), high school students in Japan (Udris, 2014), and even potentially Church of England clergy members (Longden, 2014). Research so far suggests no group is immune to this effect, and this research certainly seems to suggest the Maasai are no exception.

Dissemination of this survey ended up taking place entirely online through Facebook. I had hired local research assistants in Kenya to help network digitally with their family and friends via email and WhatsApp (which is very popular in Kenya) to disseminate the survey, but this did not work out. The research assistants had full time tourism jobs and did not have the time to dedicate to surveying that I had hoped. I was left only with my survey link and my Facebook profile. I decided to use Facebook due to its popularity. Globally, Facebook is the most used social media platform (Dalsgaard, 2016). It is also the most popular social media platform in Kenya, with 10 million monthly users (Maina, 2020). For the purposes of this research, I will define social media and social networking sites in the same way as Otieno and Matoke (2014). Social media is any internet-based technology which promotes opportunities for social interaction among its users, and social networking sites are those that promote virtual communities that can interact and communicate (Otieno and Matoke, 2014; p. 962). Mobile phone use is common among the Maasai, with mobile phone subscriptions reaching 82% of sub-Saharan Africans in 2018 (Baird et al., 2021). Additionally, Kenya has free access to Facebook through the most common phone carrier (without having to buy additional internet data) so it is highly accessible to any Maasai with a cell phone (van der Berg, 2014). This ended up being very beneficial as I was talking to participants; they often told me they were on the “free Facebook” and would take my survey when they were somewhere with Wi-Fi.

Social media is becoming more and more popular as a tool in higher education. It helps collaboration among colleagues and researchers and helps disseminate information (Guy, 2012; Gruzd, Staves, and Wilk, 2012). Some researchers are even starting to use it in place of other qualitative methods, though some have called it a poor substitute (Branthwaite and Patterson, 2011). Due to the widespread use, accessibility, and cost-effectiveness, more and more academics are using social media for various purposes. Nández and Borrego (2013) found academics were using social media to support collaborative creation and dissemination of knowledge, though they were using social networking sites less than other social media like wikis and blogs. They tried running an online survey and had a 39% response rate (Nández and Borrego, 2013).

Using social media sites to conduct surveys has been one of its top uses among researchers (Otieno and Matoke, 2014; Baltar and Brunet, 2012; Topolovec-Vranic and Natarajan, 2016). Social networking sites can help researchers easily access large populations; surveys can be run cheaply, quickly, and with a single researcher. Researchers can target particular interest groups by posting in Facebook groups, resulting in greater authenticity in the responses due to the anonymity of the internet and a lack of survey coercion. Online surveys are convenient for respondents, and respondents may feel more confident in the research when they are able to see information about the researcher (e.g., their Facebook profile) (Otieno and Matoke, 2014; Baltar and Brunet, 2012). There are also obvious weaknesses to surveying via Facebook. Respondents are limited to those with computer skills and a Facebook profile, and a high rate of non-response is always an issue, as with all surveying methods. There is an element of trustworthiness online where people may not be who they say, and surveys done this way are impersonal and lack some of the conversational aspects anthropology often desires (Otieno and Matoke, 2014; Baltar and Brunet, 2012).

Some of the above-mentioned advantages were particularly helpful to this research project. The ability to access a large portion of the population was critical. Since the survey questions had to be simplified, and I was losing the ability to have more of a traditional conversation, I wanted to make some statistical statements about the results, which require more respondents than I had initially aimed for using in-person surveys (analyzed qualitatively). Running the survey quickly and cheaply was also critical, as I had lost time and money on my failed trip to Kenya. The ability to target particular groups and interests via Facebook groups was also an indispensable aid. I have already touched on my belief that respondents would be more honest over this medium. The last point made by Baltar and Brunet (2012) about respondents feeling more confident when they are able to access information about the researcher also appealed to me.

Despite my desire to run statistics on the results of the survey (which I did), I must make it clear that those statistics (presented in the next chapter) are a compromise and not representative of the entire population. The weaknesses of social media sampling discussed above means it is impossible to construct a probability sample of the population, one in which all members have a known chance of being selected for participation in the survey. Therefore, the statistics I present are not generalizable. They present an interesting glimpse into the thoughts and opinions of some Maasai but should not be taken to be representative of the entire population. As much as a probability sample would be ideal, it is likely impossible to achieve through online sampling at this time. Social science, especially during a pandemic, often requires some compromise, and the insights gained from this survey were fascinating, despite the lack of a probability sample.

The power dynamics between researcher and researched, or between anthropologist and vulnerable population, or interviewer and interviewee, are a constant issue in anthropology and the social sciences (Bravo-Moreno, 2003). A constant struggle in anthropology is to put ourselves on equal terms with those we are researching. It is difficult to achieve. I was already dreading entering Maasai villages as a white woman in expensive cargo shorts, carrying a fancy backpack and camera equipment, and pulling out my audio recorder and clipboard to take notes. But when Facebook is your field site, this balance of power is turned on its head (Sin, 2015). By accepting the friend request of someone interested in taking my survey, I gave them just as much access to my life as I had to theirs, if not more. I have been on Facebook since 2009 and I did not alter my profile in any way before starting this research. In many aspects, I became the vulnerable party. My respondents had access to my history, thoughts, past relationships, and photos. Instead of a faceless researcher asking questions and then leaving their village forever, I became a real person with a past they could investigate as much as they wanted. The balance of power is equalized on the internet, and my hope was that this might give more people the confidence to participate in the survey (Baltar and Brunet, 2012; Sin, 2015).

The high non-response rate was a major disadvantage with this method. A large number of people simply "liked" or commented on my posts about the survey but did not actually take it. A lack of coercion or convincing is good for making people feel comfortable, but not for increasing the number of responses. I was not overly concerned about the possibility of people pretending to be Maasai to take the survey; there was nothing to be gained as the survey was not incentivized. My major concern with social media surveying revolved around who had access to Facebook and the internet. Specifically, I was apprehensive that it would consist exclusively of very young men. My unease over age proved somewhat true. I had a good number of responses in the 38-47 category, but only 2 in the 48-57 category and none in the 58 and older category. My fears about the vast majority of respondents being male did prove true. Cell phone use among the Maasai is mainly for communication about cattle herding or by those with seasonal jobs in the tourism industry. Unfortunately, these are both male domains, so women do not tend to have cell phones unless they are students or working in the tourism industry.

3.3.4 The Ethics of Social Media Research

As social media research grows and develops, the ethics of conducting such research should be considered. Before I began disseminating my survey, I read the current guidelines around social media research ethics. I then decided on my "netiquette" (Dalsgaard, 2016). There are few set rules, but I will detail my actions and the guidelines I considered. In Chapters 5 and 7, I will discuss what did and did not work.

Throughout the history of anthropology what we consider to be the field has changed (Dalsgaard, 2016). Once, the field was only the wild and exotic places of the world. In the last few decades, the field has become the office, the laboratory, the inner city. Now, the field includes the internet (Sin, 2015). Some anthropologists believe that cyberspace has spawned its own culture distinct from those in the real world (Kozinets, 2009; p.11). Others believe internet culture is merely an extension of culture in the real world, and that internet interactions are governed by how culture works in person, albeit with some changes (Dalsgaard, 2016). My experience has been the latter. Most of my interactions with Maasai online were reminiscent of those I have had in person, but with some differences.

Some of the recommended methodology for doing anthropology on the internet has so far focused heavily on how to adapt traditional anthropological methods like participant observation to the online world (Kozinets, 2009; Dalsgaard, 2016). However, these methods are not entirely transferrable (Driscoll and Gregg, 2010). Dalsgaard (2016) points out that participant observation in an online setting becomes lurking and may not be entirely ethical if the observed people do not realize you are there.

Facebook research lacks the physical elements of the field, so researchers may need to participate more and come up with entirely new methods to remain ethical (Dalsgaard, 2016).

The use of social media as a field site changes what information is public and what information is private (Sin, 2015). For most people, online social media spaces are continuous with social spaces—their posts are meant for friends and family, not researchers, and posts are not made with research in mind or meant for a wider audience, even if the privacy settings allow it to be seen by a large audience (Sin, 2015; Gelinas et al., 2017). If we “friend” someone in our study population, is it ethical to use data that someone has posted to their public wall (Townsend and Wallace, 2016)? Social media represents a continuum of public and private, and many users may not understand that continuum or who can see and access their content (Sin, 2015; Kozinets, 2009). Ethically, it is vital to consider more than just what constitutes legal use (Sin, 2015).

Though friending respondents and participants may help balance power relations, if we see posts on their pages or our feeds, this could influence our research (Sin, 2015). We cannot unsee those things, and it can bias our write-ups whether we want it to or not. If we want to use direct quotes made on the internet, even if we use them with no name attached, those quotes may be searchable, and it may be relatively easy to find out who made the comment (Sin, 2015; Steinmetz, 2012). Using social media comments, walls, and posts as a source of data is an ethical issue separate from using it to facilitate recruitment, as I am doing (Lunnay et al., 2014).

I did rely heavily on Facebook groups in this research, which necessitates some ethical consideration (a full list of Facebook groups joined can be found in Table 1). Groups are a good recruitment tool for contacting specific interest groups and segments of the population, but many have specific requirements for entry. Gelinas et al. (2017) caution the researchers to be transparent when gaining access to these groups. Care should be used if the group does not expect a researcher to be present, and your presence should be disclosed (Gelinas et al., 2017). As already mentioned, lurking can be an ethical issue online (Dalsgaard, 2016; Goralska, 2020). Lurkers are those who are present in an online community or group but do not participate (Kozinets, 2009; p. 31). Often, lurkers are interested people who do not feel comfortable participating. When a lurker is a researcher who might be gathering information on the members of the online community, it could inspire anger in the members.

Before I disseminated my survey, I decided on several ethical guidelines based on advice available for online anthropology. I knew I would be relying heavily on Facebook groups to reach Maasai people specifically. I adhered to the following self-imposed rules for joining and interacting in Facebook groups:

1. I did not attempt to join any groups whose membership requirements specifically excluded advertisements or research.
2. If the group asked why I wanted to join, I said I was a researcher based in the United States hoping to distribute a survey to Maasai people about human-wildlife conflict and conservation.
3. I never lied in any questionnaire about joining a group (e.g., I did not claim to be a student at a particular university in order to gain access to the group).

4. Once I joined the group, I immediately “unfollowed” it so I did not see posts from the group in my newsfeed (to avoid lurking).
5. Once I joined, I posted my request for survey responses within a week.
6. I did not interact with the group beyond requesting survey responses, though I did respond to comments on my posts about the survey and tried to reply to most, if not all, comments.
7. I did not post a request for survey responses more than once a week.
8. I did not request to join any particular group more than once. If I was denied, I moved on.
9. I did not request to join groups that stated they were exclusively for Maasai people.

I ended up joining 33 separate Facebook groups that ranged in membership size from 87 members to 118.9 thousand members.

I also decided to “friend” survey respondents. I followed some similar ethical guidelines when friending respondents as when joining groups. I accepted friend requests, but I immediately unfollowed the person, so I did not see their posts in my newsfeed. I never visited their personal page. I wanted the respondents to have access to my information so they might feel more comfortable, but I did not want their information to bias my analysis of the survey data.

One thing I did not anticipate before beginning survey distribution was the large number of private messages I would receive through Facebook. Many people who filled out the survey communicated with me about it first, either by commenting on a post about it or by sending me private messages, or in many cases both. Thirty-seven respondents conversed with me through private message, Facebook comments on posts or ads, or both. Some conversations started as comment threads and moved to private messages. I did answer private messages about the survey, usually by asking if they had any questions, giving more details, and sending them the link for the survey. This was often followed by them asking me more questions, such as where I lived and if I had ever visited Kenya. I engaged in many conversations over private message. I believe the vast majority of these conversations were extremely beneficial and helped respondents feel the research was more personal and useful. For example, I connected with a female student in Nairobi to discuss the details of the research. Explaining more fully what the project was about interested her much more than the brief explanation in the survey. This resulted in her forwarding the survey to friends. This was a beneficial interaction for me, as I struggled to get female respondents. However, I was not always successful in keeping these conversations on track; I will discuss a few unfortunate interactions in Chapter 7.

As already noted, the ethics of conducting anthropology on social media are not fully developed. I believe I advanced them with this research, and I hope the next generation of researchers can learn from my successes and misses, discussed later. I had favorable outcomes and some truly fascinating interactions conducting this online ethnography. It was worth doing, despite the complexity of the ethics.

3.4.0 Wildebeest Behavioral Data

In order to determine whether Maasai activities cause any change in wildebeest behavior, I wanted to find two sites in Kenya to observe wildebeest behavior. Ideally, I would have observed wildebeest near a Maasai village and near a tourist lodge. Both areas would have had humans, but these two groups of humans would have theoretically different attitudes and behaviors toward the presence of wildebeest. I hypothesized Maasai would not want them around and tourists would. By creating activity budgets based on a simple ethogram (lying down, standing, moving, interacting, eating, drinking) and comparing them between sites, I hoped to detect any broad differences in behavior caused by differences in human treatment of the wildebeest.

When travel became impossible due to the pandemic, my first instinct was to scrap this portion of the research entirely. I briefly considered hiring someone local to do it, but the difficulty in training them to conduct a reliable ethogram via Zoom or email and then trusting that all protocols were followed precisely seemed unreliable and somewhat daunting. I considered mailing video cameras to Kenya to be set up in different locations, but the odds of them making it through customs, remaining operational in the bush for days or weeks, and then making it back through customs without vanishing somewhere along the way seemed unlikely. Since I was not there to choose the sites, I could not anticipate other confounding variables (e.g., one camera being placed near a road or watering area).

After deciding there was no reasonable way to compare wildebeest behavior in Maasai versus non-Maasai areas without personally traveling to Kenya, I then remembered something I had participated in myself: citizen science—a method of recruiting the public to help with large scale data analysis projects (discussed further below). I discovered, and eventually used, a project called Snapshot Safari, which is hosted on the Zooniverse platform. Snapshot Safari is a large-scale camera trap survey that produces millions of camera trap images of animals in ecosystems and areas all across Africa. These images are then hosted on the Zooniverse website where citizen scientists can help identify the species. The classified and validated information is then made available to the public and to researchers (Snapshot Safari Introduction, Zooniverse.org). In a stroke of incredibly good luck, this data also includes behavioral categories for the animals identified in the photographs. I have classified a few Snapshot Safari camera trap photos as a citizen scientist myself and taught kids and adults about the fun and value of it. Now I found myself in a position where my research could benefit tremendously from access to the datasets generated by the project.

I contacted the University of Minnesota Lion Center to obtain the datasets from two locations: Serengeti National Park in Tanzania and Enonkishu Conservancy in Kenya. The Snapshot Serengeti Project has many locations throughout Africa, but these two locations provide the best comparison for wildebeest behavior differences caused by Maasai presence and actions. Enonkishu Conservancy is Maasai owned land just to the north of Maasai Mara National Reserve, Kenya. The wildebeest migration moves through the area when malignant catarrhal fever transmission danger is high, and the area is heavily occupied by Maasai. Serengeti National Park in Tanzania is occupied by wildebeest for much of their migration, but not when they are able to transmit MCF. Maasai are excluded from entering Serengeti National Park. Though encroachment does occur up to 10 kilometers into the National Park, it is in short trips and there is no continuous occupation (Pampuro, 2019).

Later I will discuss the many confounding variables between the two sites, making them an imperfect comparison (no perfect comparison exists). However, I am thrilled to have found such an excellent alternative that allowed me to study wildebeest behavior. The Snapshot Serengeti datasets are also incredibly robust, representing thousands of camera trap images over years of data collection. Far more data has been analyzed than I could have collected myself.

3.4.1 Citizen Science

Citizen science is a research tool that harnesses the public to assist with scientific projects, often through gathering or analyzing data (Bonney et al., 2009). Public participation in science is not a new idea; the first formal citizen science project was likely the Christmas Bird Count started by the National Audubon Society in the USA in 1900, which encouraged the public to count birds over the Christmas season. Since the 1990s its use has become more widespread and formalized (Bonney et al., 2009; Silvertown, 2009). The public is a free source of labor, skill, and computational power that can be harnessed in a cost effective way for scientific research (Bonney et al., 2009; Silvertown, 2009). The internet and phones are making citizen science accessible to more and more people, and usable software makes it easy to enlist nonexperts (Silvertown, 2009).

Kullenberg and Kasperowski (2016) determined three focal points of current citizen science research. The largest was the use of citizen science for collecting and classifying data for biology, ecology, and conservation. Projects like eBird use huge networks of citizen scientists to collect massive amounts of biological data (Dickinson et al., 2012). The other two areas in which citizen science is being utilized are with geographic data and with health and environmental issues, though Kullenberg and

Kasperowski suspect many projects may be using citizen science without making it explicit or giving proper credit in their publications (2016).

The use of citizen science in biology, ecology, and conservation is likely due to its unique ability to collect huge amounts of data over large geographic scales and/or long timescales (Silvertown, 2009; Bonney et al., 2009). Given the threat of climate change, it is becoming increasingly important to monitor large scale and long-term changes in the environment. Some projects are able to collect data remotely, but some require huge networks of people to collect that data (Dickinson et al., 2012). This is where citizen science is critical. Even for those projects where data is collected remotely, like Snapshot Safari, it may produce far more data than any one scientist or even a large team of scientists could ever analyze (Swanson et al., 2015, Bonney et al., 2009; Silvertown, 2009). Citizen science can also recruit large numbers of people, including diverse people of different backgrounds and abilities who can add to the research (Dickinson et al., 2012).

Citizen science also has the major benefit of built-in education and outreach (Silvertown, 2009). Participation creates meaningful connections and fosters an understanding of the process of scientific research (Bonney et al., 2009; Dickinson et al., 2012). In the social media world where science is increasingly questioned, this can only be a good thing. The existence of large-scale monitoring projects made possible by citizen science can also help launch question driven research into other topics, which is the case with this research (Dickinson et al., 2012). Snapshot Safari primarily monitors the presence or absence of species, but answers to my questions on wildebeest behavior are made possible by the existence of the monitoring project and the large amounts of data analyzed by the citizen scientists. By involving the public in research, we can also involve them in conservation, habitat management, and decision making (Cooper et al., 2007).

Despite the many benefits of citizen science research, there is still some general mistrust of the data among scientists and an unwillingness to use it as a primary research tool. Burgess et al. (2016) conducted a large-scale survey of professional biodiversity scientists and determined there were four main barriers to its use: many scientists believe not all biodiversity science is well suited for citizen science; there is narrow awareness among scientists of citizen science projects that match their needs; there is bias among scientists for certain data sources; and scientists fear there is inconsistency in citizen science data quality. Some of these issues can only be addressed with better awareness of citizen science. The issue of whether data collected or analyzed by citizen scientists is acceptably accurate and reliable is an important one.

Aceves-Bueno et al. (2017) compared citizen science data to reference data for 63 different studies. They found that citizen science data differed significantly from expert data in 38.4% of data. This seems disheartening, but it is not the same across all types of citizen science projects. Kosmala et al. (2016) found that diverse citizen science projects can produce accuracy equal to professional data and analysis. They point out that expert data or analysis is not necessarily always accurate. In a study of tree species in Massachusetts for example, experts correctly identified the tree species 98% of the time. Another study of tree plant species conducted by experts had an accuracy of only 88% (Kosmala et al., 2016). Citizen scientists cannot be expected to have 100% accuracy. What both Aceves-Bueno et al. (2017) and Kosmala et al. (2016)

agree on is that it depends heavily on the particular citizen scientist tasks and how the project has been designed to account for skill level and potential errors.

Kosmala et al. (2016) has many suggestions for increasing accuracy, including providing citizen scientists with training or guidance, requiring multiple volunteer measurements to increase accuracy, having large datasets to offset random error, and taking into account task difficulty. They also point out that the biases in citizen science data may be the same ones as in expert data, for instance, misidentifying similar species like Thompson's and Grant's gazelle can happen with both citizen scientists and with experts (Kosmala et al., 2016). The specifics of the accuracy and procedures of the Snapshot Safari data will be detailed in the next section. Kosmala et al. (2016) gives the sound advice that each citizen science project or dataset should be judged individually; it should not be assumed to be substandard because it is produced by citizen scientists.

3.4.2 Snapshot Safari and Zooniverse

The Zooniverse platform is a unique opportunity for scientists to host their projects and ask for citizen science assistance in analyzing their data. The platform primarily hosts photographs, videos, and audio recordings for citizen scientists to analyze (Simpson, Page, and De Roure, 2014). Galaxy Zoo was the first Zooniverse project. Launched in July 2007, it engaged 165,000 volunteers to classify images of galaxies. The platform allows the public, with or without an account, to participate in genuine data analysis for projects with scales that researchers could not analyze on their own. Zooniverse takes advantage of the fact that humans can far outpace computers in visual tasks like pattern recognition (Simpson, Page, and De Roure, 2014). Zooniverse is now the world's most popular citizen science website and, as of 2016, hosted 1.5 million volunteers worldwide (Swanson et al., 2015; Swanson et al., 2016).

The Snapshot Serengeti Project (the first project in the Snapshot Safari network) started in 2010 in cooperation with the Serengeti Lion Project and uses the same study area in the central Serengeti and southern plains, covering an area of open savannah moving into woodlands (Swanson et al., 2015). Two hundred and twenty-five camera traps were placed out across 1,125 square kilometers on trees or metal poles within their own 5-square-kilometer grid cells. These motion-detecting cameras face the direction least likely to initiate misfires. When motion is detected, they trigger, taking a series of three photos within one second during the day, and taking a single photo at night, then waiting one minute before being able to be triggered again. For more information on camera trap procedures see Swanson et al. (2015).

This type of camera trap survey is gaining in popularity since it is cheap to implement. Camera traps are increasingly inexpensive and can be left unattended in the field for months (Swanson et al., 2016). The ability of this type of project to collect data is limited only by the ability of its scientists to analyze the data. Between June 2010 and May 2013, the Snapshot Serengeti Project alone produced 1.2 million image sets, each containing 1-3 individual photographs (Swanson et al., 2015). Without citizen science, this project would not be feasible to analyze.

When a citizen scientist chooses to participate in a Snapshot Safari Project, they are led through a simple tutorial on software use and identification of the 48 possible mammalian species (Swanson et al., 2016). This tutorial can be skipped and fast identification is possible for expert or repeat users. However, the program is designed for someone with no experience. A photograph is shown, and the user is led through an identification by first identifying features like body shape, horn pattern, and color (Swanson et al., 2015). There is no option to score the picture as impossible or to say you cannot identify the animal. Pilot testing determined these options would be overused. Each image is circulated to multiple volunteers to increase accuracy (Swanson et al., 2016). An image is retired when it meets one of the following criteria: the first five classifications mark the photo as empty, the photo receives 10 empty classifications, the photo receives 10 matching classifications, or the photo receives 25 non-blank classifications (Swanson et al., 2015). However, because images are identified faster than they are produced, some retired images are recirculated. Each image is viewed by 11-57 volunteers, with the average being 27 (Swanson et al., 2016).

Once the images are identified, an algorithm is used to determine the consensus classification and produce a final consensus dataset (Swanson et al., 2015). These are the datasets I will be using. When the project began, accuracy was determined by producing an expert dataset of 3,829 randomly sampled images that were identified by experts (Swanson et al., 2016). The citizen science data had 97.9% overall agreement with the expert data, but it did vary by animal. Some animals, like giraffes, had 100% accuracy in identification. Some hard to identify animals, like the aardwolf, had only 50% accuracy. The wildebeest, which is a fairly distinctive and common animal, had 98.1% accuracy of identification (Swanson et al., 2016). Interestingly, when single experts were compared to the dataset of aggregated experts, the single experts had only 96.6% accuracy, less than the aggregations of citizen scientists at 97.9%! This does make some sense—a single person can make mistakes, get tired, and click the wrong button. For this project at least, it seems the aggregations of citizen scientists are actually more accurate than having a single expert score the data (Swanson et al., 2016).

The Snapshot Safari Project has followed the guidelines suggested by Kosmala et al. (2016) and has created a user-friendly citizen science project that is easy for those with no knowledge, and it is replicated enough to produce accurate data. Though no information exists on the accuracy of the behavioral classifications, for the reasons given above, the dataset has been shown to be robust enough to justify its use for this project.

Chapter 4: Scientist/Conservationist Surveys

4.1.0 Introduction

To truly embrace a conservation social science framework, the conservation encounter must not only be situated in its historical, economic, and political context, but it must be analyzed from the perspective of all stakeholders. As Kiik (2019) points out, despite the increasingly detailed understanding of local stakeholders in conservation, and now the recognition of non-human animals as stakeholders in those same encounters, the voices of the conservation practitioners are often missing. Assumptions may be made by anthropologists that all conservationists hold broadly the same opinions and methodologies or are impersonal in their interactions with conservation interventions (Kiik, 2019). These assumptions may prevent engagement of conservation practitioners as stakeholders in the conservation encounter (Kiik, 2019).

As Candea (2010) details, conservationists and scientists become stakeholders in their research, and do not necessarily remain impartial. Their thoughts and opinions have the potential to influence conservation intervention efficacy and quality of relationships with local stakeholders. Therefore, including them in research on a conservation encounter is critical.

I have included conservation practitioners in this research in an attempt to determine how they feel about their interactions with local people and the challenges and successes they feel they experience in those interactions. I also wanted to determine how conservationists included local groups in their research projects and whether they felt this was sufficient engagement. I then wanted to compare this data to how Maasai felt about the same issues. As discussed in the previous chapter, I have done this by surveying conservation practitioners throughout Africa via email on their feelings and opinions. The results of this survey have helped inform the creation of the survey of Maasai pastoralists and the interpretation of that data. It has also started to fill the gap of giving voice to the conservation practitioners, whose thoughts and feelings are not necessarily objective and should be analyzed in a reflexive way for a complete implementation of a conservation social science framework.

4.2.0 Methods

Chapter 2 discussed the purpose of giving voice to scientists and conservationists when considering the conservation encounter between wildebeest and Maasai. One of the main objectives was to inform the creation of the survey of Maasai people (discussed in Chapter 5). I suspected there might be a disconnect between the benefits conservationists believed they were bringing to local people and the benefits local people wished to derive or felt they were deriving from the presence of conservationists in their area.

The conservationists' survey was accomplished entirely over email. This was done to make it as convenient and easy as possible in an attempt to garner as many responses as possible (e.g., people did not have to schedule yet another Zoom call). All contact emails were acquired through the public domain; either by looking on websites, publications, presentations, or in a few cases, the respondents were people I knew personally. A search was made with the keywords "Africa" and "conservation." Any organization or individual that came up in the first four pages of the search was looked at. If the project also mentioned any involvement with local people, they were contacted if they had a public domain contact form or published email address. If I personally knew someone involved with the project, they were also contacted. Potential respondents were also identified through social media. I posted publicly on my page asking if anyone had been involved in conservation work in Africa. This started a snowball sample where several people contacted other scientists and asked them to contact me. This is where most successful responses came from: ten out of sixteen received responses were from social media sampling.

An email was sent with a brief explanation of the project and included attachments containing an information sheet, consent form, and editable Word document with the survey questions. This methodology is the same as that employed by Wiles et al. (2006). It was used in order to make the information and consent process extremely clear and formal.

If scientists were interested in participating, they were asked the following questions:

1. Give an overview of your conservation project. What are your focus animals? What is the dominant local culture?
2. To what extent do you come into contact with local people during the course of your field work?
3. To what extent does your project actively involve local people?
4. Do you believe your project benefits local people? How?
5. Describe some challenges you have faced working with local people.
6. Describe some successes you have had working with local people.
7. Would you like to see more involvement from local people in your project?

8. Do you believe involving local people in conservation work is beneficial? To what extent?

9. Would you be willing to participate in a longer discussion of these questions via Zoom?

10. If you know any other scientists/researchers/conservationists who would be willing to participate in this survey, please provide their names and emails here.

These questions were intentionally broad and were intended to encourage scientists to reveal thoughts on any aspects of their research they believed were relevant.

I obtained responses by taking a piece of advice from Boyer (2008; p. 440): engage the nonprofessional. Most of the responses I successfully procured were from nonprofessional conservationists who spent time in Africa working on another scientist's project. While not the primary researcher, they still have the insight I was seeking in terms of general views about successes, challenges, and benefits to locals. However, their responses are likely limited in that they may not be privy to all project knowledge. In total, 51 requests were sent to individual researchers and organizations, and this resulted in sixteen completed surveys.

Non-response to the survey was not random. None of the organizations I sent the survey to responded. Responses were more likely from people I had some prior connection to, either through my job, through Facebook groups I was part of, or through in-person interactions. Five of the sixteen respondents were people I had met in person, either at work or from my master's program at the University of Colorado. The sample of scientists was in no way random, and this certainly affects the results. The high proportion of people in the sample with some connection to an anthropologist (me) may make them more likely than the general scientific population to consider social science in their research. The predominance of small projects in the sample, since none of the large organizations I contacted replied, may also bias the results in unknown ways. However, this part of the project was meant to be mainly a way to better inform the creation of the Maasai survey and to round out the analysis of the conservation encounter by giving all participating parties an opportunity to have a voice. More efforts such as this need to be made, and lessons were learned in how to reach out to scientists and researchers to garner reflexivity.

4.3.0 Results

Out of 51 requests for survey responses, 16 were returned. This 31.4% response rate is only slightly lower than the mean 33% response rate found by Shih and Fan (2009) in their meta-analysis of 35 studies. Considering some of the requests were internet forms sent to conservation organizations, rather than emails sent directly to individuals, I was pleased with this return rate. Several participants promised to return the survey, but then failed to do so. I also did not have much success snowballing this survey; the potential respondents named by others generally did not complete the survey when requested.

Respondents were working on projects across Africa on everything from elephants (*Loxodonta africana*) and Grauer's gorillas (*Gorilla beringei graueri*) to plant conservation. I relied heavily on Boyer's (2008) advice (discussed earlier) to engage the nonprofessional. The majority of respondents (eleven out of sixteen, about 69%) were not team leaders; they were students or interested conservation assistants who assisted on projects for a season. However, I did have five team leaders represented in the respondents.

One project only came into contact with local people during restocking trips and another had local staff but did not routinely come into contact with locals otherwise (all quotes from scientist surveys and Maasai surveys are exact and typos are that of the original writer); “We worked with local people sporadically due to the isolated nature of our research sites. Primarily we interacted during restocking trips and in asking about behavior in anthropomorphized areas.” The other 14 projects (87.5%) all came into contact with local people often or daily. The responses for the involvement of locals were a little less consistent. Ten projects (62.5%) had local people on staff as drivers, guides, biologists, or project managers. For instance, a project in Botswana was described as a “partnership with the National Zoo of Abidjan, and so has a good source of local biologists to partner with.” The Grevy’s Zebra Trust described local people working in a wide variety of ways: “Local community members are Grevy’s Zebra Trust. The Scout, Warrior, and Ambassador programs are all comprised of indigenous people, as are the Grass Guardians and other projects. The work ranges from surveying wildlife observed in the counties to teaching school aged children about science to sewing sanitary pads for girls and women.” At a Grauer’s gorilla orphanage in the Congo, locals were described as running the project entirely: “One of our primary goals was to have the facility run in country by the Congolese. We achieved this goal in 2016.” The Save the Elephants Project, as well as involving locals to build beehive fences around their farms, responded that they “hired several locals to help with the research, design buildings and shade structures, and take care of the camp. Since we were working on farms and testing pollen addition or subtraction to plant, we had to ask their permission to work on their property and their crops." These quotes represent some of the diverse ways scientists described involving local community members in their research and conservation efforts.

Only one project said local people were involved exclusively in a cursory way; this project concerned small primates, mentioned above as the same project that interacted with locals on restocking trips: "The project involved local people in only ~5% of the study. Primarily the research focused on ecological concerns in a reserve." One respondent said that other than the locals employed by the project, no other locals were involved. This respondent worked on two projects in Tanzania and "lived in a gated area for the students but our professors, consolers, and game drivers were from the area. Outside the gates were local Iraqw people." Other local involvement included outreach to children, receiving tips from locals, and helping locals with projects. For instance, the Cheetah Conservation Fund has "outreach to some schools within the city of Hargesia and encourages local citizens to be indigenous stewards of the project to ensure the longevity of the species in the area."

The question of how scientists believe local people benefit from their projects was the most interesting question to me. One of my primary goals in conducting surveys of both scientists and Maasai community members was to determine if there was a mismatch between the services scientists believed they were providing to communities and the services communities actually wanted to obtain from local conservation. There is little doubt that local communities bear the burden of conservation, and without gaining some benefit from it, we cannot expect conservation to succeed (Minteer and Miller, 2010). The combination of these two surveys was designed to determine if scientists thought they were adequately providing benefits to offset that burden, and if communities agreed.

The most popular answer to the question of how locals benefit from their project was education, with seven projects (44%) naming it as a benefit for local people. Other popular answers included bringing jobs (five projects, 31%), helping local infrastructure (four projects, 25%), helping local livelihoods (three projects, 19%), helping local development (three projects, 19%), increasing the wildlife population (two projects, 10.5%), and bringing conservation to the area (two projects, 10.5%).

Education included knowledge about the project and animals. The GRACE gorilla orphanage claims, “We have an extensive education program that is active in the schools but also targets specific groups such as women’s groups and the military.” A member of a project confiscating cheetahs being illegally traded said, “I think the project helps to educate locals on illegal wildlife trade and how to be more vigilant on the topic.” Many projects also provided general conservation education; the Painted Dog Protection Initiative hosts “hundreds of students at an educational bush camp.”

Five projects claimed to benefit local people by bringing jobs. The types of jobs varied. The KopeLion project hires a number of locals. “KopeLion provides stable jobs that most of the men do in additional to maintaining their own livestock. KopeLion also hires women who typically would not have a job or would maybe sell jewelry or sodas on the side of the road. The women are learning to do mechanical work on the vehicles, and also how to use the computer to send emails and do data entry.” A student who worked in Kenya and Mozambique on different projects noted: "In Kenya, our drivers and field assistants were Kenyan, as were the people who worked in the kitchen and did the cleaning. In Mozambique, those roles were filled by Mozambicans." The Grevy's Zebra Trust hires locals as Grevy's Zebra Warriors, tracking and protecting zebras and "provides them a formal platform to get involved in conservation efforts and to earn wages for their work."

Four projects indicated they helped local infrastructure. This included the Painted Dog Protection Initiative who said they were building "wells, schools and hospitals," the GRACE gorilla orphanage building fuel wood tree orchards and community gardens, and the Elephants and Bees Project providing fences and beehives.

Three projects claimed to help local livelihoods. The Elephants and Bees Project helps livelihoods by deterring crop raiding and providing honey for sale. The student who worked in Mozambique stated the project helped farmers build livelihoods but did not describe how. GRACE works to improve women's livelihoods: "We work very closely with the community women's group to develop sustainable livelihoods such as more sustainable means of food allocation and preparation. There is also a loan program that supports women's entrepreneurial endeavors."

Three projects claimed to help local development. A volunteer who helped locals build improved chicken coops and live more harmoniously with domestic animals claimed: "Any improvement in relationships with animals is an improvement. Animals who are better cared for are better able and willing to work, and if joy can be found in a subsistence, poor village, then quality of life has improved. Additionally, my host family felt much safer having a tame dog (the one I adopted there) in the compound guarding it. My host brother actually requested I help him train one to continue doing so after I left with my dog. My chicken coop project, while less successful, did show them some improvement to the field (it was a mobile chicken coop, designed to move around the field to help fertilize). It also showed them that cared-for chickens can develop larger and more productively than when left to roam free around the village, at risk from dogs, hyenas, etc." A scientist working with the Limbe Wildlife Center Green Project to help give hunters an alternative source of income described developing domestic animal capacity for ex-hunters. The Painted Dog Protection Initiative helps develop tourism in the area.

Two projects claimed that increasing the wildlife population was a benefit to local people; one was a project working with banded mongoose (*Mungos mungo*) and the other is the Painted Dog Protection Initiative. The project on banded mongoose did not provide an explanation for why increased wildlife populations were of benefit to local people. The Painted Dog Protection Initiative pointed to dog populations helping the ecosystem overall and bringing tourists as benefits: "In addition to the painted dog being an integral part of the local fauna and important to the health of the ecosystem, the dog populations in Zimbabwe are a large tourist draw so there is some economic benefit as well."

Two projects claimed bringing conservation to the area was a benefit to local people. The student who worked in Kenya indicated conservation brought to local schools was a benefit: "In Kenya, there was a conservation club program that brought conservation-based activities to schools in the area." The project working to establish a wildlife conservation area in Kenya indicated they believed it would have long term benefits on livelihoods in the area, though they did not say how: “The local people are actively involved on a daily basis and in Kenya Life Net Nature is working with them to establish a conservancy that will have long term benefits for their livelihood.”

Other answers were extremely varied and included supporting local clinics, spending money locally, increasing the local quality of life, stopping hunting in the area, providing domestic animals, training locals in farming and domestic animal care, establishing a conservancy, reducing lion conflict, and bringing conservation to schools.

The challenges scientists encountered were extremely varied. By far the most common answers were language barriers (indicated by six projects), “cultural barriers” (indicated by five projects), and barriers caused by local belief systems (two projects, with one writing “an inherent belief that animals want to hurt people” and the other from a researcher who was assumed to be Afrikaans, which was not well received). Other answers included challenges with building trust, issues with rebels, lack of infrastructure, religious barriers (which caused “issues when regarding medical treatment and procedures” in a project dealing partly with zoonotic disease), differences in methods and approaches, locals not working within the project guidelines, older generations unwilling to change (“the elders are more set in their ways and do not see a need for the conservancy necessarily” in a project attempting to establish a wildlife conservation area), and dealing with “African time” (which could also be a cultural barrier). Only two projects indicated they encountered no challenges working with local people. One of these was a participant in the Elephants and Bees Project who had not encountered any challenges personally, although the project has reported some challenges. The other project only came into contact with locals when they were hired as drivers, so their minimal contact with locals is the likely reason they had no challenges.

The successes indicated by scientists included specific instances with individuals (e.g., scientists being invited into a local home): “One notable individual heard of our work and invited us to her home where she was running an unofficial sanctuary for galagos [bushbabies] rescued from private captivity.” Another success was broad feelings within communities that fostered a sense of community spirit: “The very best success I can say if it brought out the community spirit among the ex-hunters…those that were slow and not having enough difficulties the collaborated and all did group work with the use of local materials to see that they were all set before we handed them the animals (pigs and chickens).” Only two projects indicated concrete examples of success: offering training courses to locals and establishing several programs for infrastructure. The other responses focused more on the intangible successes they experienced, such as building strong relationships in the community and exchanging knowledge. A few projects indicated abstract events that they believed represented successes in building relationships, such as being able to hire locals and have locals visit the United States.

Four projects indicated they did not think more involvement from local people was possible, as they were already very involved. One project indicated they did not need more involvement. One indicated they needed more involvement from the government, and one indicated that more involvement could compromise their project. This was due to the project dealing with the illegal wildlife trade and the need for the location of their rehabilitation facility to be kept a secret so potential poachers could not locate it. The other nine projects indicated they would like more involvement from locals, even if they already had a lot of involvement.

All sixteen projects believed local involvement in conservation was beneficial. The beliefs about the necessity of involving local people were very strong. Respondents called it “essential,” “imperative,” “the best way,” “necessary,” “invaluable,” and “the only way.” Six respondents expressed the views that conservation could only be successful with local involvement and that all conservation projects should involve local people.

Though a major goal of this part of the research was to inform the creation of the Maasai survey, I will discuss the results further in Chapter 7 as they relate to the entire conservation encounter and impact reflexivity within conservation science.

4.4.0 Scientist Surveys as They Relate to the Maasai Surveys

One of the main reasons for running the scientist survey was to compare the number of scientists who believe their work benefitted locals to the number of Maasai who believe conservation work in their area benefitted them, a comparison that has, to my knowledge, not been made before. With only one exception—an isolated project that did not come into contact with locals—all surveyed scientists believed their projects benefitted local people. Maasai seem to largely agree, as 103 out of 114 participants (90% of respondents, with a 95% confidence interval of 85% to 96%) answered “yes” to the question: “Do you feel animal conservation work in your area benefits you?” I found this to be an encouraging comparison. However, only 32 of 114 Maasai respondents (28% with a 95% confidence interval of 20% to 36%) checked “They do not cause any problems” in response to the question: “Which of the following are problems with animal conservation workers in your area? (Check all that apply)." This indicates that while Maasai feel conservation is broadly beneficial, there are problems and room for improvement.

The most popular answer to this question was "They interfere with how I graze my cattle," which was checked by 45 respondents (39% with a 95% confidence interval of 31% to 48%). This is a worrying response indicating the Maasai feel conservationists are interfering with their livelihoods. Based on research by Ahmed et al. (2015) and others, this could indicate Maasai feel conservation is therefore interfering with their identities as cattle keepers. The Maasai consider maintaining their identity as cattle keepers to be a priority in the modern world, and they named conservation as a major threat to that identity (Ahmed et al., 2015). This survey suggests that, unfortunately, this is still the case. The second most popular response to this question was "They do not understand my culture," checked by 41 respondents (36% with a 95% confidence interval of 27% to 45%). This answer further supports the point that the Maasai feel conservationists do not understand Maasai culture and are not contributing to its preservation. Helping the Maasai with their goal of maintaining their livelihoods and identity would be helpful in fostering better cooperation.

This idea is fortified by the strong response to the Maasai survey question "Would you like to be more involved in animal conservation work?" This garnered 107 "yes" responses. What scientists consider involvement by locals versus how locals would like to be involved was a major comparison of interest in these surveys. Seven of sixteen scientists said their projects involved education or outreach to locals. Five said they had local drivers or guides. One project worked with local biologists. Five mentioned locals were involved with the actual projects. Others mentioned having meetings with locals or generating income for local people abstractly. On the Maasai survey, when asked how they would like to be more involved in conservation work, 24 respondents (21%) answered with something related to being involved with the actual research and 23 respondents (20%) answered with something related to education or actively helping animal conservation.

Scientists seem to view involvement of locals as drivers, guides, consultants, and occasionally research assistants as successful involvement. This does not seem to be enough for the Maasai. In response to an open-ended, optional question about how else they would like to participate, 68 responses were recorded, three of which were entire paragraphs. Respondents had specific desires and goals, such as “I want to start my own organization, forge a good team and carry out conservation projects for wild animals in the Maasai Mara,” “I really wish to be involved in researching ways that will help to eradicate Human wildlife conflict and wildlife conservation,” and “To help reduce human wildlife conflict by encouraging my Maasai people to learn the significance of living side by side with wildlife.” Their passion for conservation and their desire to be more involved was obvious.

All 16 scientists passionately acknowledged the need to involve local people in conservation research. They affirmed this need with words such as “not only is it beneficial, it is essential,” “involving locals is imperative,” and “every single conservation project should involve local people.” However, there seems to be a disparity in what locals and scientists consider involvement. Based on the feelings of the Maasai, a stronger effort is needed to include local people as researchers and scientists—not just drivers, guides, and translators. Only 13 of 114 (11%) Maasai respondents indicated they participated as part of the research team, compared to 95 (83%) as drivers, guides, and consultants.

How locals are involved seems to be as important as the extent of the involvement. The two projects that reported heavy participation by locals to assist in reducing human-wildlife conflict both reported significant successes. KopeLion states, “KopeLion overall has been very successful in the NCA. The biggest indication is the reduction in retaliatory lion killings.” The other reported a reduction of crop destruction by elephants: “Empirical data suggest that the beehive fences work, and farmer surveys indicate that they also perceive the fences as beneficial.” One of the respondents worked with the KopeLion project, a conservation project based in Ngorogoro Conservation Area focused on reducing conflict between lions and pastoralists, mostly Maasai and Barabaig (KopeLion, 2020). This project trains locals as scientists to help monitor lions and care for livestock, locating missing livestock and administering treatment to injured livestock. In 2020, this project reported a 12% increase in days with lion observations in Ngorongoro Crater (KopeLion, 2020). This success demonstrates how involving locals deeply, as participants and not just as drivers or as translators, results in dramatic successes. Two respondents worked with the Elephants and Bees Project, a Kenya-based project that uses beehive fences to deter crop-raiding elephants and thereby decrease elephant poaching (King et al., 2009). This project trains community members to maintain their own beehive fences and practice bee husbandry, thereby gaining extra income from honey sales, as well as decreasing elephant crop-raiding. This project reports an 80% success rate in keeping elephants away from farms

(King, 2015). By focusing on protecting local needs and interests, the conservation goal of protecting elephants was met.

These were the only projects that reported tangible successes in working with local people. Most projects reported intangibles such as increased education, job opportunities, and creating better relationships with the community. These intangibles have value and should not be minimized. However, if the goal is to reduce actual rates of human-wildlife conflict then involving local people more directly and fully does seem to result in greater successful conservation outcomes.

Some reported successes were one-sided, seeming to benefit the research team but not necessarily the locals. For instance, being invited to the homes of locals, being able to bargain with locals, “providing . . . environmental awareness,” and being helped by drivers who offered identification of species and animal location assistance. Though again, if this helps build relationships and good will between researchers and locals, then it is valuable. The goal when conducting research away from home should be to benefit the local population in some way.

Chapter 5: Maasai Surveys

5.1.0 Introduction

For conservation interventions to be effective, cooperation from the local resident human population is essential. As pointed out by Margules et al. (2020), most conservation interventions rely on a change in human behavior to succeed. Yet, as Sanborn and Jung (2021) report, biodiversity is continuing to decline. They posit that a potential cause of that continued decline is a failure to recognize the needs of local groups and design conservation actions that are appropriate and feasible for local contexts (Sanborn and Jung, 2021).

Huzzah et al. (2017) discussed the reasons for killing of lions in Africa and found that attitudes and beliefs were critical in both predicting lion killing behavior and potentially changing the behavior. Under a conservation social science framework, designing a locally relevant conservation intervention requires investigating the attitudes and behaviors local groups hold toward the animals in need of conservation action, and the conservation actions and practitioners in the area.

I have explored Maasai attitudes, beliefs, and actions toward wildebeest and conservation using internet surveys distributed through social media. The survey answered by 114 Maasai in Kenya included questions on their theoretical actions toward wildebeest under certain conditions, how they feel about wildebeest, their attitudes toward malignant catarrhal fever and a potential vaccine, their views of conservationists in their area, and the successes and challenges they have had with conservation, as well as demographic questions. The full survey can be found in Appendix 1.

The intention of this survey was to gather data for thematic analysis to determine attitudes toward wildebeest and how those attitudes could be affecting conservation actions. I also intended to gather data to determine how Maasai felt human-wildlife conflict and conservation affected their livelihoods and their ability to maintain their identity. The survey was conducted with a novel approach, using only Facebook to obtain participants, which required unique ethics considerations (discussed in Chapter 3), but also resulted in insights unlikely to have been gained any other way.

5.2.0 Distributing the Survey

The survey of Maasai people was written in English and translated into Swahili through a paid online translation service, where it was translated by a person, rather than electronically. It was then back translated using Google Translate. This resulted in changing how the word “wildebeest” was translated. Most translation services translate “wildebeest” to the Swahili word “nyumbu,” which can also mean “mule.” In order to avoid this confusion, I opted to refer to wildebeest as gnu in the Swahili version of the survey. Though gnu is an English word for this animal, it is in such wide use that it is commonly used by Maasai and by Swahili speakers. The English and Swahili versions of the survey were then sent to a contact in Kenya working in the tourism industry, who was fluent in both languages. This contact ensured the versions matched closely and also served as the informal pilot of the survey. No formal pilot was conducted, but four friends of this Maasai contact looked over the survey and confirmed the questions would make sense to a Maasai person.

When it came time to actually distribute the survey, I used several different methods—all on Facebook. The main method was posting the survey in Facebook groups; a full listing of all Facebook groups joined and used to disseminate the survey can be found in Table 1. I joined 33 separate groups totaling over 529 thousand people, though there was likely a large amount of overlap with people belonging to multiple groups. As already noted, groups ranged in size from 87 members to 118.9 thousand members. Though this seems like a huge audience, most of the groups were not made up exclusively of Maasai people. I joined several groups for local conservation, many for universities in Kenya, several interest groups on farming and ranching, a few Kenyan women's groups, and several tour guiding groups. Only two groups specified they were comprised of Maasai and one was for Maasai in both Kenya and Tanzania.

Facebook groups were found by searching the Facebook groups page with different terms related to the Maasai or with domains I believed the Maasai might be participating in. Terms used were "Maasai," "Maasai Mara," "Kenya cattle ranching," "Universities in Kenya," "Kenya women," "Kenya conservation," "Kenya tour guides," and "Maa." I chose to join all groups I believed might contain Maasai people. I read the rules for joining each group and did not join if the group required membership in a group that I did not belong to.

Name of Facebook Group	Number of Members
All Maasai Kenya to Tanzania	8.9k
Maa and Maa Friends Forum	14.3k
Maasai Wildlife Voices	2.5k
Friends of the Maasai	682
Maasai Mara	2.8k
Save Maasai Land and Animals	1.2k
Conserve Maasai Mara	727
Maa Youths Association	538
Kenya Tours and Safaris Networking	4.6k
Tourism Kenya	5.9k
Maasai Mara Professional Guides Association	1.2k
Magical Maasai Mara	2.8k
Beef, Cattle, Goat and Dorpor Sheep Farming Kenya	48.5k
Agriculture, the Backbone of Kenya's Economy	46.9k
Kenya Dairy Farming Forum	118.9k
Mabera Technical and Vocational College	1.5k
Friends who Like the Sheldrick Wildlife Trust	6.7k
Maasai Mara University Freshers	4.7k
University of Nairobi	27.9k
University of Kenya Science Campus	3.4k
Maasai Mara University Comrades	6.4k
Best of Mount Kenya University	4.3k
Mount Kenya University Team	25k
Kenya Universities Student Organization	33.6k
Mount Kenya University-Thika Main Campus	74.2k
University of Nairobi	23.9k
Jomo Kenyatta University of Agriculture and Technology	10.4k
Kenya Technical Trainers College	28.7k
Tour Guides Kenya	12.8k
Seeds of Freedom Kenya's Women	87
Women Drivers Kenya	761
Tour Guides KenyaP	3.9k
Leopards of the Mara Triangle	3.1k

Table 1: A full listing of all 33 Facebook Groups joined to disseminate the Maasai survey. The letter “k” represents thousands and is used by Facebook to describe number of members in a group. Number of members in the group is at the time I joined and has likely changed. Note there are two separate groups called “University of Nairobi.”

When I first began posting in groups, I wrote a rather long description of the research in both English and Swahili, with a link to the survey. As time went on, it became clear that almost no one was taking the survey without discussing it with me over comments or private message first, so I shortened the post drastically. I also started posting in English only after several weeks of having no one interact with me in Swahili. This gleaned a better response, likely because it was a shorter post that people were more likely to read. I posted in most groups multiple times. I also started posting in groups exclusively on weekends after noticing that was the only time my posts had any engagement, likely because people were not working and were able to spend time on social media. This was a critical observation that really accelerated the pace of response collection.

When having conversations with people after they took the survey, I did attempt some snowballing of responses. These were initiated by the respondents who offered to send the survey on to their own social networks, either on Facebook or WhatsApp. I never asked respondents to do so, but only took advantage of it when they offered. I do not believe this garnered many responses because after they claimed to send the survey out, I did not see an uptick in responses coming in.

I also gathered survey responses through a paid advertisement on Facebook. One of the major advantages to internet research is the ability to follow up with respondents and share results afterward. To this end I created a Facebook page for my research and invited respondents or those interested to like the page. I would be able to share results of the research after publication. Facebook prompted me to create paid ads to promote my page, so I tried it. I created an ad with very brief text, similar to what

I had been posting in groups, along with an accompanying picture of a wildebeest and a link to the survey. I set this ad to target people 18 years and older living in Kenya; it ran for 17 days on Facebook. I also posted the link to my survey on my newly created research page and on my personal page, with a request to share it. However, since Facebook sends an alert when posts have been shared, I know that neither post was shared, so this did not affect my results.

Recruitment of respondents was mostly passive; I posted the survey and allowed people to answer or not answer on their own. However, when people commented on the post or private messaged me, I did ask them to take the survey. I was not aggressive in any way but used language such as “I would very much appreciate your time/opinion/etc” to move them toward taking the survey if they commented on posts, instead of merely posting their opinion in the comments without taking the survey. Those most likely to take the survey were male, between the ages of 18-27 (though the 28-37 age category was not far behind), living in the Narok district, and keeping cattle. This represents the *ilmurran* age set. Women and the elderly were much less likely to reply, probably due to limited internet access, as discussed above. The sex, age, location, and livelihood distributions of respondents are found in Figures 3-6. The survey ran from March 3, 2021 until April 21, 2021 (50 days) and collected a total of 114 responses.

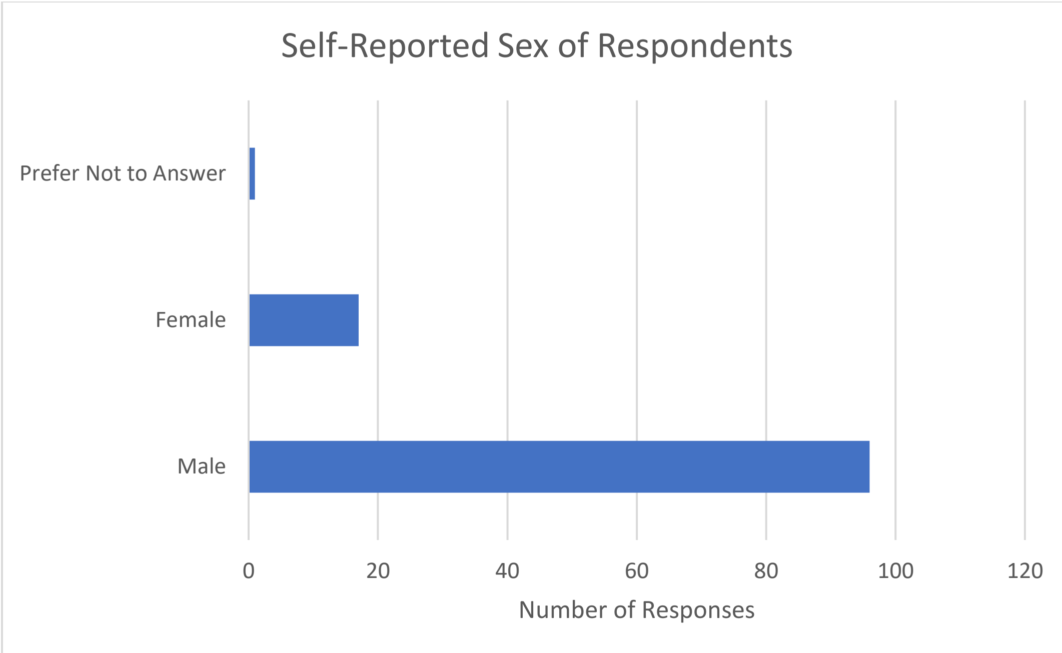

Figure 3: Self-reported sex of respondents in the Maasai survey, 114 total respondents.

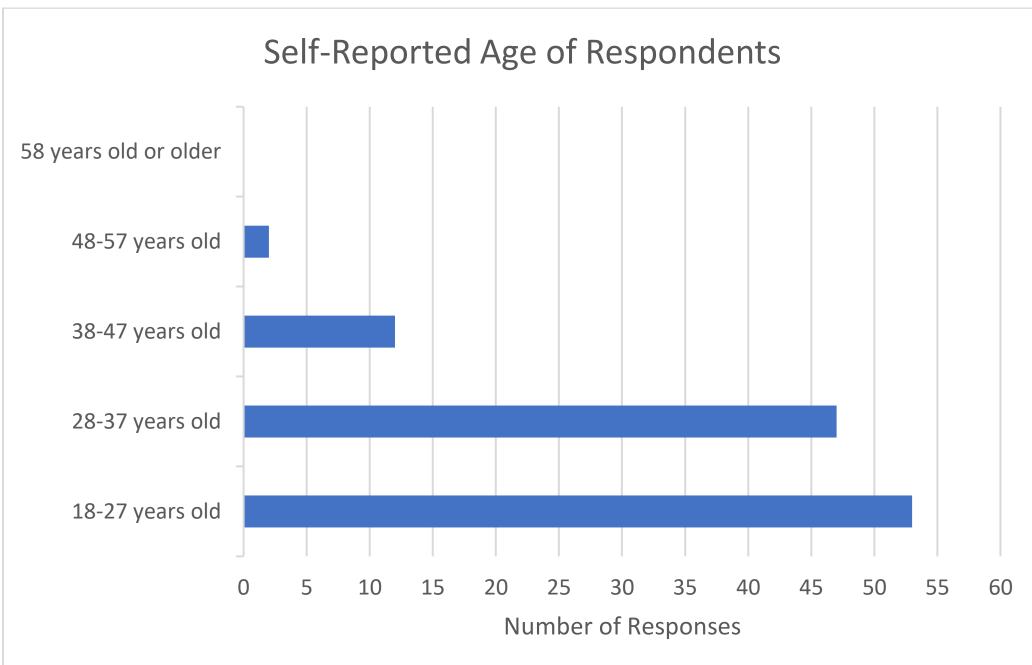

Figure 4: Self-reported age of respondents in the Maasai survey, 114 total respondents.

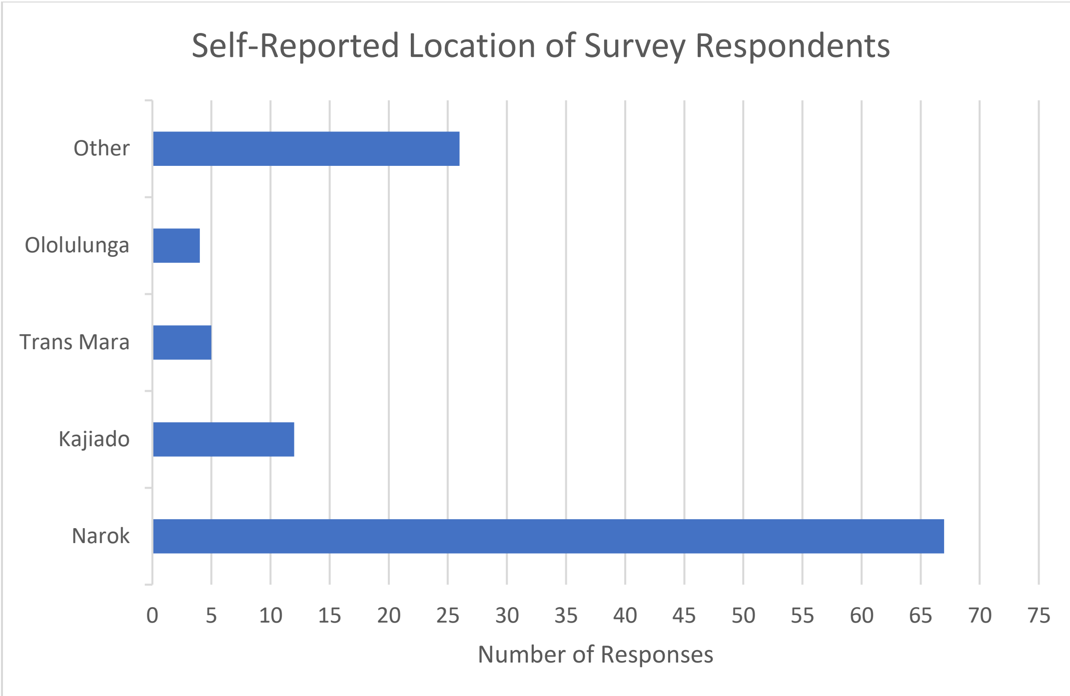

Figure 5: Self-reported location (District of Kenya) of respondents in the Maasai survey, 114 total respondents.

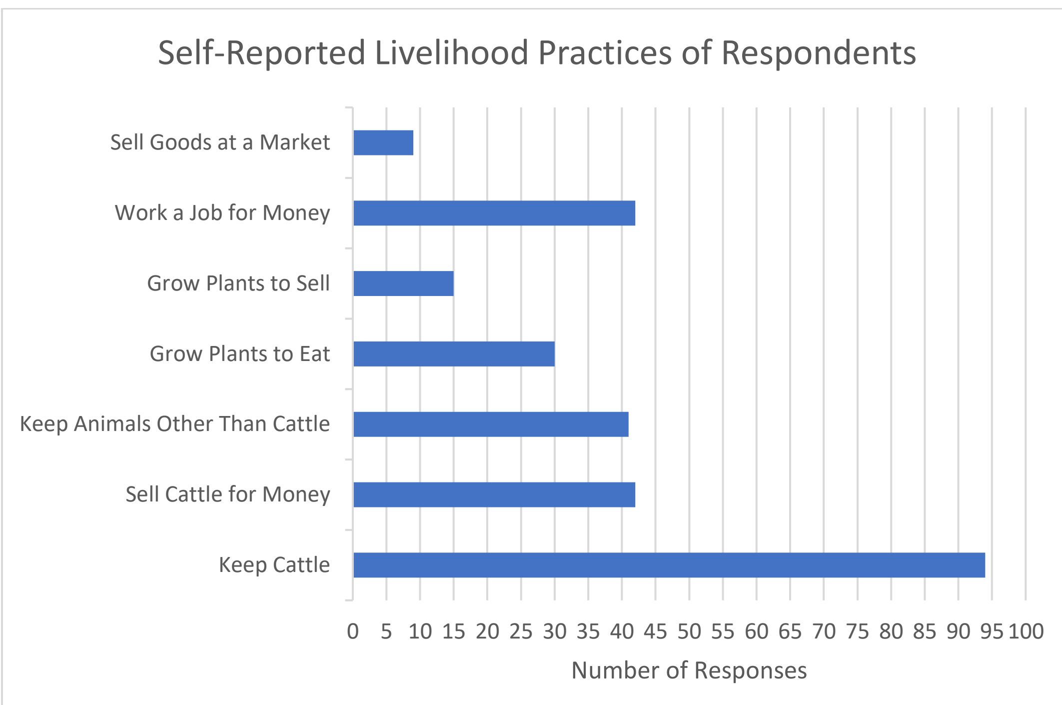

Figure 6: Self-reported livelihood practices of respondents in the Maasai survey, 114 total respondents.

Identification as Maasai was done by respondents. My survey requirements were that the respondents be 18 years or older, living in Kenya, and a Maasai person. Maasai is a changing identity, as discussed in Chapters 1 and 2. I left it to respondents to choose whether to identify as Maasai. This allowed for the possibility that non-Maasai people took the survey, introducing error. However, as the survey was not incentivized, I do not think this is likely to have been a major issue. I had many people message me or send comments, but then clarify that they could not take the survey because they were not Maasai; the requirements were being read and respected by at least some users.

In Chapter 7 I will discuss the experience of conducting this online survey and the fascinating interactions I had.

5.3.0 Analysis of Survey Data

Due to the way this survey was conducted the data represents a non-probability sample. A non-probability sample is one in which each person in the population's chances of being involved in the survey are unknown. This results in selection bias in the study that cannot be known or measured (Acharya et al., 2013). Non-probability samples result from all forms of convenience sampling and snowball sampling. In a probability sample, all individuals in a population have a known chance of being selected for the survey, which is clearly not the case here. Only literate, Facebook using Maasai with access to the internet could ever have taken this survey, and it is unknown what each individual person's chance is of falling into that category.

Because this is a non-probability sample, results cannot be generalized to the larger population, as they are unlikely to represent that larger population (Acharya et al., 2013). However, as discussed already, compromise is sometimes required in social science. I present some descriptive statistics, with the caveat that they should not be taken as representative of the entire Maasai population, but only the population I sampled. By calculating these statistics, I did discover some interesting trends in the surveyed sample that are worth noting and exploring.

In the results section, I give the proportions of the survey respondents that answered each question in a given way. I then give proportions of responses by sex, age, location in Kenya, and livelihood practice to determine if those factors are related to feelings on wildebeest and conservation. 95% confidence intervals were calculated for all responses. The 95% confidence interval was calculated to give a range of values that contains the mean for the population surveyed. Since this is a small sample, it is not clear whether it contains the population mean for the entire Maasai population, but it does demonstrate the potential spread of responses for this group. The confidence intervals represent statistical uncertainty related to this small sample size. If this survey were conducted for longer and collected more responses, these intervals are possibly where the estimates would fall, at least for the Facebook population, if not the Maasai population in general.

5.4.0 Results

A total of 114 responses were recorded from the survey of Maasai people aged 18 and older. Survey respondents self-identified as Maasai, but some people may have taken the survey who were not Maasai. However, being Maasai is a changing identity (see Chapter 1 for a discussion of the mutable Maasai identity) (Waller, 1993). I was interested in the opinion of anyone who considered themselves Maasai, so regardless of whether they were actively participating in a Maasai way of life, I would have still invited them to take the survey if I had been conducting it in-person. There was no personal incentive for deception; taking the survey allowed people to choose a Maasai charity for me to donate to.

Proportions were calculated with 95% confidence intervals for questions 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 16, and 17 (see Appendix 1 for questions). These questions were calculated for proportions and 95% confidence intervals for overall respondents and then by sex, age, location (living in Narok district or outside of Narok district), and livelihood. Livelihood was determined based on the respondents answer to question 20: "Which of the following livelihood practices do you (and your spouse if you are married) do? (Check all that apply)." If the respondent chose only "Keep cattle" and/or "Sell cattle for money" they were designated a cattle keeper. If they chose any other responses, in addition to these answers or instead of these answers, they were assigned to the diversified livelihoods group.

Table 2 (below) shows the proportions of responses and 95% confidence intervals for the entire sample. This table demonstrates a notable high awareness among the entire sample of MCF and a high preference for avoiding wildebeest.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.46	0.37	0.56
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.31	0.22	0.39
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.57	0.48	0.66
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.16	0.09	0.22
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.58	0.49	0.67
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.38	0.29	0.47
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.75	0.67	0.83
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.26	0.18	0.34
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.31	0.22	0.39
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.11	0.05	0.16
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.78	0.70	0.86
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.08	0.03	0.13

7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.53	0.43	0.62
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.60	0.51	0.69
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.58	0.49	0.67
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.32	0.24	0.41
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.04	0.01	0.08
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.91	0.86	0.96
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.05	0.01	0.09
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.64	0.55	0.73
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.69	0.61	0.78
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.39	0.30	0.48
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.28	0.20	0.36
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.39	0.31	0.48

12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.50	0.41	0.59
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.16	0.09	0.22
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.15	0.08	0.21
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.53	0.43	0.62
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.16	0.09	0.22
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.11	0.06	0.17
14) Would you like to be more involved in animal conservation work?	Yes	0.94	0.89	0.98
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.03	0.00	0.06
16) Do you feel animal conservation work in your area benefits you?	Yes	0.90	0.85	0.96
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.02	0.00	0.04
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.32	0.24	0.41
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.36	0.27	0.45
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.17	0.10	0.24
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.39	0.31	0.48

17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.28	0.20	0.36

Table 2: 95% confidence intervals for Maasai survey based on overall data. 114 respondents.

95% confidence intervals were also calculated for male (Table 3) and female (Table 4) responses, again separated by question responses. Though the sample sizes are very different, these tables demonstrate a high understanding of MCF and a wish to avoid wildebeest is shared by both men and women.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.46	0.36	0.56
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.32	0.23	0.42
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.54	0.44	0.64
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.17	0.09	0.24
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.56	0.46	0.66
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.38	0.28	0.47
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.74	0.65	0.82

5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.24	0.15	0.32
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.30	0.21	0.39
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.13	0.06	0.19
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.80	0.72	0.88
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.07	0.02	0.12
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.53	0.43	0.63
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.61	0.52	0.71
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.57	0.47	0.67
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.34	0.25	0.44
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.05	0.01	0.10
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.92	0.86	0.97
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.05	0.01	0.10

9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.67	0.57	0.76
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.71	0.62	0.80
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.42	0.32	0.52
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.29	0.20	0.38
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.40	0.30	0.49
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.50	0.40	0.60
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.19	0.11	0.27
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.15	0.08	0.22
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.50	0.40	0.60
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.18	0.10	0.25
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.13	0.06	0.19
14) Would you like to be more involved in animal conservation work?	Yes	0.95	0.90	0.99
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.02	0.00	0.05

16) Do you feel animal conservation work in your area benefits you?	Yes	0.91	0.85	0.96
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.02	0.00	0.05
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.33	0.24	0.43
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.35	0.26	0.45
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.14	0.07	0.20
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.40	0.30	0.49
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.28	0.19	0.37

Table 3: 95% confidence intervals for Maasai survey, data from male respondents only. 96 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.53	0.29	0.77
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.24	0.03	0.44
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.71	0.49	0.92
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.12	0.00	0.27
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.65	0.42	0.87

5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.35	0.13	0.58
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.76	0.56	0.97
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.41	0.18	0.65
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.35	0.13	0.58
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.00	0.00	0.00
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.71	0.49	0.92
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.06	0.00	0.17
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.53	0.29	0.77
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.53	0.29	0.77
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.59	0.35	0.82
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.24	0.03	0.44
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.00	0.00	0.00

8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.94	0.83	1.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.00	0.00	0.00
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.47	0.23	0.71
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.59	0.35	0.82
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.24	0.03	0.44
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.24	0.03	0.44
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.35	0.13	0.58
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.47	0.23	0.71
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.00	0.00	0.00
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.18	0.00	0.36
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.71	0.49	0.92
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.06	0.00	0.17
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.06	0.00	0.17

14) Would you like to be more involved in animal conservation work?	Yes	0.94	0.83	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.00	0.00	0.00
16) Do you feel animal conservation work in your area benefits you?	Yes	0.88	0.73	1.00
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.24	0.03	0.44
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.41	0.18	0.65
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.35	0.13	0.58
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.41	0.18	0.65
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.24	0.03	0.44

Table 4: 95% confidence intervals from Maasai survey, female respondents only. 17 respondents.

95% confidence intervals were also calculated for each age group bin separately: 18-27 years old (Table 5), 28-37 years old (Table 6), 38-47 years old (Table 7), 48-57 years old (Table 8), and 58 years old and up (which had no responses). These tables demonstrate a consistently high wish to avoid wildebeest across age classes, but a somewhat declining understanding of MCF as age increases.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.47	0.34	0.61
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.30	0.18	0.43
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.51	0.37	0.64
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.21	0.10	0.32
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.62	0.49	0.75
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.40	0.26	0.53
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.74	0.62	0.85
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.36	0.23	0.49
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.28	0.16	0.40
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.06	0.00	0.12
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.91	0.83	0.98

6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.06	0.00	0.12
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.53	0.39	0.66
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.62	0.49	0.75
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.58	0.45	0.72
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.34	0.21	0.47
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.04	0.00	0.09
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.91	0.83	0.98
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.08	0.00	0.15
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.60	0.47	0.74
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.74	0.62	0.85
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.38	0.25	0.51
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.28	0.16	0.40

12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.42	0.28	0.55
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.43	0.30	0.57
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.19	0.08	0.29
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.19	0.08	0.29
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.58	0.45	0.72
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.19	0.08	0.29
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.09	0.02	0.17
14) Would you like to be more involved in animal conservation work?	Yes	0.96	0.91	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.02	0.00	0.06
16) Do you feel animal conservation work in your area benefits you?	Yes	0.91	0.83	0.98
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.02	0.00	0.06
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.28	0.16	0.40
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.32	0.20	0.45

17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.13	0.04	0.22
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.36	0.23	0.49
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.26	0.15	0.38

Table 5: 95% intervals for Maasai survey data, respondents 18-27 years old. 53 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.47	0.33	0.61
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.32	0.19	0.45
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.62	0.48	0.76
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.13	0.03	0.22
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.53	0.39	0.67
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.36	0.22	0.50
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.79	0.67	0.90
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.17	0.06	0.28

5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.34	0.20	0.48
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.13	0.03	0.22
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.70	0.57	0.83
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.09	0.01	0.16
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.47	0.33	0.61
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.60	0.46	0.74
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.53	0.39	0.67
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.28	0.15	0.40
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.06	0.00	0.13
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.91	0.84	0.99
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.04	0.00	0.10

9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.66	0.52	0.80
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.62	0.48	0.76
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.38	0.24	0.52
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.28	0.15	0.40
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.38	0.24	0.52
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.60	0.46	0.74
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.17	0.06	0.28
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.15	0.05	0.25
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.45	0.30	0.59
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.15	0.05	0.25
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.15	0.05	0.25
14) Would you like to be more involved in animal conservation work?	Yes	0.94	0.87	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.02	0.00	0.06

16) Do you feel animal conservation work in your area benefits you?	Yes	0.96	0.90	1.00
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.38	0.24	0.52
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.36	0.22	0.50
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.19	0.08	0.30
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.38	0.24	0.52
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.28	0.15	0.40

Table 6: 95% intervals for Maasai survey data, respondents 28-37 years old. 47 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.50	0.22	0.78
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.17	0.00	0.38
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.67	0.40	0.93

4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.08	0.00	0.24
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.58	0.30	0.86
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.42	0.14	0.70
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.67	0.40	0.93
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.25	0.01	0.50
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.33	0.07	0.60
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.17	0.00	0.38
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.58	0.30	0.86
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.17	0.00	0.38
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.67	0.40	0.93
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.58	0.30	0.86
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.75	0.51	1.00

7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.50	0.22	0.78
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.00	0.00	0.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.92	0.76	1.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.00	0.00	0.00
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.67	0.40	0.93
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.75	0.51	0.99
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.42	0.14	0.70
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.25	0.01	0.50
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.33	0.07	0.60
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.42	0.14	0.70
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.00	0.00	0.00
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.00	0.00	0.00

13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.58	0.30	0.86
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.08	0.00	0.24
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.08	0.00	0.24
14) Would you like to be more involved in animal conservation work?	Yes	0.83	0.62	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.08	0.00	0.24
16) Do you feel animal conservation work in your area benefits you?	Yes	0.67	0.40	0.93
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.08	0.00	0.24
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.25	0.01	0.49
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.42	0.14	0.70
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.25	0.01	0.50
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.50	0.22	0.78
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.42	0.14	0.70

Table 7: 95% intervals for Maasai survey data, respondents 38-47 years old. 12 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.00	0.00	0.00
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	1.00	1.00	1.00
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.50	0.00	1.00
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.00	0.00	0.00
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.50	0.00	1.00
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.00	0.00	0.00
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.50	0.00	1.00
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.00	0.00	0.00
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.00	0.00	0.00
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.50	0.00	1.00
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.50	0.00	1.00

6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.00	0.00	0.00
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	1.00	1.00	1.00
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.00	0.00	0.00
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.50	0.00	1.00
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.00	0.00	0.00
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.00	0.00	0.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	1.00	1.00	1.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.00	0.00	0.00
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	1.00	1.00	1.00
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	1.00	1.00	1.00

12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.50	0.00	1.00
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.50	0.00	1.00
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.50	0.00	1.00
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.50	0.00	1.00
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.00	0.00	0.00
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.00	0.00	0.00
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.50	0.00	1.00
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.00	0.00	0.00
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.00	0.00	0.00
14) Would you like to be more involved in animal conservation work?	Yes	1.00	1.00	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.00	0.00	0.00
16) Do you feel animal conservation work in your area benefits you?	Yes	1.00	1.00	1.00

16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my lanugage	0.50	0.00	1.00
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	1.00	1.00	1.00
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	1.00	1.00	1.00
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.00	0.00	0.00

Table 8: 95% intervals for Maasai survey data, respondents 48-57 years old. 2 respondents.

95% confidence intervals were calculated for respondents who lived in Narok district (the primary district occupied by the Maasai) (Table 9) versus those who lived outside of Narok district (Table 10). I was interested in targeting Narok district specifically as this is where the wildebeest migrate through. Therefore, residents of Narok district may be subject to differences in opinions on wildebeest conflicts due to differences in exposure to wildebeest. These tables show both Narok and non-Narok residents prefer to avoid wildebeest. However, there is a much higher proportion of Narok residents claiming to lose money due to MCF.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.42	0.30	0.54
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.34	0.23	0.46
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.58	0.46	0.70
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.24	0.14	0.34
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.60	0.48	0.71
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.42	0.30	0.54
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.79	0.69	0.89
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.24	0.14	0.34
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.28	0.18	0.39
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.09	0.02	0.16
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.85	0.77	0.94

6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.06	0.00	0.12
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.52	0.40	0.64
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.64	0.53	0.76
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.61	0.50	0.73
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.43	0.31	0.55
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.03	0.00	0.07
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.94	0.88	1.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.06	0.00	0.12
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.67	0.56	0.78
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.70	0.59	0.81

12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.40	0.29	0.52
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.31	0.20	0.42
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.39	0.27	0.50
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.55	0.43	0.67
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.19	0.10	0.29
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.16	0.08	0.25
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.54	0.42	0.66
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.21	0.11	0.31
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.12	0.04	0.20
14) Would you like to be more involved in animal conservation work?	Yes	0.96	0.91	1.00
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.03	0.00	0.07
16) Do you feel animal conservation work in your area benefits you?	Yes	0.90	0.82	0.97

16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.03	0.00	0.07
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.34	0.23	0.46
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.39	0.27	0.50
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.15	0.06	0.23
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.48	0.36	0.60
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.25	0.15	0.36

Table 9: 95% confidence intervals for Maasai survey data, respondents who live in Narok district. 67 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.53	0.39	0.67
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.26	0.13	0.38
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.55	0.41	0.70

4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.04	0.00	0.10
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.55	0.41	0.70
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.32	0.19	0.45
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.68	0.55	0.81
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.30	0.17	0.43
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.34	0.20	0.48
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.13	0.03	0.22
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.68	0.55	0.81
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.11	0.02	0.19
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.53	0.39	0.67
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.53	0.39	0.67

7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.53	0.39	0.67
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.17	0.06	0.28
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.06	0.00	0.13
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.87	0.78	0.97
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.09	0.01	0.16
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.60	0.46	0.74
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.68	0.55	0.81
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.36	0.22	0.50
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.23	0.11	0.36

12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.40	0.26	0.54
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.43	0.28	0.57
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.11	0.02	0.19
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.13	0.03	0.22
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.51	0.37	0.65
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.09	0.01	0.16
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.11	0.02	0.19
14) Would you like to be more involved in animal conservation work?	Yes	0.91	0.84	0.99
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.02	0.00	0.06
16) Do you feel animal conservation work in your area benefits you?	Yes	0.91	0.84	0.99
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.30	0.17	0.43

17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.32	0.19	0.45
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.19	0.08	0.30
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.28	0.15	0.40
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.32	0.19	0.45

Table 10: 95% confidence intervals for Maasai survey data, respondents who live outside Narok district. 47 respondents.

Finally, 95% confidence intervals were calculated for respondents who were exclusively cattle keepers (Table 11) versus those with more diversified livelihoods (Table 12). This was determined based on the respondents answer to question 20: “Which of the following livelihood practices do you (and your spouse if you are married) do? (Check all that apply).” If the respondent indicated only “Keep cattle” and/or “Sell cattle for money” they were designated a cattle keeper. If they chose any other responses in addition to these answers or instead of these answers, they were assigned to the diversified livelihoods group. Again, these tables demonstrate that both groups prefer to avoid wildebeest. Notably, 0 cattle keepers said MCF did not affect them.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.54	0.38	0.70
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.27	0.13	0.41
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.62	0.47	0.78
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.14	0.02	0.25
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.43	0.27	0.59
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.24	0.11	0.38
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.73	0.59	0.87
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.22	0.08	0.35
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.14	0.02	0.25
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.14	0.02	0.25
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.84	0.72	0.96

6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.03	0.00	0.08
7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.49	0.33	0.65
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.54	0.38	0.70
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.43	0.27	0.59
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.22	0.08	0.35
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.00	0.00	0.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.92	0.83	1.00
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.03	0.00	0.08
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.62	0.47	0.78

12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.59	0.44	0.75
12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.27	0.13	0.41
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.19	0.06	0.32
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.32	0.17	0.48
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.35	0.20	0.51
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.22	0.08	0.35
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.08	0.00	0.17
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.43	0.27	0.59
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.08	0.00	0.17
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.11	0.01	0.21
14) Would you like to be more involved in animal conservation work?	Yes	0.95	0.87	1.00

14) Would you like to be more involved in animal conservation work?	I'm not sure	0.00	0.00	0.00
16) Do you feel animal conservation work in your area benefits you?	Yes	0.89	0.79	0.99
16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.00	0.00	0.00
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.22	0.08	0.35
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.24	0.11	0.38
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.24	0.11	0.38
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.32	0.17	0.48
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.22	0.08	0.35

Table 11: 95% confidence intervals for Maasai survey data, respondents designated as cattle keepers. 37 respondents.

Question	Response	Proportion of Response	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	Yes	0.43	0.32	0.54

2) If a gnu/wildebeest is near your village, will you attempt to get it to leave?	It depends on the time of year	0.32	0.22	0.43
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	Yes	0.55	0.43	0.66
4) If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?	It depends on the time of year	0.17	0.09	0.25
5) Which of the following problems do gnu/wildebeest cause you?	They take grass from my cattle	0.65	0.54	0.76
5) Which of the following problems do gnu/wildebeest cause you?	They take water from my cattle	0.44	0.33	0.55
5) Which of the following problems do gnu/wildebeest cause you?	They spread disease to my cattle	0.75	0.66	0.85
5) Which of the following problems do gnu/wildebeest cause you?	They destroy my property	0.29	0.18	0.39
5) Which of the following problems do gnu/wildebeest cause you?	They eat plants I am growing	0.39	0.28	0.50
5) Which of the following problems do gnu/wildebeest cause you?	Gnu/wildebeest do not cause me any problems	0.09	0.03	0.16
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	Yes	0.75	0.66	0.85
6) Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?	I've heard of it but don't know what it is	0.10	0.04	0.17

7) Which of the following are ways that malignant catarrhal fever affects you?	I must graze my cattle away from gnu/wildebeest	0.55	0.43	0.66
7) Which of the following are ways that malignant catarrhal fever affects you?	Some of my cattle die of malignant catarrhal fever	0.62	0.52	0.73
7) Which of the following are ways that malignant catarrhal fever affects you?	I worry about my cattle getting malignant catarrhal fever	0.65	0.54	0.76
7) Which of the following are ways that malignant catarrhal fever affects you?	I lose money selling cattle because there is malignant catarrhal fever here	0.38	0.27	0.48
7) Which of the following are ways that malignant catarrhal fever affects you?	Malignant catarrhal fever does not affect me	0.06	0.01	0.12
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Yes	0.91	0.84	0.97
8) If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?	Only if it did not cost me money	0.06	0.01	0.12
9) If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?	Yes	0.65	0.54	0.76
12) Which of the following do people studying animal conservation bring to your area?	Education about animals	0.74	0.64	0.84

12) Which of the following do people studying animal conservation bring to your area?	Resources for our schools	0.44	0.33	0.55
12) Which of the following do people studying animal conservation bring to your area?	Medical care	0.32	0.22	0.43
12) Which of the following do people studying animal conservation bring to your area?	Veterinary care	0.43	0.32	0.54
12) Which of the following do people studying animal conservation bring to your area?	Opportunities for jobs	0.57	0.46	0.68
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a driver or guide	0.13	0.05	0.20
13) Are you involved in animal conservation work in any of the following ways?	I am hired to be a translator	0.18	0.10	0.27
13) Are you involved in animal conservation work in any of the following ways?	I am asked about animals	0.57	0.47	0.68
13) Are you involved in animal conservation work in any of the following ways?	I am trained to conduct animal research	0.19	0.11	0.28
13) Are you involved in animal conservation work in any of the following ways?	I am part of the research team	0.12	0.05	0.19
14) Would you like to be more involved in animal conservation work?	Yes	0.94	0.88	0.99
14) Would you like to be more involved in animal conservation work?	I'm not sure	0.04	0.00	0.08
16) Do you feel animal conservation work in your area benefits you?	Yes	0.91	0.84	0.97

16) Do you feel animal conservation work in your area benefits you?	I'm not sure	0.03	0.00	0.06
17) Which of the following are problems with animal conservation workers in your area?	They do not speak my language	0.38	0.27	0.48
17) Which of the following are problems with animal conservation workers in your area?	They do not understand my culture	0.42	0.31	0.53
17) Which of the following are problems with animal conservation workers in your area?	They increase the wild animal population	0.13	0.05	0.20
17) Which of the following are problems with animal conservation workers in your area?	They interfere with how I graze my cattle	0.43	0.32	0.54
17) Which of the following are problems with animal conservation workers in your area?	They do not cause any problems	0.31	0.21	0.42

Table 12: 95% confidence intervals for Maasai survey data, respondents designated as having diversified livelihoods. 77 respondents.

5.5.0 Discussion

Creating an internet survey of a population living in a remote area, with intermittent access to the internet, and using English (a third language for most participants) was never guaranteed to work. I am still amazed at the number of responses, and even more surprised at the level and depth of engagement with the survey. Three of the survey questions were optional text-only questions, not analyzed in the results section. The question asking how people would like to be more involved with conservation work was discussed above. Here, I will discuss the other two text entry questions.

Question 3 was a follow-up to Question 2 and asked how respondents would get a wildebeest to leave the area around their village. Sixty-four (56%) respondents answered this question. The most popular answer was to chase it away, with 19 indicating this would be their course of action. Additionally, 9 people would use dogs to chase it away, 6 would scare it off, 6 would call someone (e.g., park rangers) to get rid of it, 3 would throw stones at it, 2 would shout at it, 2 might kill it, and one would use fire. This is generally in line with the wildebeest avoidance methods reported by Bedelian et al. (2007) and Cleaveland et al. (2001) for Maasai in Kenya and Tanzania respectively. Bedelian et al. (2007) and Cleaveland et al. (2001) found the most common methods used to rid an area of wildebeest were chasing, dogs, fire, illegal killing, and fences. This survey supports that, with throwing stones and shouting also reported. The reports of calling park rangers to remove the animal may be somewhat disingenuous—perhaps people wanted to appear as though they would do the legal thing. It is likely that the killing of wildebeest (which is illegal) was underreported. Illegal activities, such as poaching of bushmeat and large carnivores, have been repeatedly found to be underreported throughout Africa, including in the Serengeti and South Africa (Knapp et al., 2010; St John et al., 2012).

The question I was more interested in was the one that asked if the respondent would get a wildebeest to leave their village; 53 answered “yes” (46% with a 95% confidence interval of 37% to 56%) and 35 answered “it depends on the time of year” (31% with a 95% confidence interval of 22% to 39%). Additionally, 65 (57% with a 95%

confidence interval of 48% to 66%) answered that they would avoid wildebeest while grazing their cattle and an additional 18 answered “it depends on the time of year” (16% with a 95% confidence interval of 9% to 22%). This clear need to avoid wildebeest, and get rid of them in some way, is labor and time intensive for Maasai people. The respondents answering “it depends on the time of year” for whether they would get wildebeest to leave their village or avoid them were of interest. This answer is likely reflecting the fact that malignant catarrhal fever is only present at certain times of year and, therefore, wildebeest only present this danger at certain times.

Question 10 asked respondents to explain their answer to Question 9, which asked whether respondents would want wildebeest near their village if they did not transmit malignant catarrhal fever (MCF) to cattle; 73 respondents answered “yes” and 41 answered “no.” Seventy-one respondents chose to answer the optional Question 10. Negative responses included 14 respondents saying wildebeest would still compete with cattle for pasture (“They compete with cattle for grass and water”), 7 indicating wildebeest spread other diseases (“They will still transmit ticks to my cattle”), 3 saying they eat crops (“They may end up doing other damages like destroying crops”), 2 saying they destroy property (“Because they will destroy my property”), 2 saying they bring lions with them (“I would not want because there will be less grass for my cattles, they will also attract other wild animals like lions, who will attack my cattles”), and one saying they are dangerous (“Apart from infecting cattle they are generally dangerous”). Respondents who answered that they would want wildebeest near their village explained that wildebeest would not be a problem without MCF, with some indicating they would be a tourist attraction or even that they liked wildebeest. Respondents explained; “I will no longer be worried,” “Yes because they play a key role in the Ecosystem around our village,” “It will bring benefit to me through tourism,” and “I will allow them to live and graze near my homestead since they will not affect my cattle which are the source of capital and food for my children.”

Of the 114 respondents, 104 (91% with a 95% confidence interval of 86% to 96%) answered that they would want a vaccine for MCF if one were available, an additional 6 (5% with a 95% confidence interval of 1% to 9%) would want it if it were free. This strong positive response, paired with the many text answers to both questions 10 and 3 mentioning the need for a vaccine, demonstrate how beneficial a vaccine would be for the Maasai in this area and how the human-wildlife conflict with wildebeest would be greatly reduced as a result.

The write-in answers to Question 10 show that human-wildlife conflict between Maasai and wildebeest is about more than just MCF. There are also issues with competition for grazing land, other diseases, property destruction, and attraction of predators near *bomas*. However, MCF is the sole reason wildebeest are seen as a problem by some respondents: “If there will be a vaccine, gnus Will graze together and we will only compete for grass and will not be worried of loosing any cow,” “I will no longer be worried,” “They will be harmless,” “Because other than malignant catarrh, wildebeest do attracts tourists where we also benifits from Conservancy fees, employment, development projects etc.,” “Yes because they play a key role in the Ecosystem around our village” and many more. A total of 40 comments indicated that without malignant catarrhal fever people would be happy to live alongside wildebeest. A vaccine for MCF is almost unanimously desired by the surveyed Maasai (96% would accept it). A vaccine would drastically reduce conflict with wildebeest by decreasing cattle loss and eliminating the labor needed to graze cattle away from migrating herds or in moving wildebeest away from cattle.

A vital message that I hope will result from this research is the need for a commercially available vaccine for malignant catarrhal fever. Decker et al. (2021) ran a choice experiment in 12 pastoral (mostly Maasai) villages in Northern Tanzania with a partially effective MCF vaccine that is not commercially available. They found that although MCF incidence, vaccine efficacy, and vaccine cost were all significant factors in vaccine uptake, acceptance and desire for the vaccine was consistently high among the Maasai, even when the vaccine was relatively expensive (Decker et al., 2021). This is consistent with my findings that most Maasai are eager for an MCF vaccine. Decker et al. also found a trend in which MCF has a greater negative impact on smaller households with less resources, leading to further impoverishment of Maasai communities (2021). Both my survey in Kenya and the choice experiment conducted by Decker at al. in Tanzania show that a vaccine for MCF—were it commercially available—would be welcomed by the Maasai at large and would have positive effects on their livelihoods.

This disease is locally devastating for this population (Milo et al., 2015; Cleaveland et al., 2001; Bedelian et al., 2007). Maasai are self-reporting illegal activities toward wildebeest and disturbance of herds, which is a conservation issue. These actions are almost certainly under reported. In later sections, I will discuss indications that these activities are affecting wildebeest behavior.

5.5.1 Difference Between Maasai Groups

Survey responses are divided into subgroups to ascertain possible differences by self-reported sex, age, location of residence, or livelihood practice. Answers by males and females were broadly similar, with almost all confidence intervals overlapping. Differences in responses were likely due to the very small number of female participants, a source of error foreseen in this survey from the start and discussed earlier. Respondents consisted of 96 males, 17 females, and one respondent who preferred not to answer.

Differences in responses by age group were of great interest, since age is vital to the Maasai (as discussed in Chapter 1). Unfortunately, there were no respondents in the 58 and older category. This was also a foreseen source of error—younger people have the most access to phones and the internet (Lewis et al., 2016). Respondents consisted of 53 people in the 18-27 age group (46.5%), 47 people in the 28-37 age group (41.2%), 12 people in the 38-47 age group (10.5%), and 2 people in the 48-57 age group (1.8%).

It is difficult to make comparisons across age groups with such varying sample sizes, but there were a few interesting trends. The number of respondents who answered “yes” to having heard of malignant catarrhal fever decreased as the age group increased, albeit with overlapping confidence intervals. This could indicate an increased awareness and understanding of the disease among younger Maasai. The desire for an MCF vaccine stayed consistently high across all age groups. Most other answers were similar across age groups, or differences were likely due to differences in sample sizes.

Respondents were split between those who reported living in Narok district (67 respondents, 58.8% of total respondents), the primary district of Maasai occupation, and those who reported living outside of Narok district (47 respondents, 41.2% of total respondents). This split reveals some interesting differences. In response to Question 4 ("If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?"), 24% of Narok respondents responded "it depends on the time of year" versus just 4% of non-Narok respondents. This could be due to the reduced exposure to wildebeest, and therefore MCF, outside of Narok district, revealing just how localized and extreme the MCF issue is in Narok.

On Question 7 ("Which of the following are ways that malignant catarrhal fever affects you? (Check all that apply)"), 43% of Narok respondents selected that they lose money selling cattle because of MCF, versus only 17% of non-Narok respondents. This further illuminates the localized nature of the MCF problem. After colonization, the Maasai became highly centralized in Narok district around the Maasai Mara (Campbell, 1993). The prevalence and near exclusivity of MCF there reveals the broader suppression of the Maasai people. It is nearly impossible for them to catch up with wealthier cattle herders elsewhere in Kenya when they are the only ones fighting this issue.

Another concerning answer was in response to Question 13 ("Are you involved in animal conservation work in any of the following ways? (Check all that apply)"). Only 9% of Narok respondents checked that they were trained to conduct animal research, versus 21% of non-Narok respondents. Conducting research is what most respondents want to do (Question 15 answers), so why are there so few in Narok district? Could it be due to the Maasai in that district leading a more traditional Maasai life, and therefore being seen as less educated and therefore less able to assist with research? This concerning possibility merits further investigation, but it is beyond the scope of the current research.

One final difference of note was found in Question 17 (“Which of the following are problems with animal conservation workers in your area? (Check all that apply)”). Though the confidence intervals do overlap, only 28% of non-Narok respondents checked “they interfere with how I graze my cattle” versus 48% of Narok respondents. This may be due to the proximity of Narok district to Maasai Mara National Park, and therefore the increased presence of conservationists and conservation work. A Maasai belief that conservation workers interfere with their cattle grazing is unlikely to foster good relationships with conservation workers and projects. Half of surveyed Maasai in Narok district report feeling this way. Could this be a potential reason for the failure of conservation projects in this area?

Finally, respondents were divided into cattle keepers (37 respondents, 32.5% of total respondents) and those with diversified livelihoods (77 respondents, 67.5% of total respondents) as described in the preceding sections. On Question 5 (“Which of the following problems do gnu/wildebeest cause you? (Check all that apply)”), 39% of diversified livelihood respondents checked “they eat plants I am growing” versus only 14% of cattle keepers. This is unsurprising— far fewer cattle keepers are growing crops for wildebeest to destroy. Most other differences were minor, with overlapping confidence intervals.

One interesting difference is a trend in the answers to Question 12 (“Which of the following do people studying animal conservation bring to your area? (Check all that apply)”). Though all confidence intervals did overlap, cattle keepers had lower rates of “education about animals” (59% versus 74% in diversified livelihoods), “resources for our schools” (27% versus 44%), “medical care” (19% versus 32%), “veterinary care” (32% versus 43%), and “opportunities for jobs” (35% versus 57%). It is interesting that cattle keepers had distinctly lower rates with respect to these potential conservation benefits.

Chapter 6: Wildebeest Behavioral Data

6.1.0 Introduction

Persecution by humans has the potential to cause behavioral changes in animals. From changing space use in hyenas (Kolowski and Holekamp, 2009), density of lions (Ogutu, Bhola, and Reid, 2005), elephants fleeing from certain human groups (Bates et al., 2007), or baboons changing their activity budgets to crop raid (Strum, 2010), humans can have drastic effects on animal behavior, resulting in fitness costs. Though changes in behavior for wildebeest have not been investigated in response to humans, wildebeest do show behavioral plasticity between populations (Vrahimis and Kok, 1993; Berry, Siegfried, and Crowe, 1982; Ben-Shahar and Fairall, 1987). Other hoofstock have shown behavioral plasticity in response to temperature (Beever et al., 2017).

I investigated whether persecution reported by Maasai pastoralists (such as chasing reported in the surveys in Chapter 5) might be causing behavioral changes in wildebeest in Maasai areas. Maasai occupied land in Kenya is critical habitat for wildebeest during the migration, and behavioral changes in that area could have an impact on wildebeest fitness and conservation, not just of wildebeest, but of the entire Serengeti Maasai-Mara ecosystem that depends on them as a keystone species (Ogutu et al., 2014).

To compare wildebeest behavior in an area of heavy Maasai occupation and in one of little to no Maasai occupation, I utilized camera trap data gathered by the Snapshot Serengeti project in Serengeti National Park and in Enonkishu Conservancy. These locations represent vastly different levels of Maasai occupation and offer the chance to compare behavior, despite confounding variables due to other differences between the sites and data sets. It is important to include this behavioral information in a discussion of the conservation encounter. The non-human actors of this encounter, the wildebeest, and their responses to both Maasai actions and conservation should inform future interventions to both improve Maasai livelihoods and to introduce more effective conservation initiatives in the area.

6.2.0 Organization of the Data

In order to make the data from the two sites as easily comparable as possible, some transformation was needed. The behavioral categories in the Snapshot Safari data closely match those I had originally envisioned in my ethogram: standing, resting, moving, eating, and interacting. Each category has an assigned number from 0 to 1, representing the proportion of citizen scientists that chose that behavior as being present in the photograph (citizen scientists are able to choose multiple behaviors as being present). In order to obtain the most accurate information possible, and because in an activity budget an animal is traditionally scored as performing only one behavior at a time, I chose to keep only the most reliably scored behavior. The behavior with the largest proportion of citizen scientists marking it as present was kept and given a score of 1. All other behaviors were given a score of 0. In the case of a tie, the tied behaviors were both given a 1.

The data available for Snapshot Serengeti runs from July 2010 to January 2016 and the Enonkishu dataset runs from September 2018 to January 2020. The fact that the two datasets do not overlap, and therefore behavior cannot be compared within the same year, is likely my largest confounding variable. However, I decided to compare the calendar year of 2019 from Enonkishu (the only full calendar year available) and 2015 from Serengeti. Comparing one full calendar year to another ensured I had comparable data across the same seasons. I believe the latest year in Serengeti was the best option since the number of people should be most similar to 2019, and the climate should also be most similar, as both areas have been experiencing a steady decline in rainfall.

Each behavioral observation includes its original date of capture, time of capture, and location of capture. In addition, I also assigned each observation a time code and season code. Time codes were assigned as follows: if the photo was taken between 2100 and 0559 it was given the code “night,” between 0600 and 0859 it was given the code “early morning,” between 0900 and 1159 it was given the code “late morning,” between 1200 and 1459 it was given the code “early afternoon,” between 1500 and 1759 it was given the code “late afternoon,” and between 1800 and 2059 it was given the code “evening.” These codes were assigned so that changes in behavior throughout the day could be more easily determined.

Each observation was also given a season code, either “wet” or “dry.” “Wet” was assigned for all observations in March, April, and May for the long rains and for all observations in November and December for the short rains. The season code “dry” was assigned to all observations in January, February, June, July, August, September, and October.

Observations were also grouped into stages of the wildebeest migration. The migration can loosely be divided into two-month long stages that I believed might be of interest for comparison. Therefore, data was divided into the following groups:

December and January when the wildebeest herd is in Southern Tanzania before the calving, February and March when the herd is in Southern Tanzania during the calving, April and May when the herd begins moving north during the long rains, June and July when the herd begins moving into the Maasai Mara, August and September when the bulk of the herd crosses the river into the Maasai Mara, and October and November when the herd begins to leave the Maasai Mara and head back south (Hahn, 2020; Estes, 2014). Comparisons between time of day, season, and stage of the migration were ultimately not relevant to the hypotheses being tested. However, graphical representations can be found in Appendix 2 in Figures 8-10 and calculations of 95% confidence intervals for comparisons can be found in Appendix 2 in Tables 14-16.

6.3.0 Statistical Analysis of Data

Since this data was not gathered specifically for the purpose of comparing behavior between sites, simple statistics were done to indicate the possibility of significant differences between the two sites. 95% confidence intervals were calculated for the proportion of each behavior in Enonkishu and Serengeti sites, wet and dry seasons, time of day, and stage of migration.

To indicate differences between sites, tests for the equality of proportions in two independent samples were performed. Proportion tests were performed to compare the proportion of each behavior between the Enonkishu and Serengeti sites. Proportion tests were calculated in RStudio Version 4.0.4 using the prop.test function. The prop.test function in R and RStudio tests the null hypothesis that two given proportions are the same. It was determined to be the best test for this data since two proportions of time spent on behaviors were being compared in each test for statistical significance.

The proportion tests were used to test the following hypotheses:

H_0: There will be no significant differences in proportion of time spent standing, resting, moving, eating, or interacting between the Enonkishu Conservancy and Serengeti National Park.

H_1: Wildebeest in Enonkishu Conservancy will spend significantly more time standing than wildebeest in Serengeti National Park.

H_2: Wildebeest in Enonkishu Conservancy will spend significantly less time resting than wildebeest in Serengeti National Park.

The null hypothesis states there will be no differences between the two sites. Hypothesis 1 is based on using the standing behavior as a proxy for alertness. Rather than using the more traditional behaviors of “head up” and “head down,” which are not available here, I will assume that a more alert wildebeest will spend an increased amount of time standing. Hypothesis 2 follows on this assumption that a more alert wildebeest will also spend less time resting. These hypotheses are based on the assumption that wildebeest in Enonkishu are more persecuted due to the presence of Maasai and therefore must spend more time on the alert.

6.4.0 Results

The sources of error in the wildebeest behavioral data are numerous, as this data was not collected specifically for the purpose of addressing the research questions associated with this study. As already noted, the COVID-19 pandemic did not allow travel to Kenya to collect a dataset specifically aimed at answering the research questions. However, working under an anthrozoological and conservation social science framework necessitates the inclusion of the possible effects of this conservation encounter on the other-than-human actors participating in it. The wildebeest must also be given a voice and agency in acting and reacting to the changing landscape of disease, colonization, and conservation in which they exist. A large and powerful dataset with the ability to make comparisons and speculate on wildebeest behavior was utilized, in lieu of my own in-person observations. This dataset had the ability to potentially support the null hypotheses stated in the previous chapter. If, with all the other differences in the two locations (in addition to Maasai presence), wildebeest were found to not have statistically significant differences in behavior in these two locations, it would be a strong indication that Maasai are not influencing wildebeest behavior. Though Hypothesis 1 and Hypothesis 2 cannot be confirmed with this data set, the null hypothesis is also rejected, which gives some evidence that Maasai presence might be influencing wildebeest behavior, and indicates additional research is warranted.

The Snapshot Safari Project is designed to collect long-term data on species compositions. The behavioral categories added into the citizen scientist analysis were used here as proxies for vigilance and alertness behaviors. The goal of this comparison is to determine if there might be behavioral differences based on presence or absence of Maasai, but there are numerous confounding variables and differences between the sites that may be obscuring those differences.

The largest source of error in this comparison is that the data is from different years. The Enonkishu data is from 2019, while the Serengeti data is from 2015. This four-year separation presents a huge source of error. The wildebeest population itself would be quite different between those years. Climatic differences in particular represent a major issue, as climate plays a role in behavior and is certainly accounting for some of the behavioral variation seen in the data. Rates of lying down and feeding have been known to change based on temperature and precipitation for other hoofstock such as cattle (Graunke, Schuster, and Lidfors, 2011). Since the two projects did not have data for the same years, this major source of error was unavoidable, but it precludes drawing any strong conclusions from the data. However, the size and strength of the dataset does allow for the formulation of interesting questions regarding the wildebeest response to human presence. Theories about the overall behavioral plasticity of wildebeest can be posited.

The sites themselves also present a source of error. It is unknown how similar the microclimates might be between the two areas where camera traps were placed. Differences in the proximity of roads, watering holes, tree cover, kopjes (which conceal predators like lions and leopards), and many other factors would change wildebeest behavior in the vicinity of the camera traps and confound this comparison.

The presence of calves in the Enonkishu area and not the Serengeti area (as calves have grown significantly by the time the migration makes it to that area) is also another confounding variable. Behavior alters with the presence or absence of calves (Estes, 2014). Prior to COVID-19, I had planned to compare two areas within the Maasai Mara so that both sites would have calves, thereby eliminating a variable.

There are no doubt numerous other sources of error confounding and obfuscating the desired comparison of Maasai versus non-Maasai sites. This comparison of the Enonkishu Conservancy and Serengeti National Park should be considered an exploration to suggest potential differences in behavior caused by Maasai presence. No definitive conclusions can be drawn from the proportion tests performed; any potentially significant differences could be caused by a number of factors. Instead, the significant differences should be considered interesting suggestions for future study and exploration.

Wildebeest behavioral categories by site are represented in Figure 7.

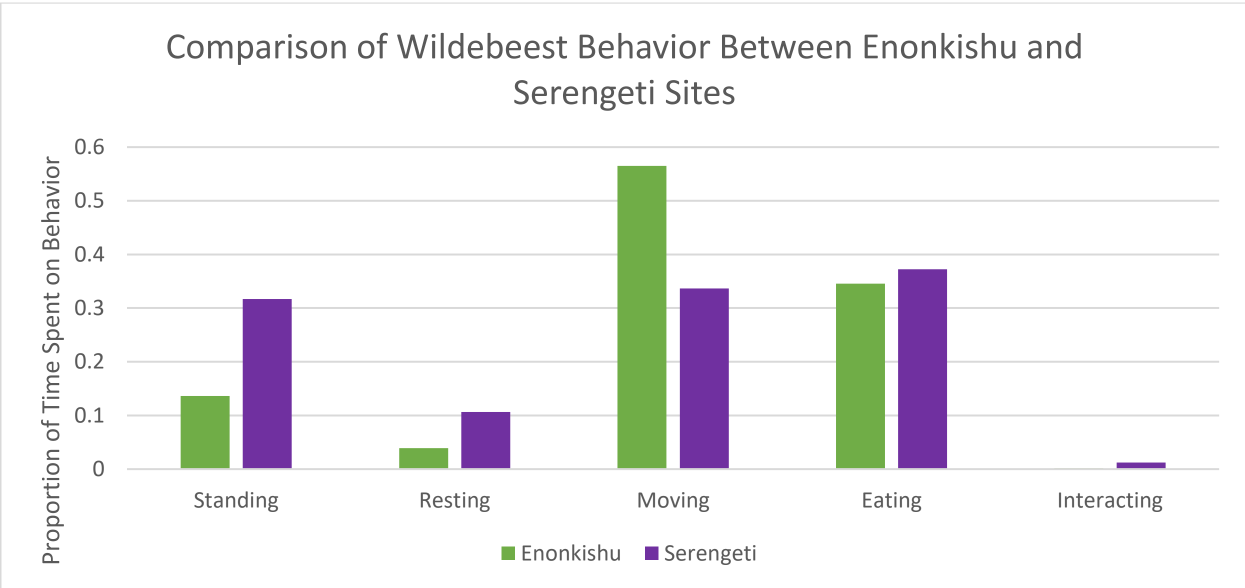

Figure 7: Proportion of wildebeest behaviors by site. 54,200 observations for Serengeti and 3,228 observations for Enonkishu. 95% confidence intervals are: 0.122 to 0.150 for Enonkishu standing, 0.031 to 0.047 for Enonkishu resting, 0.545 to 0.585 for Enonkishu moving, 0.326 to 0.365 for Enonkishu eating, 0.000 to 0.003 for Enonkishu interacting, 0.312 to 0.322 for Serengeti standing, 0.103 to 0.110 for Serengeti resting, 0.332 to 0.342 for Serengeti moving, 0.367 to 0.378 for Serengeti eating, and 0.006 to 0.010 for Serengeti interacting.

Two tailed proportion tests were performed in RStudio as described above. All proportion tests were two-tailed to be as conservative as possible (Table 13).

Behavior	Standing	Resting	Moving	Eating	Interacting
Proportion (Enonkishu)	0.14	0.04	0.57	0.35	0.00
Proportion (Serengeti)	0.32	0.11	0.34	0.37	0.01
P-Value from Proportion Test	<0.01	<0.01	<0.01	0.01	<0.01

Table 13: Proportion of time spent on each behavior at each site and p-values for proportion tests comparing proportion of wildebeest behaviors between Enonkishu and Serengeti sites. The p-values for standing, resting, and moving are less than 2.2e-16, which is the lowest p-value RStudio is able to return at default settings.

By convention, most statistical tests are considered significant if the p-value falls below 0.05. For the Enonkishu versus Serengeti comparison, all five behaviors differed significantly between the two sites. Interesting implications of these tests will be discussed in the next section.

6.5.0 Differences in Wildebeest Behavior

The hypotheses relating to the wildebeest behavioral data were as follows:

H_0: There will be no significant differences in proportion of time spent standing, resting, moving, eating, or interacting between the Enonkishu Conservancy and Serengeti National Park.

H_1: Wildebeest in Enonkishu Conservancy will spend significantly more time standing than wildebeest in Serengeti National Park.

H_2: Wildebeest in Enonkishu Conservancy will spend significantly less time resting than wildebeest in Serengeti National Park.

Based on the proportion tests presented in the preceding section, the null hypothesis is clearly rejected. The differences in proportions of all five behaviors (standing, resting, moving, eating, and interacting) between the Serengeti and Enonkishu sites were significantly different (see Table 13). H_1 is also rejected, as wildebeest in Serengeti spend significantly more time standing than those in Enonkishu. H_2 is supported, as wildebeest in Enonkishu did spend significantly less time resting than those in Serengeti. I will now turn to a discussion of the differences seen, why they might occur, and what those differences might indicate.

The sources of error in using these datasets—to look at differences in wildebeest behavior between the two sites—have already been discussed. It is worth reiterating that statistically significant differences could be due to a number of factors other than differences between the sites. For instance, differences in levels of Maasai use, differences in years, climate variations, presence of calves, tourist occupation levels, or a combination of these and others. Therefore, no conclusions can be drawn here about the effect of Maasai occupation on wildebeest behavior. Instead, what follows are interesting indications and possibilities that warrant additional study.

Wildebeest in Serengeti National Park were found to demonstrate standing behavior significantly more often than those in Enonkishu Conservancy, 32% of the time in Serengeti versus only 14% of the time in Enonkishu, giving a p-value of less than 2.2e-16 in the proportion test. This is contrary to Hypothesis H1 that wildebeest in Enonkishu would be more alert due to Maasai presence and demonstrate more standing behavior there. Without knowing more about the microclimatic and habitat variations it is difficult to speculate on the reason for this difference. Standing is the default for wildebeest, and they can sleep while standing up, like most hoofstock (Estes, 1976). Standing is not a perfect proxy for alertness.

Wildebeest in Enonkishu did spend significantly less time resting than in Serengeti, consistent with Hypothesis H2. Resting behavior is not defined for citizen scientists classifying camera trap photos. They are able to judge the behavioral categories for themselves. The majority of citizen scientists may have only checked resting if an animal was laying on the ground. Wildebeest rarely do this, as it takes them time to get up and run from a predator or threat. They must be in a very restful and secure state to do so. Therefore, the significantly lower rate of resting in Enonkishu does indicate the wildebeest there feel less secure and able to express behaviors associated with low alertness. I cannot conclude that this is due to Maasai presence (including possible chasing and harassment), though this is one distinct possibility. It could also be due to the presence of calves, increased numbers of humans overall, less stringent rules about how close tourists can get, increased numbers of predators in the area, or any number of other factors. However, the high significance of this difference is interesting and worth investigating further to determine its most probable cause.

An unexpected outcome was that wildebeest in Enonkishu spend significantly more time moving than wildebeest in Serengeti. Rates of movement are not generally used to indicate alertness, so I made no hypothesis about rates of moving. However, the much higher proportion of time spent moving by Enonkishu wildebeest (who spend over half their time moving) could be due to being chased off of grazing land by Maasai; 46% of Maasai respondents self-reported that they would attempt to get wildebeest to leave if spotted near their village. If this number is fairly accurate and generalizable for the Enonkishu Conservancy, it would mean wildebeest would be facing a lot of chasing as they grazed, thus explaining the high rates of observed movement. Again, this is not conclusive and could be due to other factors such as roads and predators, but it is worth investigating.

Proportions of time spent eating were also found to be significantly different between the two sites; wildebeest at Enonkishu spent less time eating than those at Serengeti. However, this difference was less pronounced than other behavior differences and could be a product of the difference in the sizes of the two data sets. Another possibility is a variation in food availability at the two sites. It is possible that being chased off grazing land by Maasai leaves less time for grazing, but I am hesitant to consider that possibility due to the wealth of confounding variables.

The time spent interacting was also significant, with less time spent interacting in Enonkishu. However, this was almost certainly a product of the differences in sample sizes and the small number of observations of this behavior (only three observations of interacting were made in Enonkishu). Though wildebeest interact with each other frequently, it can be difficult to detect from a still camera trap photo. Citizen scientists marked this behavior infrequently, and so I will not make any suppositions about rates of this behavior.

The significant differences seen in rates of standing, moving, and resting between the Enonkishu Conservancy and Serengeti National Park are intriguing. Despite the many confounding variables, these differences do offer a noteworthy possibility that Maasai presence could be having an effect on wildebeest behavior. The Maasai who participated in my survey self-reported such behaviors as chasing wildebeest, throwing stones at them, and using fire to deter them. These behaviors would almost certainly not be seen in Serengeti National Park, where Maasai presence is illegal and any Maasai encroaching into the park would likely be keeping a low profile. Additionally, the wildebeest would no longer have calves capable of transmitting malignant catarrhal fever, so there would be less perceived need to chase them away from cattle in Serengeti National Park. It is therefore possible that these self-reported behaviors are the cause of wildebeest spending significantly less time resting and more time moving in Enonkishu Conservancy than in the Serengeti.

6.5.1 Differences in Activity Patterns of Wildebeest

Figure 7 demonstrates the proportion of time spent on each behavior in the two study sites. These wildebeest activity budgets can be compared to the activity budgets discussed in Chapter 1. In a study of this same wildebeest species (*C. taurinus*) in Etosha National Park, Namibia, Berry, Siegfried, and Crowe (1982) found wildebeest spent 52.9% of their time resting, 32.0% grazing, 13.8% moving, 0.1% drinking seasonal water, 0.2% drinking perennial water, 0.1% suckling, and 0.9% in social encounters. Based on the Snapshot Serengeti and Enonkishu data, I found that wildebeest in Enonkishu spent roughly 13.6% of their time standing, 3.9% of their time resting, 56.5% of their time moving, 34.5% of their time eating, and 0.12% of their time interacting. Serengeti wildebeest spent 31.7% of their time standing, 10.6% resting, 33.7% moving, 37.2% eating, and 1.22% interacting.

Clearly, the most dramatic difference here is in the time spent resting. Berry, Siegfried, and Crowe claimed wildebeest in Namibia spent over half their time resting (52.9%), compared to 10.6% in Serengeti and only 3.9% in Enonkishu. This could be due to differences in how resting is defined. Berry, Siegfried, and Crowe did not specify how they defined resting, nor was it defined for the citizen scientists scoring the camera trap data on which the current study was based. However, it does seem that such a large difference may represent an actual difference in rates of resting. This could be due to differences in location, time, human occupation, presence of predators, or a number of other factors. Both Enonkishu and Serengeti wildebeest also spent more time moving than wildebeest in Berry, Siegfried, and Crowe's study, perhaps because this is a migratory herd, rather than a resident population. It could alternatively be a result of the environment, necessitating more movement to find food or to avoid predators or humans. Though these activity budgets are disparate in time and space, the differences present an intriguing suggestion of the flexibility of wildebeest.

Additional activity budgets could help determine the degree of phenotypic plasticity available to wildebeest. Altered behavior is a form of phenotypic plasticity that can be due to anthropogenically driven environmental changes (Gross, Pasinelli, and Kunc, 2010). Behavioral shifts have been found to be common in animals living longer than three years in response to chronic stimuli, such as the presence of humans (Beever et al., 2017). Various mountain ungulates, such as chamois (*Rupicapra rupicapra*) and ibex (genus *Capra*) have been found to alter their activity budgets in response to temperature, climate, and the presence of competitors (Mason et al., 2014). However, the response of ungulates to change is poorly understood and can also be influenced by individual personality (Found and St. Clair, 2019; Beest and Milner, 2013). Bolder individuals in a population of elk (*Cervus canadensis*) were found to habituate to humans faster, leading to increased human-wildlife conflict, increased likelihood of zoonotic disease spread, and decreased likelihood of migrating (Found and St. Clair, 2019). A better understanding of the behavioral flexibility of wildebeest between populations in different environments, between groups within the population, and between individuals would lead to a better understanding of likely long-term responses to human presence (Lea et al., 2020).

Ben-Shahar and Fairall (1987) studied *C. taurinus* in Pretoria, South Africa and divided their activity budgets by season. During the winter, their research determined wildebeest spent 25.76% of the time grazing, 48.03% lying down, 18.69% standing, and 7.33% walking. In the summer, wildebeest spent 24.41% of the time grazing, 39.07% lying down, 24.06% standing, and 11.73% walking. This study is interesting because it specified lying down as a behavior, instead of something more abstract like resting. It also specified walking instead of moving but does not allow for other types of movement (presumably running would be scored with walking). Both of these activity budgets also demonstrate some drastic differences from both the Enonkishu and Serengeti activity budgets. Lying down is considerably higher for the wildebeest in the Ben-Shahar and Fairall study (48.03% in the winter and 39.07% in the summer) than resting is for either the Enonkishu (3.9% with a 95% confidence interval of 3.1 to 4.7%) or Serengeti wildebeest (10.6% with a 95% confidence interval of 10.3 to 11%). Walking is much lower than moving, 7.33% spent walking in the winter and 11.73% spent walking in the summer in the Ben-Shahar and Fairall study, compared to 56.5% (95% confidence interval of 54.5 to 58.5%) spent moving in Enonkishu and 33.7% (95% confidence interval of 33.2 to 34.2%) spent moving in Serengeti; again, possibly due to this population being non-migratory.

Interestingly, both available studies on activity budgets of *C. taurinus* demonstrate the same trend; more resting and less walking/moving than the Serengeti or Enonkishu wildebeest. As noted above, this indicates some flexibility in the species.

The amount could be critical for their resilience to both climate change and human encroachment. More studies of activity budgets could help determine their adaptability and assist with conservation efforts. Across animal species, changes in reproductive behavior have been found to be the most common phenotypic response to climate change, along with changes in dispersal, migration, foraging, habitat use, thermoregulation, and predator avoidance (Beever et al., 2017). Behavioral flexibility in wildebeest is an indicator of their resilience to rapid anthropogenic changes, including climate change, and can help manage and conserve the population (Beever et al., 2017).

Chapter 7: Discussion

7.1.0 Impact on Reflexivity and the Conservation Encounter

Conducting the survey (Chapter 4) with researchers was an enlightening experience. Many of the scientists seemed taken aback by the questions. I received one refusal to participate because the questions were perceived as being rude to the scientists. This was not entirely surprising as I was approaching a breaking point in the scientific etiquette discussed by Sangren (2007). Sangren explored how traditional etiquette in academic communications could hinder reflexivity and prevent anthropological analysis of the familiar (Sangren, 2007). Reflexivity does not occur without discomfort. The colonial legacy of conservation science cannot be challenged and changed without pointing it out (as discussed in Chapter 2), and the same scientists who push for partnership with locals are sometimes the ones who need to redefine how that partnership is framed, from one of hiring locals as merely drivers or guides to working with them as equals in the scientific endeavor. Later in this chapter, I will discuss conservation projects that have engaged local people in the scientific endeavor as full partners (e.g., the Elephants and Bees Project, Lion Guardians, Grevy's Zebra Warriors); these demonstrate how much more effective conservation efforts can be.

Though this survey was small in scale and basic in nature, it was novel for the participants in its approach, purpose, and methods. None of the scientists I contacted had been previously approached in this manner or asked to reflect on their interactions with local people. Considering the strong feelings local people (at least, the Maasai surveyed for this project) have on their interactions with conservationists, this is clearly an area in which outside scientists could improve. Introducing a reflexive turn to conservation science is critical in improving the ability to work with and involve local people, discussed in detail below.

Research on conservation encounters should also start involving the perspectives of the scientists. Rather than only discussing how the animals and local people interact, the near constant presence of conservation workers and/or scientists in many areas makes them an integral part of that encounter and they should not be left out of the discussion. Conservationist presence affects animal behavior, as Candea (2010) detailed for researchers studying animals. Conservationist presence can affect how local people view animals, and therefore potentially their behavior toward them according to the theory of planned behavior (Ajzen, 1991). The conservation encounter is incomplete without a thorough discussion of the conservation workers themselves, their actions and attitudes, and how they are working and relating with the animals and local people.

7.2.0 The Online Experience

I have discussed at length the desire for a reflexive turn in conservation, and the need for conservationists and scientists to reflect on their place in the conservation encounter. It is now time to reflect on my own place in this particular encounter, and my experience conducting this project. I hope that by looking back reflexively on the choices I made and the interactions I had, I can inform the next researcher conducting a similar study.

There is sparse guidance available for conducting the type of convenience internet sampling through social media that I used for the Maasai surveys; available resources were reviewed previously as well as personal ethics rules. But there were challenges beyond merely the ethical. Each time I was contacted by a participant, I was challenged to decide how to proceed. What questions should I answer and not answer? How much should I explain? Would revealing my motivations bias the results of the survey? Was it ethical to attempt to convince people to take the survey? How should I respond when people ask for money, either to take the survey or as a favor? Should I continue talking with them after they have taken the survey? I will recount some of the most memorable experiences below in the hopes that future researchers can learn from my mistakes and successes and make their own choices on how to conduct their online anthropology research.

Certainly, the most notable experience I had while the survey was open was the proposal to move to Kenya to start seriously dating a participant (referred to as M, to protect his identity). M first contacted me via a comment on one of the many groups where I had posted information about the survey. Like many others, he wanted to ask some follow-up questions, such as where I was located, what school I was working with, and why I was conducting this research. These were standard questions that participants had the right to ask, and as a researcher I had an obligation to answer.

One of the benefits in internet research is the ability to disrupt traditional research power dynamics (Baltar and Brunet, 2012). Internet research can thus be seen as what Ross calls an empowering methodology, one where the research subjects are able to engage with the research on equal footing with the researcher and where the methodology itself could help dismantle inequalities in the researcher-subject power dynamics (Ross, 2017). I had no desire to dampen the empowerment of internet methodologies, so I allowed participants to guide conversations as much as possible. The conversation moved from comments on the post to a Facebook private message, which happened 32 times during the survey. M offered to take my survey and also to forward it to Maasai friends and family. I enthusiastically thanked him and told him how much I appreciated his assistance.

After taking the survey, M continued messaging me with benign questions about what I did for a living and what America was like. I continued engaging with him over private message, aware that parachute science and hit-and-run anthropology are top reasons for failure of conservation projects and mistrust of anthropologists (Beck et al., 2021; Lewis, 1973). These messages were quite casual, as is typical for the internet. I was careful to never get too personal. At some point M started sending me pictures of himself and telling me about his ex-girlfriend who had broken up with him. At this point I became somewhat uncomfortable, but I assumed he thought, at this point, that we were friends, and I did not want to seem rude. My method was to tell him I had to go to work whenever I became uncomfortable; I was careful not to reveal too much personal information. One day, quite unexpectedly, M informed me that he would really like me to move to Kenya to be with him and that he would take really good care of me.

I spent several days carefully considering how to proceed with the interaction, finally telling him, as kindly as possible, that I did not think that would be best for either of us. I reluctantly blocked him from my social media. This was by far the most uncomfortable I have ever been conducting research, even more so than while pursuing my master’s research and becoming covered in leeches in a Vietnamese jungle. Guidance for anthropologists in these situations is somewhat lacking, due largely to the fact that romantic encounters and issues in fieldwork are simply not mentioned within legitimate ethnographic work, as pointed out by Newton (1993). Even with the reflexive turn, romantic encounters and emotions between researchers and informants are discussed in the abstract, and my very concrete issue was something I had never seen discussed in any literature (Newton, 1993). However, avoidance of these types of encounters is something most female anthropologists practice. Though it is rarely found in any methods section, Newton discusses a few of the ways female ethnographers have established their disinterest in sexual encounters in the field and presented themselves firmly as non-sexual objects (1993). I myself, before realizing my research would have to take place online, had taken the steps most women take before entering the field, including carefully planning my clothing for maximum coverage (as opposed to comfort) and strategizing on how best to make it clear I was unavailable. It is more difficult to do this when conducting research on social media. Rather than respondents having access only to the carefully sanitized “researcher” version of me, they have access to years of photos and information.

As previously stated, power dynamics change on the internet, and people become far bolder than one would expect (Lapidot-Lefler and Barak, 2012). Looking back, I should have closed off the interaction earlier. But things escalated very slowly until the end, so there was never a definite crossover point where it became inappropriate, that is, until it became quite inappropriate. I became extremely cautious after that and started viewing any and all personal questions with suspicion, likely losing me some participants.

Some personal messages resulted in excellent interactions, however. One participant (referred to as F) afforded a very different experience. I had been posting in many groups with similar members and had seen this person "like" my posts more than once, but I was unsure if she had actually taken the survey. At this point I had few female respondents and was actively seeking each one I could get. I joined several female specific groups and posted my survey. In one of these, F finally commented on the post. At this point I had started replying to comments, telling people I was seeking their insight and to please take the survey; I had noticed many people commenting but not actually taking the survey. After I replied to her, she sent me a private message to ask the usual questions about my school and research. After a few exchanges, she agreed to the survey and asked if she could forward it to her friends. I believe this may be where several female respondents originated.

Another excellent interaction occurred early in the survey timeline. After posting in a small Maasai Mara conservation group, I was contacted by the administrator of that group (a conservationist himself; referred to as Z) asking for more details about the research. I happily answered all his questions. Z was thrilled about the research, took the survey, and gave me the encouraging feedback that this was exactly the sort of research the Maasai wanted and needed in their area ("Incredible work and I can't wait to see the final document to read the conclusion and recommendations of your work"). He also reiterated to me the need for a vaccine ("The biggest breakthrough is to find a vaccine and it will be a big step towards solving HWC") (HWC is an acronym for human-wildlife conflict). Z invited me to several other Facebook groups where I could post my survey, and he commented on my posts, encouraging others to take the survey. Z was doing local conservation work himself, helping other villages deal with wild animals in their areas. He told me all about his conservation work, and I now regularly see posts about the wonderful conservation work his organization does.

I had a relatively short interaction with a respondent referred to as D. He initially presented himself as interested in the survey, commenting on a post about it, and then private messaging me with follow-up questions. However, after only a few messages it became clear that D was not remotely interested in the survey, but instead wanted to "date a white woman" (his words). He really wanted me to come to Kenya so he could show all his friends he had a white girlfriend.

As a result of this interaction, I created a cut-and-paste template for such queries. It read, "Hello! Thank you for contacting me! Can I answer any questions for you regarding my research survey?" If they responded to this, I then followed up with a brief explanation and a link to the survey (also a template). I generally left it there unless they answered with specific questions that I felt comfortable answering.

D and M were not the only men who made comments or sent private messages asking me on dates or to be their girlfriends. I was asked multiple times for pictures. When I first created the Facebook page to be the informational center for my research, I made the profile picture a long-distance shot of myself in front of the University of Exeter sign. This had to be changed rather quickly because of the number of comments about my appearance (e.g., "Looks nice," "Nice n lovely smile"). These interactions left me uncomfortable and confused. I continually asked myself if I was doing something wrong to prompt this. After rereading many comments, interactions, and messages, I have decided the picture was not inappropriate. My time interacting in Maasai Facebook groups and on pages has revealed that this seems to be how they interact online; most comments led nowhere. Prior to this, I used social media almost solely to keep in contact with close friends and as a source of cute animal pictures, so these comments were new for me. However, my continued communication with Maasai participants after the close of the survey has helped my understanding of these interactions.

A study by Delise (2014) discussed the gendered use of social media, focusing on Facebook. Delise found that men and women used social media to perform and demonstrate much the same gender roles they presented in face-to-face interactions (2014). In the context of Maasai culture, and especially in the *ilmurran* age set (most of my participants), their behavior makes perfect sense. Interacting with women online, commenting on a woman’s appearance, and pursuing single women, would outwardly demonstrate their position as young and unmarried. Interacting with a foreigner would increase their prestige. Doing so publicly on social media, where their peers might see, is an excellent way to demonstrate these traits, but has not proven to mean much (no men who have commented on my photos have followed up with anything further). Now a few months on from the end of the survey, I believe many of the comments I received on photos were merely a demonstration of traditional gender and age-set roles and had very little to do with me personally.

Presenting yourself as a researcher on the internet also comes with inevitable critique. One particular comment accused me of being a government official and doing research without doing anything helpful. I tried to explain that I was a student and not affiliated with any government, but I never received a return comment from that particular person. I also received many complaints about the donations made for the survey (the final question of the survey allowed each participant to choose a Maasai charity for me to donate 200 Kenyan shillings to) and the lack of personal incentives. Many complained that they wanted the 200 Kenyan shillings for themselves instead of being sent to a charity. Several mocked the small amount of 200 Kenyan shillings, and many others named a price (often five or ten US dollars) and told me they would take the survey for that price. To each of these comments, I replied that I was a self-funded student without much money, but I wanted to give back to the community, so I was donating a small amount to charities. A few commentors actually accepted that and apologized, but I do not know if they then took the survey; my privacy policies did not allow me to track where responses were coming from.

I had several private messages asking me for money. Some were from people who wanted to take the survey but had to have money for “internet bundles.” From context I believe that means that internet access on cell phones can be purchased by amount of data. I decided at the first request that I would not pay individual respondents for internet or anything else, as it would make the survey unequal and it felt unethical. Some people took the survey and then messaged me saying I now owed them, and they needed money or a loan. One respondent asked for 1500 US dollars—no small sum. I kindly explained to each that I was a student and did not have the money, but many argued, assuming that since I was an American, I must have plenty of money. These interactions were uncomfortable.

Several comments, especially concerning the paid advertisements, questioned why I did not visit the Maasai Mara. Many people expressed dissatisfaction that I was not coming to talk to them in person in order to understand their frustrations and difficulties (e.g., “I wish you’d come down here…Walk in the Savannah and talk with the affected people…”). The paid advertisement was often the target of these comments; I believe this was because it was more difficult to determine the origin of the ad. I tried to reply to each of these comments with an explanation of my inability to travel due to the pandemic, but I never received responses from these interactions.

Despite the many uncomfortable interactions (and honestly, discomfort is as much a part of ethnography as the pens and paper we take notes with) there were also many wonderful encounters. I received several comments thanking me for conducting the research and affirming that reduction of human-wildlife conflict and MCF was exactly what the Maasai needed (e.g., “Great survey about the wild beest,” “am glad you doing a research on wildbest”, “I liked the questions they are just what is happening here in mara,” “thank for taking part in research in Kenya,” “incredible work and I can’t wait to see the final document and read the conclusion and recommendations of your work. Malignant catarrhal fever is causing havoc…Thank you for what you do. God bless you abundantly.”, “Good study I think this matter of conflict in between maasai and wildebeest comes through cattles. when the wildebeest give birth in a nearby cattles place then the wildebeest's amniotic fluid is totally danger disease in cattle, this is the main effectively killing of livestock . . . with more effort we should have time to search of this disease then we might have a way of reducing this conflict”).

I had no less than six platonic invitations to visit Kenya and be shown around the Maasai Mara (e.g., “Catch up when you are in Kenya,” “Would you come to Maasai Mara Kenya for your research?”, “We can connect and am ready to help whenever possible”). The outpouring of kindness from Kenyans, Maasai and otherwise, professing their condolences that the pandemic was keeping me away from their beautiful country and assuring me they would be happy to have me visit when it was over, was both moving and comforting. Self-isolating and trying to conduct ethnographic research from home during COVID was difficult, but connecting to my field site through the eyes and voices of people who live there and love their country was magnificent. In a way, I saw Kenya, the Maasai Mara, and the wildebeest herds through them. It was a fascinatingly different way to “visit” a field site. Though I was forced into it, I cannot bring myself to regret anything about the way this research was conducted. Knowing the Maasai in this new form, talking to them through the internet, was so novel I felt this research had value simply in its unconventionality.

Though online ethnography has been used for decades to connect with many different groups, I believe (based on an extensive trawl of academic databases and Google scholar) I may be the first to engage the Maasai in this way. Their limited access to the internet and their status as an exotic people in the mind of Westerners has always made them a target of traditional anthropological methods. I also considered traditional methods to be the only way to engage with them. If not for the pandemic, I would never have considered online methodologies.

As anthropologists and ethnographers are forced to explore “anthropology at home” we may find that novel insights from this type of work, rather than impoverished results standing in for traditional fieldwork, are the norm (Goralska, 2020). Kim et al. (2021) points out that in disaster ethnography in the United States, online ethnographers can become more familiar to people with an online presence, leading to rapport-building often even better than that achieved in-person. Many ethnographers are already realizing that digital ethnography has the potential to build stronger ties with participants over longer time periods, since researchers do not leave the field as they traditionally did (Ghosh, 2020). Anthropologists and ethnographers, such as myself, who had to use digital ethnographic methods because no other options were available, are finding they have many benefits and can lead to singular insights.

I felt uniquely placed in this conservation encounter because of the way I conducted online anthropology. Throughout the process of gathering responses, and even now months later, I still feel unsure of my place. It is easy when walking into a village with pen, paper, and recording equipment for everyone to know exactly who and what you are. You place yourself solidly as the outside researcher. But once I became a group member, a Facebook friend, a contact, did I become something else? Was I something else merely by being accepted into Facebook groups meant for Kenyans? When I engaged with a participant through private message, did I move from researcher to casual acquaintance? For the participants still following me and commenting on my Facebook posts, am I now a friend? Internet culture gives us the ability to become different things in virtual spaces. As pointed out by Driscoll and Gregg (2010), when we conduct online research, we start out already sharing the same spaces as our participants. The line between the researcher and participant is complex and blurred and, in a way, we may start out by already having “gone native” (Driscoll and Gregg, 2010). Ethnography cannot be exactly translated to the internet but intimacy with participants can and does arise, often much more so than in normal in-person fieldwork (Driscoll and Gregg, 2010; Murthy, 2008).

Robards (2013) points out that a Facebook friend does not exactly equate to traditional friendship, but it does make the online researcher more of an insider than a traditional ethnographer might be considered to be. This leads to both participant and researcher being granted more personal information about the other than in traditional research (Robards, 2013). In many cases this facilitates participant comfort with the process and can encourage post-research engagement, but it also challenges the traditional roles played by the researcher during and after the research process (Robards, 2013).

As researchers, we can become what we need via the internet: professional, friendly, humble, detached. This is true much more so than in person, where the difficulties of the field can sometimes preclude these things (e.g., where the need to pack light can preclude us from appearing in highly professional dress, or our personal appearance can immediately set us off as an outsider). This could be an advantage, but it could also become a source of dishonesty. By being able to present ourselves in any way we want, we also have the capacity to mislead research subjects. Boellstorf discusses this at length in his book “Coming of Age in Second Life,” where he conducts participant observation fieldwork within a virtual “game” environment (2015). I held to the ethical guidelines Boellstorf laid out for himself; to present oneself as honestly as possible at all times and never hide your status as a researcher (Boellstorf, 2015).

The possibility that I could have been misrepresenting myself or my research or misleading potential respondents was a constant source of stress for me. Each interaction brought the question of how friendly and encouraging to be and how much to privately message someone. As a researcher and conservationist, was I placed on the conservation side of the encounter? As an anthropologist, was I more aligned with the Maasai? I was unsure of where I fell myself, and I worried I would unintentionally misrepresent my intentions. The common and seemingly benign questions of why I was conducting this research and what my goals were sometimes seemed loaded. Certain answers would align myself with certain parties in the encounter; if I answered that I wanted to conserve wildebeest, I was aligned with animals and conservationists; if I answered that I wanted to help Maasai, I was aligned with them. I do not believe that traditional ethnography requires us to think so deeply about our underlying intentions. We research for research's sake; we reveal the sides of a conservation encounter because they are interesting. But I needed answers to these questions that would represent my research and intentions fairly, honestly, and consistently. It was therefore necessary to do more self-reflection than I think is customary during the research process. In the end, the answer I shared was that I was conducting this research in order to help all three parties. I wanted to help improve Maasai livelihoods, protect wildebeest, and improve relationships between Maasai and conservationists. This became the consistent answer I gave to respondents. It is the truthful answer.

The challenge in doing applied anthropology is that it may border on advocacy, which, while seemingly desirable, runs the risk of preferencing one group over another or speaking *for* marginalized groups (Hastrup et al., 1990). My goal in this research is to illuminate the problems faced by all three participants in the conservation encounter, and, by discussing those issues, highlight the challenges faced by each group and the complexities of the conservation encounter. My hope is that it leads to better cooperation and conservation.

As the COVID-19 pandemic rages on and the possibility of additional pandemics and restrictions on travel due to climate change and other factors loom, online anthropology will likely become more popular. It is therefore advisable, as we use these techniques, to develop set practices and ethical guidelines for their implementation.

This research used social media in a very specific way—to contact respondents in a traditionally hard-to-reach group and recruit them to participate in an internet survey on their attitudes and opinions. It was successful in doing so, and anyone interested in surveying similar groups should consider using this technique, either in addition to more traditional techniques or in place of them. For the researcher with little funding, these techniques are invaluable. Even a short trip to the field requires much work in terms of grant writing, fundraising, and planning. Internet techniques can be implemented quickly and are cheap or free. As academia strives to make higher education and research more diverse and inclusive, anthropologists should be actively looking for ways to include researchers with less financial means.

Though online techniques can be implemented quickly and cheaply, they should not be done with the expectation that they will be easy or take far less time than traditional field work. In a traditional fieldwork day, the researcher has a set amount of the day dedicated to gathering data, after which there is time for relaxing and working. That is not the case with these techniques, and I advise aspiring online anthropologists to be prepared for that. Especially when conducting research with a group in a different time zone that moves in and out of internet access, I needed to be available to answer messages and comments quickly before potential respondents lost interest or internet access. I spent many hours a day, sometimes late into the night—when it was a convenient time in Kenya—monitoring social media, searching for new groups, replying to messages, and creating posts and advertisements.

Each post and comment should be carefully considered. An early version of my post reading “I want your opinion” was met with a lot of negativity by Maasai who thought it rude and too forceful. It was then changed to “I humbly request your opinion,” which had a much better reception. Depending on the group you are working with, traditional ways of advertising or posting online may come across as discourteous to different cultures. Though internet culture has bloomed into a culture all its own, Dalsgaard argues it is still rooted in the cultures it sprang from (2016). This fact should not be ignored or underestimated when creating posts. We are presented with the new challenge of having only a few sentences to introduce ourselves and our work, so every word should be chosen carefully.

I had much more success with shorter posts. My original post was a fairly long paragraph explaining who I was, my survey, and why I was conducting it. This post received little interaction, likely because it was too long. Research focused on attention spans of internet users suggests long text is unlikely to be read and visual content is the way to garner attention (Subramanian, 2016). Once I shortened it to two brief sentences and a picture, I received more responses and interactions. I allowed interested parties to interact, and I explained the salient information in comments and messages rather than the original post.

Searching for and joining relevant Facebook groups was a major part of disseminating this survey. At first, I joined only groups that mentioned their membership contained Maasai people. This was a very small number of groups and a small audience. As survey collection progressed, I joined groups for universities in Kenya, cattle ranching, farming, and women's groups. I had a lot of success in these groups. Though I did receive comments from people expressing their opinions on the topic, but then saying they were not Maasai and could not take the survey, I did reach Maasai respondents in these groups. The women's groups in particular were valuable as I had so few female respondents.

Though it was productive to join women's groups to find more female respondents, it did make me wonder how the results of my survey were being affected by the groups I chose to join. Though I attempted to join all Maasai related groups without discrimination, would I have gotten different survey results by surveying a different set of groups? The survey is already somewhat biased by sampling only internet-using Maasai. Is it biased by sampling only those who use certain groups? The advertisement aimed at all of Kenya might have mitigated that slightly, but it is impossible to know. The use of certain Facebook groups is potentially a huge source of bias in these techniques. Certainly, these techniques are a specific type of convenience sample.

Those who worry that doing online anthropology will lack the personal connection the field brings should consider the unique ability of the internet to allow us to form connections. Online communities are just as "real" as offline ones (Wilson and Peterson, 2002). Online communities are culturally produced artefacts rich in identities, interactions, and opportunities for investigation into numerous avenues (Wilson and Peterson, 2002). Social media pages are constantly altered and produced by people, and access to such a page allows for a level of intimacy and familiarity rarely achieved in the field (Robards, 2013).

The anonymity of the computer conceals differences and has the power to put us on equal footing, finally helping to reduce the traditional power differential between researcher and researched. For me, the role of researcher has always been an uncomfortable one. The ability to type messages back and forth to a Kenyan conservationist like Z or a student like F without worrying about one another's age, appearance, economic situation, or any other confounding factor may have truly united us in the love for Kenyan wildlife and the protection of the Maasai Mara and Maasai livelihoods. For me, these uncomplicated interactions broke through all the issues of culture and nationality and became purely about our shared goals and how we could help one another and work together. The answers to my survey, typed by Maasai on their own devices away from my prompting gaze, seemed more honest and truer than any I would get as the wide-eyed American visitor, where the rules of politeness and social responsibility may have kept the whole truth from coming out. Though at first, I mourned for my lost field experience and the bonds it would bring, in the end, I feel the internet connected me to the encounter between the Maasai and their wildebeest neighbors in unexpected and powerful ways.

7.3.0 The Case for More Social Science in Conservation

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services released in 2019 showed a dim view for the future of biodiversity (Sanborn and Jung, 2021). The report showed that despite decades of conservation efforts, biodiversity and ecosystem services have declined in the last several decades and are projected to continue to do so. 25% of species assessed are now threatened by humans (Sanborn and Jung, 2021). The 2020 report from the Convention on Biological Diversity is no better. It describes unprecedented declines in biodiversity that are rapidly accelerating (Hirsch, Mooney, and Cooper, 2020). Clearly, if we are to save the biodiversity of planet Earth, conservation science must improve. Catalano et al. (2019), in a survey of the few conservation failures that are actually published, deduces that failure is not only common, but the norm. I will argue that social science can help improve conservation efficacy.

Part of the issue with conservation failures may be rooted in the historical philosophies of conservation. Conservation ideology as we know it today developed in the 1960's with a strong mindset of nature as an independent entity, something aside from and separate from humanity (Sanborn and Jung, 2021). Since its inception, there have been two philosophies for why conservation should be done: the anthropocentric and the biocentric (Sanborn and Jung, 2021). The anthropocentric view holds that the environment should be conserved to maintain ecosystem services for humanity. The biocentric view holds that nature should be conserved for itself, because it has intrinsic value separate from what it provides for humans (Sanborn and Jung, 2021). The conflict of these two philosophies can still be seen today, as anthropocentrists may alienate other conservationists as they prioritize communities, and biocentrists may ask communities to shoulder the costs of conservation interventions (Sanborn and Jung, 2021). In reality, neither of these two extremes have produced meaningful results for either biodiversity or improvement of human life (Sanborn and Jung, 2021). The only reasonable way to do conservation is to move toward a brand-new way of doing that is interdisciplinary, reflexive, and holistic. As I argued in Chapter 1, I believe working under conservation social science as a theoretical framework for doing conservation research and implementing conservation solutions may be the answer (Rust et al., 2017; Bennet and Roth, 2019).

Pressey et al. (2017), in an impressive demonstration of reflexivity, dared to ask of conservationists whether they were making any difference at all for biodiversity, or whether conservation interventions were just displacement activities in the face of the overwhelming problem of biodiversity loss. Pressey et al. pointed out the seemingly insurmountable disconnect between the goals of preserving biodiversity and the day-to-day consumption activities of humans (2017). Pressey et al. argued that conservationists do not always do what is necessary for conservation, but what is possible and reasonable, making decisions more on belief systems than on evidence (2017). Though I found this criticism harsh, especially because conservationists face extreme barriers in the forms of funding, regulations, etc., Pressey et al. (2017) does make one very salient point: conservation continues to focus on protected areas and increasing them, despite little evidence that this actually protects biodiversity.

I will not pretend to know all the complex and varied reasons conservation interventions fail. However, there is considerable evidence that a lack of social science is a factor for conservation failure in many cases. In their survey of published failures, Catalano et al. (2019) found the most frequent causal factor to be “relationships between stakeholders.” A failure to consider the social dimensions and realities of local communities has hindered the success of many conservation initiatives (Sanborn and Jung, 2021).

In tropical low-income countries, where much conservation is being done, there is a particular failure to achieve conservation outcomes (Margules et al., 2020). Conservation in these areas is not rooted in a deep understanding of the socio-ecological systems surrounding them and the influences on human behavior. Yet, most conservation interventions seek to influence human behavior (Margules et al., 2020). Conservation efforts in developing countries often seek to restrict income-generating activities. This leads to conflict between local people and conservationists with the conservation effort being rejected, and a resulting failure of the conservation project (Margules et al., 2020). My own survey showed 39% of Maasai felt conservationists interfered with how they grazed their cattle (their main income-generating activity). Without identifying the societal values, constraints, and opportunities, conservationists cannot design feasible conservation solutions (Margules et al., 2020). Conservationists must understand the existing strengths and capabilities of the society and culture they are working with and design conservation actions and solutions within it, rather than imposing externally designed solutions destined to fail (Margules et al., 2020). Later, I will describe some examples of projects that did just that, with great success.

It is not only advisable for conservationists to address livelihood concerns; it is expected and has been for decades. The World Conservation Strategy of 1980 argued for integrating conservation and development, though it laid out no guidelines and most attempts have failed (Margules et al., 2020). Conservation actions today are largely expected by the public, governments, and funding agencies to also reduce poverty—a lofty goal on top of an already challenging field. There are arguments about whether this is an unreasonable expectation (Walpole and Wilder, 2008). In a survey of the far-reaching projects of Flora and Fauna International, 85% of them mentioned some engagement with local communities and poverty issues as part of their actions (Walpole and Wilder, 2008). The most popular rationale for this inclusion is reducing threats to biodiversity by improving livelihoods (e.g., reducing poaching by increasing living standards). Also popular was offsetting the costs of conservation by reducing poverty (Walpole and Wilder, 2008). Many projects use livelihood improvement to gain entry with communities and generate support (Walpole and Wilder, 2008).

A search of most conservation organizations will show similar claims of poverty reduction and assistance to local communities. All of the conservation scientists I surveyed also claimed to help the local community in some way, the most popular answers being bringing education (7 projects) and bringing jobs (5 projects). This matched the Maasai survey, as 69% of respondents claimed conservation workers brought education about animals and 50% said they brought opportunities for jobs. However, the responses to later questions indicate that the education component is largely useless, at least for the Maasai. The jobs brought by conservationists; 16% drivers/guides, 15% translators, 16% trained to conduct research, are not the ones the Maasai are seeking. Some of the answers to the question “In what ways would you like to be more involved with animal conservation work?” consisted of: “I will like to educate my people the importance of the animal's to our ecosystem,” “Being offered the chance to participate in such programs and education of the local community on importance of conservation,” “As a mediator between human and wildlife and teach people on the important of wildlife." My own interactions with Maasai people and my knowledge of their long history of living with the land indicate they need little education about animals and the environment from outsiders. Though jobs were offered, most Maasai indicated they wanted to be more deeply involved in research with answers such as "I really wish to be involved in researching ways that will help to eradicate Human wildlife conflict and wildlife conservation," "Take part in wildlife research, more on animal behaviors there's a lot to learn on animals," "Community participation and involvement in decision making." Though bringing education and jobs are not seen as negative, social science surveys like the one I have conducted could benefit conservationists by advising them on what benefits could actually be of use to the community, thus fostering relationships to actually improve, not just buy-in, real conservation outcomes.

More collaboration and social science training are needed for conservationists. However, qualitative conservation social science is sometimes criticized by natural sciences as inappropriate for their goals (Rust et al., 2017). What many natural scientists fail to recognize is their own inherent research philosophies. Objectivism is itself a research philosophy and a choice made by natural scientists in their research design (Moon et al., 2018). Qualitative and quantitative data complement each other and can reveal more sides of an issue (Moon et al., 2018). This research is an example of that. I have used qualitative methods to research attitudes of conservation scientists and Maasai, and quantitative methods to research wildebeest behavior. Together, these methods elucidate more of the complexities of this conservation encounter than either method alone. A natural scientist asking why wildebeest behavior is different in the two locations would need the social science information gained by studying the social and cultural aspects of the Maasai in the area. A social scientists interested in Maasai livelihoods needs information on wildebeest migration patterns and disease to fully grasp why restriction of traditional Maasai migration is such an issue today. By bringing all aspects together, the social and conservation issues are illuminated more effectively, and conservation and livelihood interventions can be devised that are more successful.

Many natural scientists are already conducting social science research on some level, but without, perhaps, the proper training (Mathevet and Marty, 2019). Many conservation interventions are aimed at changing human behavior, so understanding the factors that influence human behavior is essential for doing this (St. John, Edward-Jones, and Jones, 2010). Biologists and conservationists do recognize that a lack of social science is limiting the effectiveness of conservation actions and they want to bridge that gap (Fox et al., 2006). However, many social scientists do not believe conservationists are interested in social science, which is one of the barriers to fully integrating it into conservation (Fox et al., 2006). Other barriers include a lack of common vocabulary, academic systems that discourage meaningful interdisciplinary work, a lack of funding for collaboration, and limited opportunities for collaboration (Fox et al., 2006). Time limits on conservation projects are also a major barrier and conducting social science research before beginning conservation action may be too time prohibitive for some (Margules et al., 2020).

In addition to the barriers listed above, Bennet et al. (2016) identified four general barriers to full integration of social sciences in conservation. They believe engagement with the social sciences is still superficial, despite acknowledgement of its importance, likely due to ideological, institutional, knowledge, and capacity barriers (2016).

Ideological barriers include differences in the types of sciences in thinking about how the world works and how it is appropriate for scientists to engage with it. Importantly, this includes differing views on what constitutes valid methods and data (Bennet et al., 2016). Institutional barriers include the configuration of conservation organizations for natural scientists. These barriers may privilege natural scientists within their organizations, resulting in a feeling of distrust of social scientists (Bennet et al., 2016). Knowledge barriers include discipline specific language and the theories, methods, and assumptions already held by both parties that they may be unwilling to change (Bennet et al., 2016). Finally, capacity barriers include a lack of funding to bring on social scientists and the lack of human capital within conservation organizations to fully realize social science integration (Bennet et al., 2016). All of these barriers act to prevent a true mainstreaming of social scientists in conservation. Bennet et al. (2016) argue that social scientists should be present within the conservation science community, conservation agencies and organizations, and global conservation policy influencing bodies for true integration. We are certainly not there yet.

Since the 1980's conservationists have been attempting the model of community-based conservation (Brooks, Waylen, and Mulder, 2013). This model is based on the idea that long-term conservation success requires engaging with and providing benefits for local communities. Though some conservationists have feared trade-offs between conservation and economic development, community-based conservation has been widely adopted (Brooks, Waylen, and Mulder, 2013). Brooks, Waylen, and Mulder (2013) evaluated 136 community-based conservation projects for 4 measures of success: attitudes, behaviors, ecological factors, and economic features. They found that project design, specifically capacity building in local communities, was critical in generating success in all outcomes. Encouragingly, they found that well-designed projects could prevail over disadvantages in the national and local context and produce real conservation outcomes (Brooks, Waylen, and Mulder, 2013). Conservation can be successful when it understands the factors shaping human-environment interactions and the drivers of human effects on biodiversity (Blicharska et al., 2016). A survey of publications on the Natura 2000 network (a network of protected areas in the European Union) found stakeholder involvement to be critical for success (Blicharska et al., 2016). Most conservationists are aware of the importance of stakeholder involvement or buy-in, and social scientists are often brought on at the end of projects to try and win that buy-in (Niemiec et al., 2021). However, social science has much more to contribute.

Social science has the potential to facilitate conservation policies and outcomes that are more robust and effective, as later examples will demonstrate (Bennet et al., 2017). Bennet et al. describes 10 ways that social science can contribute to conservation (2017):

1. Social science can document and describe the diversity of conservation practices.
2. Social sciences can help diagnose why conservation projects and practices are succeeding or failing.
3. Social sciences can reveal inequities, power imbalances, or systemic issues.
4. Social sciences can guide conservationists toward more reflexivity of their underlying assumptions.

5. Social sciences can help conservation learn from ways of thinking and generate innovative ways of thinking.
6. Social sciences can improve management practices.
7. Social sciences can enable better designs and models for conservation interventions.
8. Social sciences can help justify conservation actions.
9. Social sciences can help achieve ecological outcomes.
10. Social sciences can facilitate more socially equitable processes and outcomes.

Bennet et al. (2017) indicates one of the barriers to realizing these benefits is the lack of integration of social science during every stage of conservation research.

Niemiec et al. (2021) provides guidance on the four stages of conservation research in which social science should be involved. They believe social science can contribute to the following stages of the research process: defining the problem and the project team, defining the goals of the project, identifying the impact and designing the interventions, and developing and evaluating the indicators of success or failure (Niemiec et al., 2021). Essentially, a social scientist should be present throughout the process and can help develop more inclusive and just conservation (Niemiec et al., 2021). Too often, they are recruited at the end to “talk to people” and get their support or buy-in, or help market the project locally (Niemiec et al., 2021). But with the proper collaboration, and a social scientist present at all stages, conservation initiatives can be designed that match the social, economic, cultural, and governmental contexts in which they need to function (Niemiec et al., 2021). Some of the examples later will show just how effective conservation can be when this is done.

Another benefit social science can bring to conservation is reflexivity. As discussed in Chapter 2, conservation suffers from a general lack of reflexivity. Though social science is starting to be used more and more in conservation, reflexivity has not yet made it into the toolkit of conservation (Beck et al., 2021). The influence of the researcher is not only under-recognized in conservation, but often intentionally avoided. Conservation is a science with intended actions and outcomes, and these are rooted in the values and objectives of the scientists. Reflexivity will allow conservationists to be more aware of how the individual researcher is shaping the scientific process (Beck et al., 2021). Beck et al. (2021) outlines four major ways in which conservationists should practice and consider reflexivity: how conservation science is informed by personal values, how it requires true partnership, how it must contend with its own history, and how it demands progress. Personal values, though underrepresented, effect all levels of science, including what questions get asked in the first place (Beck et al., 2021). Most famously, this has led to an overrepresentation of birds and mammals in conservation literature, known as taxonomic bias. The methods used to answer research questions are also affected by internal biases (Beck et al., 2021). By conservation requiring true partnership, Beck et al. means that conservation needs to be both more interdisciplinary and partner more with local communities (2021). The coproduction of knowledge with local partners can create more lasting impacts than the traditional way of doing conservation, often called “parachute science,” where a researcher has no in-country partners and can often leave behind damage (Beck et al., 2021). Conservation science must contend with its own history. Much of the history of conservation, as discussed for Kenya in Chapter 2, is one of colonization, violence, and land alienation. Conservationists must consider how this effects their current science and reception by local communities (Beck et al., 2021). Finally, conservation science demands progress, and conservationists must look to the future and consider how their messages and recommendations will be received by policymakers, and the effects it could have on management (Beck et al., 2021).

By looking inward, outward, backward, and forward, conservationists will be better able to reflect on the biases inherent in their research, how they as researchers shape the process of conservation, and how they can design more effective conservation solutions and serve the communities they work in (Beck et al., 2021; Montana, Ryan, and Wyborn, 2020). There are many tools for increasing reflexivity, some of which have been used in this research. Citizen science, interdisciplinary studies, and allowing the discomfort of asking difficult questions are all ways conservationists can increase their reflexivity (Montana, Ryan, and Wyborn, 2020). Reflexivity results in better qualitative data (Kleinsasser, 2000). As conservationists engage with more social science research and qualitative date, reflexivity will become mandatory.

In addition to the fact that it will help conservation be more effective, there is one final reason for the engagement of social science by conservationists. That reason is hope. The conservation philosophy that developed in the 1960s assumed a disconnect between humans and nature and sought to protect “nature despite people.” Such thinking still shapes conservationism even today (Sanborn and Jung, 2021).

Conservationists often think of themselves as at war with people, and too often they view local communities as the enemies of biodiversity (Walpole and Wilder, 2008). This mindset goes back to the anthropocentric versus biocentric views of conservation—should we conserve conservation for humans or for itself (Sanborn and Jung, 2021)? This research asks: why does it have to be one or the other? The Maasai believe they are part of nature and meant to care for it (Western et al., 2019). Many indigenous societies have a strong conservation ethic. Local communities are not inherently against conservation; it is poverty and livelihood struggle that make them appear to be. It is time to stop thinking of people as separate from nature and see the system as one working whole. Decades of conservation in spite of people has not worked; it is time for a new way. Recent publications on the decolonization of conservation, such as that by Annette Lanjouw (2021) on how to decolonize primatology, have proposed an expansion of the audience for conservation, a greater recognition of the role of capitalism in ecosystem degradation and biodiversity loss, and co-ownership of conservation initiatives with local communities. However, Mabele, Sandroni, and Collins (2021) argue that even these steps will not necessarily lead to decolonization. They advocate for a reframing of conservation with non-Western perspectives and an interrogation of the philosophies that underpin conservation efforts; the philosophy that Western science and knowledge is a more legitimate way of knowing should be questioned. Local philosophies and approaches should be integrated into conservation.

In 2004 a new pulp mill opened in Chile on the Cruces River. Runoff from the mill caused the destruction of local wetlands and the devastating crash of the local population of black-necked swans (*Cygnus melancoryphus*) from over 6,000 birds to less than 300 (Dayer et al., 2020). The situation seemed dire, until a grassroots movement led by local Chileans, many of them extremely low income, began a campaign called *Acción por los Cisnes* (Action for the Swans). This movement led not only to the company that owned the mill being ordered to repair the damage to the wetland, but to the enactment of major reforms in Chile’s flawed environmental policies. The swan population has since recovered (Dayer et al., 2020). Local communities are not the enemies of conservation; they can be its greatest ally and asset. Below, I will discuss examples of conservation projects from Africa that have not only partnered with local people for conservation, but found innovative ways to solve issues of poverty, livelihoods, and human-wildlife conflict for the benefit of animals and communities. When social scientists, conservationists, and local communities work together, stunning conservation outcomes can be achieved. The following projects demonstrate the efficacy of conservation social science, not just as a theoretical framework, but as a practical means of achieving real conservation and social justice goals.

7.3.1 Examples of Effective Conservation Projects in Africa

Across Africa, with the Maasai and other communities, conservation social science has been applied to solve the problems of local people while achieving conservation outcomes. I will start with one of the most famous examples and expand to other successful but less well-known projects.

Elephants and Bees

The Elephants and Bees Project, already discussed in the literature review, is part of a wider program aimed at human-elephant coexistence run by Save the Elephants (Elephants and Bees, 2021). This award-winning project developed from many lines of research (Elephants and Bees, 2021). Early observations of trees, some of which were entirely destroyed by elephants and some of which were all but untouched, led to inquiries and the discovery of the avoidance by elephants of trees inhabited by bees (Vollrath and Douglas-Hamilton, 2002). This also uncovered a long history of Maasai stories and knowledge of the elephants' fear of bees (Vollrath and Douglas-Hamilton, 2002).

Experimentation with bee sounds confirmed that elephants will flee and avoid areas believed to be bee-inhabited (King, Douglas-Hamilton, and Vollrath, 2007). This early research into bee sounds and elephant avoidance was very much on the side of traditional natural sciences. Though some interest had been paid to Maasai legends, most of the research being done at this stage of the project was traditional conservation science. That changed quickly when the scientists realized the utility of bees as a way to keep elephants away from certain areas.

The first bee deterrent trials were quickly employed to solve a major crisis: human-elephant conflict in Kenya due to elephant raiding of food crops (King, 2009). As already noted in Chapter 2, farmers in Kenya lose crops to elephants frequently, resulting in increased rates of elephant shooting, spearing, and poisoning (King, 2009). This was the initial conservation problem: how to prevent farmers from killing elephants. There were several options for solving this conservation crisis, but the scientists in this case, Dr. Lucy King and the Save the Elephants team, used conservation social science as a framework. They used the scientific and indigenous knowledge of elephants' fear of bees to create a solution to the social problem of elephant crop-raiding and threats to livelihoods.

The Save the Elephants team began full-scale beehive fence trials in Turkana communities in Kenya (King, Douglas-Hamilton, and Vollrath, 2011). In an initial two-year trial, out of 45 attempted farm raids, only once did an elephant actually break through the beehive fence (King, Douglas-Hamilton, and Vollrath, 2011). The collection of honey by the farmers was a bonus (King, Douglas-Hamilton, and Vollrath, 2011). A longer trial led to an astounding 80% effectiveness rate of the beehive fences, and farmers requested inclusion in the project (King et al., 2017). One of the major strengths of this project is the community support. Elephants and Bees does not just have buy-in or tolerance, they have excitement from community members who ask to be included in the project. Locals make money off the immediate benefits, both in reduced crop-raiding and in honey production (King et al., 2017). Beehive fences are now being trialed all over Africa and even in Asia (Elephants and Bees, 2021).

The Elephants and Bees Project has not stopped with the building of beehive fences; they are now using their relationship with communities in Kenya to begin other projects. They have Kenyan interns deploying camera traps to study animal movements in Tsavo East National Park and are working with local farmers on composting and soil fertility (Elephants and Bees, 2021). This project has improved community livelihoods, and in doing so, improved community perceptions of elephants (King and Raja, 2016). In Chapter 1, I discussed how attitudes toward animals are a major predictor of behavior toward them, so an attitudinal shift toward a more positive outlook on elephants represents a major win for conservation.

The success of the Elephants and Bees Project in improving the lives of local communities and in reducing the human-elephant conflict is largely due to its application of conservation social science. The conservation encounter between elephants and local farmers was evaluated as a holistic system with humans whose livelihoods and attitudes were important components in that system. By not only partnering with local communities, but by solving their livelihoods problems and improving their situation, the Elephants and Bees Project has been able to achieve their conservation goals and create a project that is sustainable.

The strengthening of traditional livelihoods, instead of attempting to change them, is what the Maasai desire. Finding ways to reduce conflict with wildebeest in similar ways (e.g., with vaccines) could result in positive outcomes and a return to favorable attitudes about wildebeest.

Living Walls

The Living Walls Project is run by African People and Wildlife (Living Walls - Saving Big Cats While Uplifting Livelihoods, 2021). This project was started in northern Tanzania in response to carnivore depredation of livestock within Maasai *bomas* (Living Walls - Saving Big Cats While Uplifting Livelihoods, 2021).

Retaliatory killing of lions following livestock attacks is a major cause of their decline across East Africa (Lichtenfield, Trout, and Kisimir, 2015). Following the framework of conservation social science, the best way to reduce those killings would be to reduce the instance of livestock killing and improve local perceptions of lions. Living Walls are living *Commiphora* trees secured to chain-link and planted in circles around *bomas* to create dense fortifications to keep predators away from livestock (Living Walls - Saving Big Cats While Uplifting Livelihoods, 2021). When properly maintained, these Living Walls have been 99.9% successful in excluding carnivores (Lichtenfield, Trout, and Kisimir, 2015). Across the projects initial run, the fortified *bomas* had no lion, leopard, or hyena deaths due to retaliatory killings (Lichtenfield, Trout, and Kisimir, 2015).

The Living Walls Project employs Warriors for Wildlife, who are local Maasai that build and maintain the Living Walls to continue the project. This furthers the ownership of the project by the community (Living Walls - Saving Big Cats While Uplifting Livelihoods, 2021). This project has also been shown to increase positive feelings toward carnivores and optimism about coexisting with them among those protected by the Living Walls (Living Walls - Saving Big Cats While Uplifting Livelihoods, 2021).

Like Elephants and Bees, this is another project that solved a human livelihood problem in order to reach conservation goals. The near complete absence of lion, leopard, and hyena killings in communities with Living Walls is an incredible testament to the efficacy of this conservation social science project (Lichtenfield, Trout, and Kisimir, 2015). This project is also distinctive for its culturally appropriate solution. *Bomas* are traditionally fortified by stick fences. Living Walls has not interfered with how livestock is housed or kept; it has only slightly altered the way *bomas* are protected in order to create an easily adoptable and culturally relevant solution (Lichtenfield, Trout, and Kisimir, 2015).

Lion Guardians

The Lion Guardians motto is "Lion Guardians, Conserving Lions, Preserving Cultures" (Lion Guardians, 2021). This motto is an accurate encapsulation of the project, which employs Maasai and other pastoralists as "lion protectors." These local people would naturally come into conflict with lions, but as lion protectors, they track and monitor lion populations and help their own communities coexist with lions (Lion Guardians, 2021). The guardians themselves are Maasai who conduct scientific research by tracking lions, using radio telemetry, and conducting transects and recording tracks to understand lion movements and trends, thereby helping their communities avoid conflict with lions. They also reinforce *bomas*, recover lost livestock, find lost herders (many of whom are children), and stop lion hunts (Lion Guardians, 2021). Along with a naming program, the ownership of the lions is returned to the Maasai guardians and the communities. This project involves the Maasai as scientists, researchers, and educators, which is exactly what my survey indicates they desire.

The Lion Guardians Project, rather than eliminating lion-related prestige amongst the Maasai, instead found a way for the *ilmurran* to gain prestige through the tracking and protecting of lions, rather than killing them (Lion Guardians, 2021). Employment and education are already valued among the Maasai, so those employed in working with and "owning" lions are well regarded.

Maasai culture and its deep knowledge of lion ecology and behavior (due to a long history of tracking and hunting) was seen as a benefit and used as a tool toward conservation goals, rather than as an obstacle to be changed. This has helped prevent 50 lion hunts and saved $2 million USD in lost livestock each year for the Amboseli

Maasai community (Lion Guardians, 2021). The Lion Guardians Project also improves attitudes toward lions, thereby reducing retaliatory killings (Hazzah et al., 2017). This project works within Maasai culture to create real, sustainable change. This project furthers the decolonization of conservation, returning the viewed ownership of wildlife back to local communities. It also helps strengthen the culture of the *ilmurran*, one of the main goals of the Maasai.

Maasai Olympics

The stopping of the *olamayio* has been a focus of several conservation projects as lion populations have dropped in Kenya. The Maasai Olympics is one such project conceived of by the Maasai themselves (Maasai Olympics, 2021). This project grew from the respect the Maasai have for lions and their desire to see the population persist. The Maasai of Amboseli conceived of a system to help warriors gain prestige and to demonstrate their skills in another way: through a biannual sporting competition called the Maasai Olympics (Maasai Olympics, 2021).

The local Maasai of Amboseli approached the Big Life Foundation to start this project and to acquire funding (Maasai Olympics, 2021). With the help of the Big Life Foundation, the Maasai Olympics are able to offer monetary rewards for competitors and pair the event with a conservation education initiative in the community to spread the word about the dwindling lion population and their importance to Maasai culture and identity (Maasai Olympics, 2021).

The events chosen for the Maasai Olympics are culturally appropriate and demonstrate the skills traditional warriors need (Maasai Olympics, 2021). Events include running, jumping, and javelin throwing. Women are a culturally critical part of the warrior hunts and demonstrations of skills, so they are also included (Hodgson, 1999). Women compete in two events of their own to encourage their attendance and participation in conservation initiatives (Maasai Olympics, 2021).

This project has benefits for both the Maasai and the lions. Maasai warriors gain the prestige they seek, as well as monetary benefits (Maasai Olympics, 2021). 84% of surveyed warriors who participated in the 2016 Olympics said it was a good or very good alternative to lion hunting. The entire community has a chance to celebrate and reinforce their culture (Maasai Olympics, 2021). Following the Maasai Olympics in 2018, there was a 17% increase from 2017 in warriors saying they had never taken place in a lion hunt—a major win for the lion population of Amboseli (Maasai Olympics, 2021). 73% of warriors asserted they wanted the Maasai Olympics to continue following the 2018 games (Maasai Olympics, 2021).

The success of this project is based largely in its affirmation of Maasai culture. Big Life Foundation listened to exactly what the Maasai wanted and worked within Maasai culture to build a conservation initiative that was locally conceived of, locally driven, and locally relevant. Rather than trying to take something away—the prestige that comes with lion hunts—they offered more opportunities for recognition and a celebration of all things Maasai. The Maasai Olympics do not change Maasai culture; they strengthen and celebrate it. In this way, the community is not supporting the conservation goals of outsiders, they are taking ownership of conservation. The protection of lions in Amboseli is now the responsibility of the Maasai, and they are the ones working toward that goal.

Snares to Wares

Snares to Wares is a unique partnership between Michigan State University and the community of Pakwach, Uganda, that borders Murchison Falls National Park (Snares to Ware Initiative, 2021). On their website, the Snares to Wares Initiative describes walking through the community of Pakwach and seeing kids playing with toys made from the same wires as the snares found in the National Park, leading to "an abrupt realization that the 'poaching problem' was actually a human livelihood issue" (Snares to Wares Initiative, 2021). Within the framework of conservation social science, most conservation issue can indeed be traced back to human livelihood issues.

The Snares to Wares Initiative aims to reduce poaching by removing wire snares placed within the National Park and turning them into artwork made by local artisans. These are sold, thereby creating an alternative source of income for the community (Snares to Wares Initiative, 2021). The initiative also offers other employment opportunities to discourage poaching. The proceeds sponsor Ugandan students who wish to study conservation and take an active role in protecting their own wildlife (Snares to Wares Initiative, 2021).

This project benefits the local community by providing jobs and income from the sale of the snare art, and it benefits the wildlife by removing dangerous wire snares that entrap and kill animals (Snares to Wares Initiative, 2021). The recognition of the livelihood issues behind the placement of snares and the poaching of wildlife is an example of the importance of conservation social science. This is exactly the sort of realization that is commonplace within this framework. The addition of using art as a medium in this project represents a further interdisciplinary foray that makes Snares to

Wares unique and successful. This project has moved far beyond the original community and now reaches hundreds of communities in Africa; the art has also traveled widely. I proudly display a snare art warthog in my home in Florida.

Within this conservation encounter, the recognition that chasing and even killing of wildebeest is only occurring due to extreme challenges to livelihoods is critical. Many survey respondents expressed a general neutrality or even liking for wildebeest if MCF were not an issue. Conservation social science encourages finding the root of the problem before applying conservation interventions. Instead of trying to stop persecution of wildebeest, we must help reduce MCF.

Livestock Guarding Dogs

The Livestock Guarding Dog Program is another project by the Cheetah Conservation Fund. This program aims to reduce human-wildlife conflict between farmers and cheetahs (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021). Livestock kills due to cheetahs are a major problem in Namibia and a major threat to the cheetah population. The Cheetah Conservation Fund raises Kangal and Anatolian Shepherd puppies, which are given to farmers for free or at a nominal fee. These dogs are raised with their livestock herds and protect them from cheetahs, which are deterred from preying on livestock by these large dogs (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021). Farmers involved in the project report an 80% to 100% reduction in livestock kills by cheetahs and other predators, and in turn they no longer need to kill cheetahs (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021).

Overall, farmers are very satisfied with the Livestock Guarding Dog Program, with the majority reporting no livestock lost in the year after their dog was put in place (Marker et al., 2020). Attitudes toward cheetahs have also improved, with farmers feeling more positive toward coexisting with predators since they are no longer shouldering the costs (Marker et al., 2020; Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021). This program has also proved to be sustainable, with effectiveness remaining high since 1994 (Marker et al., 2020). It has also spread to Botswana, South Africa, and Tanzania (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021).

The success of the Livestock Guarding Dog Program is due in part to the huge amount of support it receives. This program has been established in Namibia since 1994 and is a constant presence supporting the farmers and providing them with follow-up care for the dogs and constant monitoring (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021). Dogs are provided with food, vaccines, and veterinary care from the Cheetah Conservation Fund, and farmers are provided with ongoing education and training on how to integrate their dogs and introduce predator friendly farming techniques (Livestock Guarding Dog Program - Cheetah Conservation Fund Canada, 2021). This is no parachute conservation program. The Cheetah Conservation Fund is supportive as long as farmers are involved in the program, and if the program is not working for them, help is provided. This is perhaps key to this program's success, as providing a one-time livelihood solution might not be sustainable. Conservation initiatives need to be long-term collaborations between communities and scientists.

Grevy’s Zebra Warriors

The Grevy’s Zebra Warriors is a small-scale project that resembles the Lion Guardians Project. This project employs Samburu warriors as trackers who monitor, protect, and educate about Grevy’s Zebra in northern Kenya (Grevy’s Zebra Warriors - Grevy's Zebra Trust, 2021). Unlike the Lion Guardians, Samburu were not chosen because they are in particular conflict with zebras, but because they have extensive knowledge of them and are a group not usually involved in conservation decision-making (Grevy’s Zebra Warriors - Grevy's Zebra Trust, 2021).

The Grevy’s Zebra Warriors provide supplementary food and water to the zebras when necessary and track them across harsh terrain only accessible on foot or by camel. They have created networks in their community to educate others about the conservation of the zebras (Grevy’s Zebra Warriors - Grevy's Zebra Trust, 2021). The great effectiveness of this project has been in returning ownership of these endangered animals back to the Samburu, who live alongside them. The warriors feel the Grevy’s zebras belong to them, as they are the ones conserving them (Grevy’s Zebra Warriors - Grevy's Zebra Trust, 2021). And of course, the data on and protection of the species has been a major conservation benefit (Grevy’s Zebra Warriors - Grevy's Zebra Trust, 2021).

Within the conservation social science framework, achieving enthusiasm for conservation among the communities is key. In Africa this is particularly important for decolonizing conservation. The Grevy’s Zebra Warriors is a project that effectively returns ownership of an endangered animal back to the local people, rather than to the government, as in colonialism. The local community is in the best position to protect wildlife. This has more potential for long-term sustainability than a conservation program imposed from the outside. The long history of land alienation of the Maasai have created widespread feelings of animals belonging to the government. Projects such as this return ownership to the communities.

KopeLion

The KopeLion Project is another program aimed at decreasing human-wildlife conflict between humans and lions, this one specific to Ngorongoro Crater (KopeLion. Bringing back lions through coexistence in Ngorongoro, 2021). One of the respondents on the scientist survey conducted for this research was affiliated with the KopeLion project. This program bears many similarities to other projects discussed: local people are engaged to help track lions, herders are warned of lions in the area, injured livestock is treated, lost livestock is found, and *bomas* are reinforced against predator intrusion (KopeLion. Bringing back lions through coexistence in Ngorongoro., 2021).

KopeLion also includes a predator compensation fund, but with an interesting twist. Instead of compensating for livestock losses, this fund rewards communities as a whole with development funds when conservation goals are achieved (2020 Impact Report, 2021). As previously discussed, KopeLion has had a measurable impact on both lions and livelihoods. Since 2017 there has been a 12% increase in lion observation days. In 2020, 174 livestock enclosures were repaired in local communities, 879 animals were treated after predator attacks, and 4,266 lost livestock animals were recovered. This represents a major benefit to the communities’ livelihoods (2020 Impact Report, 2021).

The KopeLion project is newer than some of the other projects discussed, but it is using all the guidelines of conservation social science and shows promise for being sustainable in the long term. The local communities are deeply involved in the conservation goals and research and have an interest in their outcomes. Livelihoods challenges are being solved and ownership of animals is being returned to local communities.

These projects from all over Africa demonstrate the efficacy of conservation social science as a framework for improving conservation and social justice goals in a wide variety of settings and situations. Many of the methods they used such as returning ownership of animals to the community, strengthening livelihoods, working within the culture, and strengthening the *ilmurran*, could also be applied in the case of conflict with wildebeest. In the next chapter I will discuss how conservation social science may be applied to facilitate the goals of the Maasai and conservationists in the conservation encounter between wildebeest, Maasai pastoralists, and conservationists in the Maasai Mara.

7.4.0 Climate Change, the Serengeti, and the Maasai

No discussion of conservation—be it of nature, wildlife, or culture—can be done without discussing the effects of climate change, both current and future. The world is on the brink of climate disaster, and it will affect every ecosystem, economy, and culture in the coming years and decades (IPCC, 2021). The Serengeti-Mara ecosystem is one of ever-changing conditions and inherent disequilibrium, but the new rapidity of the changes it will experience will be challenging for the ecosystem, the wildlife, and the Maasai (Leal Filho et al., 2017).

Current climate models predict rainfall in the Serengeti, and East Africa as a whole, will become less predictable. Dry seasons will get drier, and wet seasons will get wetter (Haile et al., 2020). Water scarcity and agricultural failures are predicted throughout East Africa (Adano et al., 2012). Droughts are expected to increase in arid and semi-arid regions, but flooding events are also expected to increase (Haile et al., 2020; Leal Filho et al., 2017). Across the Serengeti, plant assemblages adapted to low rainfall may remain stable, but those adapted to higher rainfall may undergo compositional changes (Anderson, 2008). The effect on the baobab tree has already been discussed; nine of the thirteen oldest baobabs in Africa have already been lost, and it is likely that very little habitat will remain suitable for baobabs in the future (Sanchez, 2018; Sanchez et al., 2011).

The size of the wildebeest population is most sensitive to changes in annual precipitation, dry season precipitation, and precipitation in the south-east of the Serengeti-Mara ecosystem (Mahony, 2020). Droughts result in decreased survival of wildebeest calves and nursing cows, and severe droughts can greatly decrease the overall wildebeest population (Estes, 1976). A severe drought in the Amboseli region of Kenya in 2009 caused an 85% reduction in the wildebeest population, crashing from 15,000 in 2009 to only 3,000 in 2010 (Kilungu et al., 2017). Rainfall changes also affect the timing of the Great Migration; animals may spend more time in different areas and/or be delayed or accelerated based on rain (Kilungu et al., 2017). Practically, the wildebeest population, biodiversity, and the predictability of where and when the Great

Migration will be has dramatic effects on tourism. Attractiveness of an area to tourists is linked to biodiversity and specifically the size of the wildebeest population (Kilungu et al., 2017). Reductions in wildebeest numbers and predictability of the migration results in decreased tourism and tourism income (Kilungu et al., 2017). Tourism in Africa relies on biodiversity. As biodiversity is lost, tourism will suffer (Rotich et al., 2019), and so will local communities who rely on income from tourism.

More pertinent to this work, climate change is likely to have severe impacts on disease dynamics. Environmental changes alter host-pathogen-vector interactions and can therefore change the distribution, intensity, and dynamics of human and wildlife diseases (Gallana et al., 2013). Climate change has already been linked to changes in some diseases. Warmer temperatures have been correlated with increased ranges of bluetongue and hantavirus in Europe (Slenning, 2010). Infectious diseases among wildlife have been increasing in recent decades, and climate change almost certainly plays a role (Cohen et al., 2020).

With warming temperatures and rainfall changes, the geographic distribution of hosts, vectors, and pathogens may change and can be difficult to predict. For instance, an oyster parasite has already been seen moving northward in the Atlantic Ocean as warmer temperatures occur (Gallana et al., 2013). Increased temperatures have shortened the life cycle of a musk ox parasite in Canada from two years to one year, increasing infection rates in musk ox (Gallana et al., 2013). The physiological hosts, vectors, and pathogens may also change with climate change, as well as immune capabilities and immune responses. For example, snails in warmer water have been found to have a weakened immune response (Gallana et al., 2013).

Increasing temperatures are generally predicted to result in more severe and frequent disease epidemics (Price et al., 2019). This was tested empirically in the United Kingdom with the case of frogs and ranavirus epidemics by Price et al. (2019). In wild frog populations at higher temperatures, more severe and more frequent epidemics of ranavirus were found. In the laboratory, ranavirus propagation, disease incidence, and frog mortality were all higher at higher temperatures (Price et al., 2019).

Of particular interest for the Serengeti, higher temperatures can accelerate the development and reproductive rate of ticks, mosquitoes, and other ectothermic parasites that carry many of the wildlife and livestock diseases that impact the Maasai (Buttke et al., 2021). East Coast Fever, passed by ticks, is of particular concern among the Maasai (Gachohi et al., 2012; Hughes, 2010). Cattle are more susceptible to ECF in drought conditions and ECF is rated as the fifth most important livestock disease in the Maasai Mara area of Kenya (Kimaro et al., 2012; Nthiwa et al., 2019). Under climate conditions of increased drought and increased tick populations, ECF has the potential to be devastating.

Disease risk areas could also expand under climate change conditions (Buttke et al., 2021). If parasites and vectors are able to colonize new areas, they could bring disease to areas previously free from it. In Africa, an expansion of the tsetse belt and associated trypanosomiasis would be extremely destructive (Machila et al., 2003; Steverding, 2008). Water-borne diseases could also increase with increased rainfall events and floods (Slenning, 2010). Increased stressors, such as drought and hunger, could increase the susceptibility of wildlife and livestock to disease and cause increases in disease rates (Slenning, 2010). All of these factors mean livestock and wildlife diseases are likely to worsen in the coming years and decades.

The Maasai are already starting to see the effects of climate change. Though they may not always call it that, they are extremely cognizant of the changes in their environment and are already shouldering the costs, including increased water scarcity, increased daytime temperatures, and loss of pasture (Korir and Ngenoh, 2019). The Maasai perceive changes in climate as one of the greatest threats to their livelihoods (Leal Filho et al., 2017). Maasai surveyed in the towns of Magadi and Elang'ata Wuas in Kenya recognize changes in climate and have experienced social-economic stress due to droughts that have killed livestock (Rogei, 2015). Thus far, the increase in droughts is the most relevant change for the Maasai. In northern Tanzania, Maasai are being forced to migrate to urban centers and abandon their way of life after losing their herds to drought (Theodory, 2014). Farming is not being named as an attractive coping mechanism, as the same droughts killing livestock are also causing agricultural failures (Leal Filho et al., 2017). Climate models predict crop yields in Africa will decline by 10-20% by 2050, leading to potential food crises (Korir and Ngenoh, 2019).

The drought of 2009 had a major impact on Narok District, the district with the highest population of Maasai. It led to a loss of 500,000 domestic animals, food shortages, and a rise in human-wildlife conflict as humans, wildlife, and domestic animals competed for scarce water and forage resources (Korir and Ngenoh, 2019). Droughts have a much greater impact now than in the past, due partly to their increased frequency and partly due to policies (Korir and Ngenoh, 2019; Rogei, 2015). Policies such as breaking down Maasai land into smaller units and encouraging sedentism makes traditional Maasai adaptation strategies (e.g., migrating during drought to new areas) impossible. The Maasai are no strangers to an environment in flux, but modern policies have eroded their resilience to change (Rogei, 2015). The Maasai recognize this and see themselves as victims of a lack of land and natural resource management (Rogei, 2015).

The Maasai have their own methods of forecasting and adapting to change (Bobadoye et al., 2016). They have traditionally predicted climatic events by observing the clouds and winds and watching the behavior of animals (Bobadoye et al., 2016). As the Serengeti underwent changes, the Maasai adapted by migrating for pasture and water, destocking their herds, buying hay, and diversifying their livelihoods (Bobadoye et al., 2016). However, the traditional forecasting methods are no longer reliable as droughts and floods become more frequent, more severe, and less predictable (Bobadoye et al., 2016; Korir and Ngenoh, 2019). Traditional coping strategies are no longer tenable due to major demographic, economic, and environmental changes (Leal Filho et al., 2017). The magnitude of current climate change is much greater than the Maasai have ever encountered and their traditional strategies are no longer working (Bobadoye et al., 2016). This situation is accelerating Maasai cultural changes and forcing livelihood changes (Osano, 2011).

The Maasai have identified water shortages as their greatest climate challenge (Bobadoye et al., 2016). They have also indicated that better education and infrastructure could help with these changes, and they insist that the ability to perform traditional herd migration is critical for their adaptation (Bobadoye et al., 2016).

Sara de Wit (2020) explored the various ways climate change was being presented to the Maasai and how they were engaging with discourse surrounding climate change in the village of Terrat in northern Tanzania. Her work clarifies how the Maasai, who inherently understand changes in climate and their environment but are not necessarily engaged with global scientific climate discourse, relate to larger climate issues and discussions. There is a general lack of education and information in most of Maasailand about global climate change. So, while the Maasai are acutely aware of climate issues and problems on their local level, most are unaware of the more global scale of the problem (de Wit, 2020). Global climate change is being presented to the Maasai, through radio and video media, as a validation of the trends they are already seeing. The issue is then globalized and blamed on industry in large countries. The "scientific" discourse stresses that this is a man-made problem and praying to God will not help, rather, humans must fix the issue themselves (de Wit, 2020). Some of this media then goes on to describe how the Maasai are partly responsible (cutting down trees) and how they can help (planting trees) (de Wit, 2020). Laying any blame on those already shouldering the costs—whose contribution to global climate change is nearly nothing—is a disheartening strategy for buy-in.

De Wit found that older Maasai did not necessarily recognize current climate changes (2020). For them, the Serengeti is, after all, always changing. Variability is the norm and many older Maasai saw the current fluctuations as representative and did not recognize any normal state to deviate from. Some acknowledged climate issues but did not believe it was the climate that had changed, but rather the Maasai who had changed. Since the Maasai no longer migrate, some believed this was the reason the droughts seemed worse (de Wit, 2020).

Environmental decline was also linked closely with cultural decline by Maasai communities, especially among women who are holders of morality and religion in Maasai culture (de Wit, 2020). Women believed the disappearance of love and respect from culture was linked to the lack of rainfall and believed God may decrease rainfall due to moral declines. It is impossible to disentangle weather and God for the Maasai. In Maa, the word *Eng'ai* means God, rain, and the sky (or heaven). For the Maasai, the weather is an expression of God. Less rain is also blamed on cultural and religious changes, such as the lack of ritual prayers and sacrifices of goats and sheep, which are now prohibited by the church (de Wit, 2020).

When the Maasai are presented with climate science free of God, they are both confused and mistrustful. They do not understand how climate can be understood in an absence of God, and they see climate scientists without God as speaking falsely (de Wit, 2020). They do not trust climate science when it is presented in this way. They can, however, accept human actions as the cause of climate change. De Wit calls for a locally meaningful climate discourse, without being antiscientific. If climate change is to be made meaningful to the Maasai, it must be presented in a way that is culturally relevant and gets at the source of how this discourse is applicable to them (de Wit, 2020).

Whether the Maasai engage with the discourses around the global climate crisis or not, their lives will be affected as the climate changes. The wildebeest and the entire Serengeti-Maasai Mara ecosystem will undergo drastic changes that neither the Maasai nor conservationists may be prepared for. These impending changes make it all the more critical for Maasai and conservationists to work together.

Chapter 8: Conclusion

8.1.0 Key Findings

The three threads of this research each have noteworthy findings on their own, and together form an intriguing picture of the overall conservation encounter between wildebeest, Maasai, and conservation scientists. The overall aim of this research project was to illuminate the complexities of this conservation encounter within the framework of conservation social science, with the goal of revealing paths toward better conservation initiatives for wildebeest and the Serengeti-Maasai Mara ecosystem, and to encourage better cooperation between Maasai and conservationists.

The key findings of the conservationist survey are mostly relevant in relation to the Maasai survey. Conservationists broadly feel they benefit local people with their presence. Local people largely agree. However, local people also feel conservationists bring problems, the most concerning of which is interference with livelihood practices (cattle keeping in the case of the Maasai). I did not ask conservationists if they felt they were negatively impacting local people, as I felt that would be crossing the line of politeness and would cause survey rejection (answers could be illuminating though, and this is a potential area worthy of future investigation). Past exclusionary and harmful practices within conservation have led to backlash against it, and reflecting on whether a conservation initiative had any potentially harmful aspects would be essential to its use within a conservation social science framework (Bennet and Roth, 2019).

Another key finding of the conservationist and Maasai surveys concerns the level of involvement of local people. Conservationists want local involvement but tend to believe that hiring local drivers and guides was sufficient to incorporate local knowledge and engage with the local community. Though the Maasai confirmed jobs as drivers and guides were available, survey results demonstrated that they wanted more involvement. There was strong verification that Maasai desire more participation in conservation. They want to be part of the research team—as scientists, researchers, collaborators, and educators. Merely being hired as drivers and guides is not enough; deeper and more meaningful involvement and collaboration is wanted and needed. This is perhaps the most important finding to come out of these two surveys. Every one of the 16 conservationists surveyed strongly supported local involvement in conservation. This survey of Maasai people indicates that this local population, and probably many others, desires a greater connection with conservation efforts. Local collaboration and involvement are essential to successful conservation initiatives (Muhumuza, Sanders, and Balkwill, 2013; Mascia et al., 2003; Margules et al., 2020; Sanborn and Jung, 2021; Catalano et al., 2019; Dayer et al., 2020; Niemiec et al., 2021; Bennet et al., 2017; Blicharska et al., 2016). The results of this study indicate that a major goal of conservationists should be to involve locals more broadly in their projects to better their conservation outcomes.

The Maasai survey also led to illuminating findings about attitudes and reported actions toward wildebeest. Maasai reported avoidance of wildebeest, both near their homes and when grazing their cattle. A major reason given for this was the presence of malignant catarrhal fever. Increased tolerance was indicated if malignant catarrhal fever were no longer an issue. Disturbance of wildebeest was reported to include chasing and killing. Problems caused by wildebeest were widely reported, with 85 of 114 respondents (74.6%) reporting disease as a problem and only 12 respondents (10.5%)

reporting no issues caused by wildebeest. The problems caused by wildebeest and the effects of malignant catarrhal fever (e.g., lost money and alterations in grazing of cattle) reported by surveyed Maasai were drastic. The associated attitudes and reported behaviors toward wildebeest were largely negative.

The indicated desire for a vaccine for MCF in this survey was extremely high. Of 114 respondents, 104 (91.2%) want a vaccine and a further 6 (5.3%) would want it if it were free, indicating a vaccine would be accepted by a total of 96.5% of this surveyed population. Decker et al. (2021) also found wide desire for and acceptance of an MCF vaccine among Maasai, even when the vaccine was relatively expensive. Vaccines have been tested, and if funding were available to develop these vaccines and make them commercially available, they could have a drastic impact on this population. As climate change worsens in the Serengeti, Maasai livelihoods, already deteriorated from a long history of colonialism and land alienation, are only going to get worse. This population could suffer worsening poverty and struggles, leading to further abandonment of their traditional livelihoods and culture. The Maasai desire to remain true to their pastoral history and culture (Ahmed et al., 2015). Conservation and anthropology should be helping them to do so. A vaccine for MCF could help relieve pressure on their livelihoods and make more of their limited grazing land available to them. Relaxing the need to move cattle would help maintain herds at better levels and body conditions. This research indicates that a commercially available MCF vaccine would be extremely beneficial and have good uptake. It should be a major goal of conservation and humanitarian efforts in Kenya.

Surveyed Maasai reported extensive disturbance of wildebeest around their homes, including chasing, yelling, throwing things at them, and even killing. The comparisons of wildebeest behavior between the Maasai populated Enonkishu Conservancy and the Serengeti National Park (where Maasai are not allowed, and encroachment is minimal) indicate this may be causing some behavioral changes in wildebeest. The hypotheses investigated were related to whether wildebeest would demonstrate more alertness when Maasai were present; that they would spend significantly more time standing and significantly less time resting in Enonkishu Conservancy than in Serengeti National Park. The null hypothesis of no behavioral differences was rejected. The hypothesis that wildebeest would spend more time standing in Enonkishu was also rejected, but support was found that wildebeest spent significantly less time resting in Enonkishu than Serengeti.

Wildebeest had lower rates of standing, resting, eating and interacting in Enonkishu than Serengeti and had higher rates of moving, all statistically significant. The number of reports of interacting are too low to make any definitive statements, so it must be discarded. Eating is also difficult to assess, due to the large number of confounding variables. The trends in standing, resting, and moving are of most interest here. The pattern of increased moving and decreased standing and resting in Enonkishu as compared to Serengeti could indicate responses of the wildebeest to Maasai presence and persecution. This would be logical because wildebeest that are chased or harassed would move more and spend less time standing and resting. This is an intriguing possibility but needs further investigation; the large number of confounding variables (discussed at length earlier) makes the actual reason for the behavioral differences unclear. However, what is certain is that wildebeest at the two sites are behaving differently. The null hypothesis is firmly rejected, and more research into the behavioral differences of wildebeest in different areas would lead to a better understanding of their phenotypic plasticity and potential resilience to climate change.

The overall picture of the conservation encounter formed by this research is complex. Conservationists, Maasai, and wildebeest are all interacting within the Serengeti-Maasai Mara ecosystem. Each has their own motivations and goals. For successful conservation of the ecosystem, survival of wildebeest, and preservation and reinforcement of Maasai culture and livelihoods, all must work together. The framework of conservation social science can help bring these seemingly disparate goals together. The examples of successful conservation social science projects given in the previous chapter, along with the findings of this research, provide a roadmap for how this may be done. Conservationists and Maasai working together on a more meaningful level can find novel ways to mitigate the effects of malignant catarrhal fever, just as they have found ways to mitigate the effects of elephant crop raiding and lion depredation. This will protect wildebeest—the drivers of the ecosystem—while protecting Maasai livelihoods. As the examples in Chapter 7 demonstrate, returning a sense of ownership back to local people can have a substantial impact on attitudes and associated behaviors toward animals. This is something that should be done with wildebeest. My survey indicates that absent the effects of MCF, many Maasai would already be largely tolerant of wildebeest and would appreciate their importance. By returning ownership back to them, by involving them as scientists and researchers of the wildebeest population, we could strengthen these positive attitudes and increase tolerance of wildebeest.

The conservation social science framework has proven beneficial in studying this conservation encounter. It informed the design of the research by promoting the presence of all three components of the project. By bringing in each aspect, the conservation encounter has been more fully illuminated in its complexities. By using reflexivity at each stage of the research the connections between each component were investigated. The major benefit of conservation social science as a framework is that it does not end at formulating questions, methods, or writing publications. It should continue to be applied to this encounter to devise better conservation outcomes and modes of cooperation. It has been beneficial in this research and should continue to be so as conservation initiatives are formed in the real world.

8.2.0 Contributions

Aside from the results of the research discussed above, this study also made interesting contributions in terms of methodologies and frameworks. The use of conservation social science as a theoretical framework was relatively novel. Though it has been widely discussed as a way toward better conservation outcomes (see Bennet et al., 2016; Bennet et al., 2017; Bennet and Roth, 2019), its use as a theoretical framework to inform research from start to finish demonstrated its efficacy even further. By using conservation social science as the theoretical framework for this research it was able to be applied throughout the inquiry process, informing questions asked, methodology used, analysis, and conclusions drawn. This proved useful in framing the conservation encounter in human terms and could be beneficial for future research of this kind.

The use of online anthropology in this research was also done in a novel way. The COVID-19 pandemic forced adaptations to be made that resulted in possibly the first online study of the Maasai using digital ethnographic methods. Remote populations such as the Maasai are not traditionally reached in this way as it is generally considered impractical. The success of this project in not only reaching the Maasai but engaging with them in a way that led to unique conclusions, is one of its major strengths. The ability of the internet to change the dynamics between researcher and participant meant this survey garnered answers that an in-person survey likely would not have, increasing the depth of knowledge about Maasai attitudes and reported behaviors. Online anthropology has been a fascinating way to investigate a real-world conservation issue, yielding many benefits. Though it has drawbacks and may not be a substitute for in-person work in all situations, it should be considered and possibly used more often when researching conservation issues.

The extensive use of the Zooniverse data, generated through citizen science, was essential in this research. Without it, the wildebeest behavioral comparisons could not have been made. Citizen science is a vital resource that is only beginning to be fully utilized. The need for at-home research presented the perfect time to utilize such data. As climate change continues and scientists need to analyze data over longer time periods, citizen science will become even more crucial (Dickinson et al., 2012). The reliability of citizen science has been shown to be high (Kosmala et al., 2016) and the public education and outreach that comes with involving citizens in the scientific process is more important than ever before as the internet (specifically social media) spreads misinformation and distrust of science (Silvertown, 2009; Bonney et al., 2009). By increasing our use of citizen science, we help not only ourselves, but the entire discipline.

8.3.0 Recommendations for Further Research

Each of the three components of this research suggest further investigation. The conservationists' surveys were small in scale but illuminating in results. The context they gave to the Maasai surveys and to the examples of successful conservation projects discussed in Chapter 7 was critical. The encouragement of reflexivity in scientists and the scientific process is a major tenet of using conservation social science as a framework, so by conducting these surveys I was also encouraging uptake of the framework I was using. However, these surveys were also challenging. The rejection by many scientists led to low collection numbers. This is a major area that warrants further study. A larger scale survey of conservationists could be critical in understanding conservation successes and failures and could also act as a way to encourage reflexivity. This survey was only open to those working in Africa but providing surveys to scientists working globally should be done as well. Insights from other ecosystems and community contexts could offer insights into how conservation is working in other situations. Following up email surveys with in-person or video calls of a less structured nature would also be useful, leading to more natural conversations and better reflexivity.

The Maasai survey was the largest component of this research and was more successful than I anticipated. However, a return of 114 is still a relatively small number.

Further online surveys of the Maasai should be attempted. In-country networking, snowballing, and more advertisements could increase response rate. Now that the Maasai have been shown to have an internet presence, more traditional digital ethnography could also be attempted. Creating a presence in online Maasai spaces, while challenging, is possible for researchers and could lead to fascinating research and engagement. Pairing surveys and digital ethnography with in-person anthropology could be highly beneficial. Getting to know people online before entering the field might be a way to change the power dynamics in the field and put researcher and participant on a more equal footing.

The trends I noticed in how the Maasai engaged with me online were also noteworthy and worth investigating. As larger numbers of Maasai in Kenya and Tanzania access the internet, we will see the Maasai start to form their own ways of engagement and use. Researching the ways in which the Maasai use the internet would be an exciting area of research, and one that could help us understand how we might communicate more effectively with them on important issues like climate change.

The wildebeest behavioral data indicated enticing possibilities about changes in wildebeest behavior with Maasai presence. This research determined that wildebeest are acting differently in locations with and without Maasai. Now we must determine whether that is due to Maasai presence or another confounding variable. Two sites need to be chosen that are as close together and alike as possible, one with Maasai presence and one without. Activity budgets should be created in these two sites and wildebeest behavior observed over a long period of time to determine if behavior changes are being caused by Maasai presence. If they are, it could have effects for their conservation and management.

More research into this specific conservation encounter is also needed. There are many questions we must answer before interventions can be made to help improve Maasai livelihoods and mitigate the effects of malignant catarrhal fever. More information is needed about the grazing areas available to the Maasai herders when wildebeest are in the area. In the absence of a vaccine, the best way to help the Maasai is to make sure they can move their cattle to proper areas without risking other diseases or incurring high energetic costs. This should be assessed by conservationists on the ground.

The final bit of research that needs to be done, and one I have already mentioned multiple times, is into a vaccine for malignant catarrhal fever. A vaccine could be a game changer for the Maasai of Kenya. It could free them of energetic and monetary costs of a disease that has plagued them throughout colonialism. It could strengthen their traditional livelihoods and culture.

8.4.0 Post Research Engagement

One of the benefits of online research is the ability to easily stay in touch with research participants after the data collection ends. Previous contact with participants through social media makes it easier to find them and contact them again. Since data collection ended, I have remained online friends with many participants, who sometimes comment on my posts and message me. This is the ideal environment and opportunity for feeding research results back to participants.

The ethical implications of whether or not to ensure research participants are given access to research results have been debated in many fields, with some fields, such as the health sciences field, only ensuring publication in scientific papers (Fernandez, Kodish, and Weijer, 2003). However, it has also been argued that in research with human subjects capable of giving free and informed consent, respect extends to informing them of the results of their participation (Fernandez, Kodish, and Weijer, 2003). Using the framework of conservation social science and deep engagement with people to improve conservation, I agree with that argument and one of the goals of this research from the outset was to ensure participants were given access to results.

The creation of the Facebook page directed toward my research project will be the primary means of disseminating results. This page is easily accessible and followed by over 500 people, including almost all of the research participants and many other Maasai who became interested after data collection was over. I intend to share any publications on this page that result from the research, as well as this document. However, to make the results more accessible, I will also be writing a series of shorter blog-like posts summarizing the results in accessible language. I will make all scientific publications available to participants in case they can be used for their benefit in policymaking in matters of human-wildlife conflict.

This last point does bring up an issue discussed by Cooper (2007; p.11) as an argument against results sharing as an ethical imperative. He believes anthropologists can sometimes be seen as a resource by local people and be a way for them to further their agendas (Cooper, 2007; p.11). There is a possibility this research could be used by the Maasai to gain support for policies that help them avoid malignant catarrhal fever. However, this was a work of applied anthropology and one of the goals of conducting this research was to find ways to reduce the conflict between Maasai and wildebeest. Its use to do just that is not a problem, but a benefit.

A much more concerning issue raised by Cooper (2007; p. 11-12) is the possibility of participants viewing the use of their indigenous knowledge for research as furthering colonial power inequalities. This research has attempted to give as much voice as possible to the participants, but analysis was still done on their words without their further involvement or oversight of the analysis. Cooper points out that representing the lives of participants to the wider world in published works could be perceived as exploitation and open researchers up to critique (2007; p.12). My concern here is perceived misuse by participants, not critique. However, I do not believe this possibility is an argument against sharing my results, as Cooper implies it might be, rather, I believe the only solution is to share the results. If the participants feel they have been misrepresented, that is critical to know for further research and other researchers. We can only do better in the future by inviting such critique. An even deeper engagement with participants would be to solicit their views on the analysis as it is done, thereby making them part of the research process before publication. This was not done here due to the anonymous nature of the survey. Some of the questions about actions toward wildebeest may have included sensitive answers, so anonymity of participants was crucial.

The use of social media to disseminate results is a powerful tool that should be considered in the future, whether or not digital ethnographic methods were used. I hope to garner both critique and conversation on the results of this research from the people who made it possible, furthering the dialogue and moving toward a more constructive anthropology.

8.5.0 Final Thoughts

I cannot say, as most anthropologists can, that my research took me on an adventure to new places. I did not get to take that bumpy ride in a 4x4 across the Maasai Mara. I did not sleep in a tent and write my fieldnotes by flashlight. I did not hike out each day to dusty Maasai villages and nervously ask to speak to people. I did not get to see wildebeest grazing at sunrise or hear the whoops of hyenas at night. My research took place at a desk, in the thickets of the internet. Squinting at messages from Maasai people in the bright Delaware sun on my breaks from work, sitting on my couch until late at night responding to messages on my laptop, I was far removed from the place the conservation encounter occurred. But what is place? Is it the physical location of an event? Or is it, as Benjamin Schneider (1987) argues, people? If the conservation encounter is the people, and other-than-human actors involved in it, perhaps I did go somewhere. Through the messages and thoughts of Maasai locals I imagined the difficulties of their livelihoods; through the descriptions of their fieldwork, I felt the hope of conservationists for their work, and through snapshots of their behavior I understood the adaptions of wildebeest. I certainly feel I have gone on a journey; if not physical, then mental. The distance I have traveled to understand the conservation encounter is great, but there are miles to go.

This research has uncovered an extraordinary passion amongst the Maasai for conservation work. Despite the issues it has brought them, despite their long and fraught history with colonialism, and despite their frustrations with wild animals, they want to conserve their environment. Maasai culture is strong, and its people want it to endure. They desire greater partnership and cooperation with conservationists, as researchers, educators, and scientists. And the scientists agree. Every conservationist surveyed wanted local involvement and agreed it was the best way forward for conservation. The fact that cooperation is not always done, that both conservationists and local communities get frustrated with one another, is not due to irreconcilable differences in opinions, but only misunderstandings. This research has revealed that all the players involved have the very same goals: preservation of nature, culture, and animals. Local communities like the Maasai are our most important allies for conservation. The examples in Chapter 7 prove that when everyone works together, conservation encounters are not only successful, they are groundbreaking.

Appendix 1: Full Survey of Maasai People in Kenya

Feelings on Gnu/Wildebeest and Conservation

Description

I (Robin Fiore) am a PhD research student with the University of Exeter. I am doing research on human-wildlife conflict around the Maasai Mara. I would like you to take this survey because you are a Maasai person living in or near the Maasai Mara. I think you have valuable opinions on gnu/wildebeest and conservation work. You will not be paid for taking this survey. But I will be donating 200 KSH on your behalf to a Maasai organization of your choosing and I hope this work will help conservation work benefit you more. You are free to choose to not take this survey or to stop taking it at any time. If you do fill it out and submit it, you agree to your answers being used in academic and popular articles, a dissertation, and a book. It may also be looked at by other people at the University of Exeter. Once you submit this survey, you cannot withdraw. This study has been reviewed by the Research Ethics Committee at the University of Exeter (Reference Number 202021-027). Your data will be stored securely through Qualtrics. The University of Exeter processes personal data for the purposes of carrying out research in the public interest. The University will endeavor to be transparent about its processing of your personal data and this information sheet should provide a clear explanation of this. If you do have any queries about the University's processing of your personal data that cannot be resolved by the research team, further information may be obtained from the University's Data Protection Officer by emailing dataprotection@exeter.ac.uk or at www.exeter.ac.uk/dataprotection. For further information contact Robin Fiore at rf408@exeter.ac.uk. For complaints please contact: College of Social Sciences and International Studies Research Ethics Committee: ssis-ethics@exeter.ac.uk Thank you for your interest in this project!

You must be a Maasai person living in Kenya and at least 18 years old to take this survey.

Q1 Have you read the above information and agree to take this survey?

o Yes

o No

Section 1 Questions About Gnu/Wildebeest

Q2 If a gnu/wildebeest is near your village, will you attempt to get it to leave?

- o Yes
- o No
- o It depends on the time of year

Q3 How would you get it to leave? (optional)

____

Q4 If you were grazing your cattle and saw a herd of gnu/wildebeest, would you avoid them?

- o Yes
- o No
- o It depends on the time of year

Q5 Which of the following problems do gnu/wildebeest cause you (check all that apply).

- ▢ They take grass from my cattle
- ▢ They take water from my cattle
- ▢ They spread disease to my cattle
- ▢ They destroy my property
- ▢ They eat plants I am growing
- ▢ Gnu/wildebeest do not cause me any problems
- ▢ Other (please specify)

____

Q6 Have you ever heard of malignant catarrhal fever, also called gnu/wildebeest disease or gnu/wildebeest sickness?

- o Yes
- o No
- o I've heard of it but don't know what it is

Q7 Which of the following are ways that malignant catarrhal fever affects you (check all that apply)?

- ▢ I must graze my cattle away from gnu/wildebeest
- ▢ Some of my cattle die of malignant catarrhal fever
- ▢ I worry about my cattle getting malignant catarrhal fever
- ▢ I lose money selling cattle because there is malignant catarrhal fever here
- ▢ Malignant catarrhal fever does not affect me
- ▢ Other (please specify)

____

Q8 If there was a vaccine for malignant catarrhal fever, would you want it for your cattle?

- o Yes
- o No
- o Only if it did not cost me money

Q9 If gnu/wildebeest did not give malignant catarrhal fever to cattle, would you want them near your village?

- o Yes
- o No

Q10 Please explain you answer above (optional).

____

Section 2 Questions About Conservation

Q11 How often do foreigners come to your area to study animal conservation?

- o Never
- o A few times a year

o Once a month

o There are always foreigners here

o I'm not sure

Q12 Which of the following do people studying animal conservation bring to your area (check all that apply).

▢ Education about animals

▢ Resources for our schools

▢ Medical care

▢ Veterinary care

▢ Opportunities for jobs

▢ Other (please specify)

____

Q13 Are you involved in animal conservation work in any of the following ways? (check all that apply)

▢ I am hired to be a driver or a guide

▢ I am hired to be a translator

▢ I am asked about animals

▢ I am trained to conduct animal research

▢ I am part of the research team

▢ Other (please specify)

____

Q14 Would you like to be more involved in animal conservation work?

o Yes

o No

o I'm not sure

Q15 In what ways? (optional)

____

Q16 Do you feel animal conservation work in your area benefits you?

o Yes

o No

o I'm not sure

Q17 Which of the following are problems with animal conservation workers in your area? (check all that apply)

▢ They do not speak my language

▢ They do not understand my culture

▢ They increase the wild animal population

▢ They interfere with how I graze my cattle

▢ They do not cause any problems

▢ Other (please specify) ____

Section 3 Questions About You

Q18 Are you male or female?

o Male

o Female

o Prefer not to say

Q19 How old are you?

o 18-27 years old

o 28-37 years old

o 38-47 years old

o 48-57 years old

o 58 years old or older

Q20 Which of the following livelihood practices do you (and your spouse if you are married) do? (check all that apply)

▢ Keep cattle

▢ Sell cattle for money

▢ Keep animals other than cattle

▢ Grow plants to eat

▢ Grow plants to sell

▢ Work a job for money

▢ Sell goods at a market

▢ Other (please specify)

____

Q21 Which district of Kenya do you live in?

____

Q22 To which of the following groups would you like me to donate 200 KSH on your behalf?

o Maasai Association

o MANDO Maasai

o Community Wildlife Fund

o Maasai Wilderness Conservation Trust

o Maasai Girls Education Fund

o Osiligi Charity Projects

o Conserve Maasai Mara

Appendix 2: Comparisons of Wildebeest Behavior between Wet and Dry Seasons, Times of Day, and Stages of the Migration

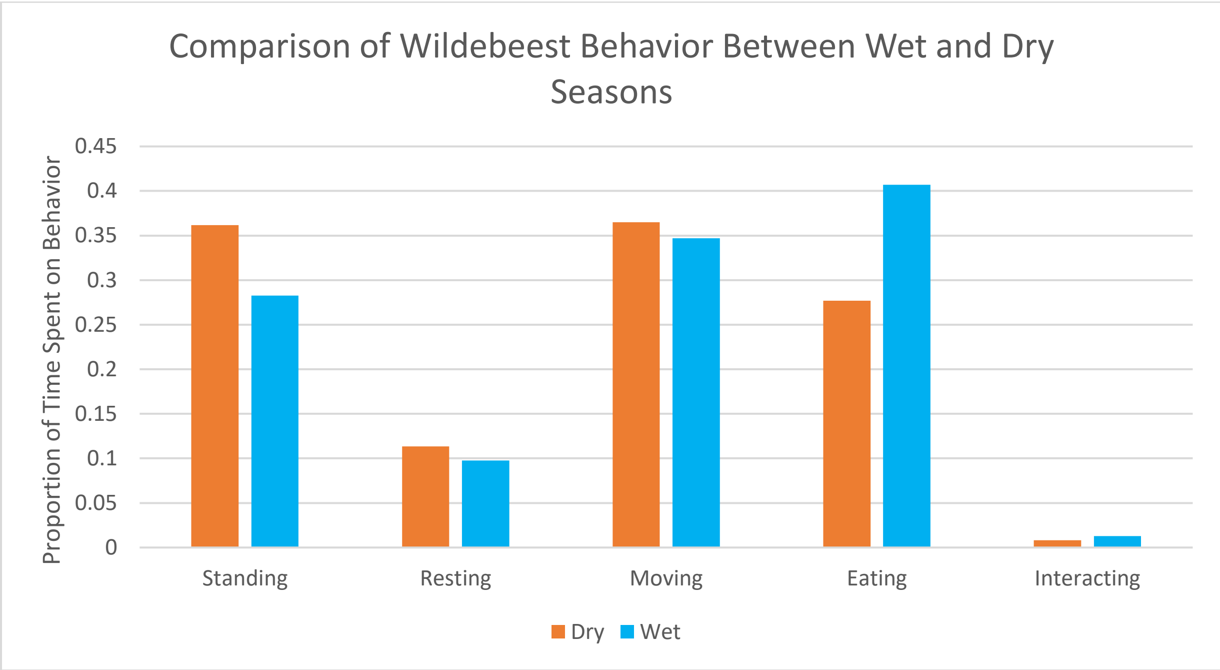

Figure 8: Proportion of wildebeest behaviors by season.

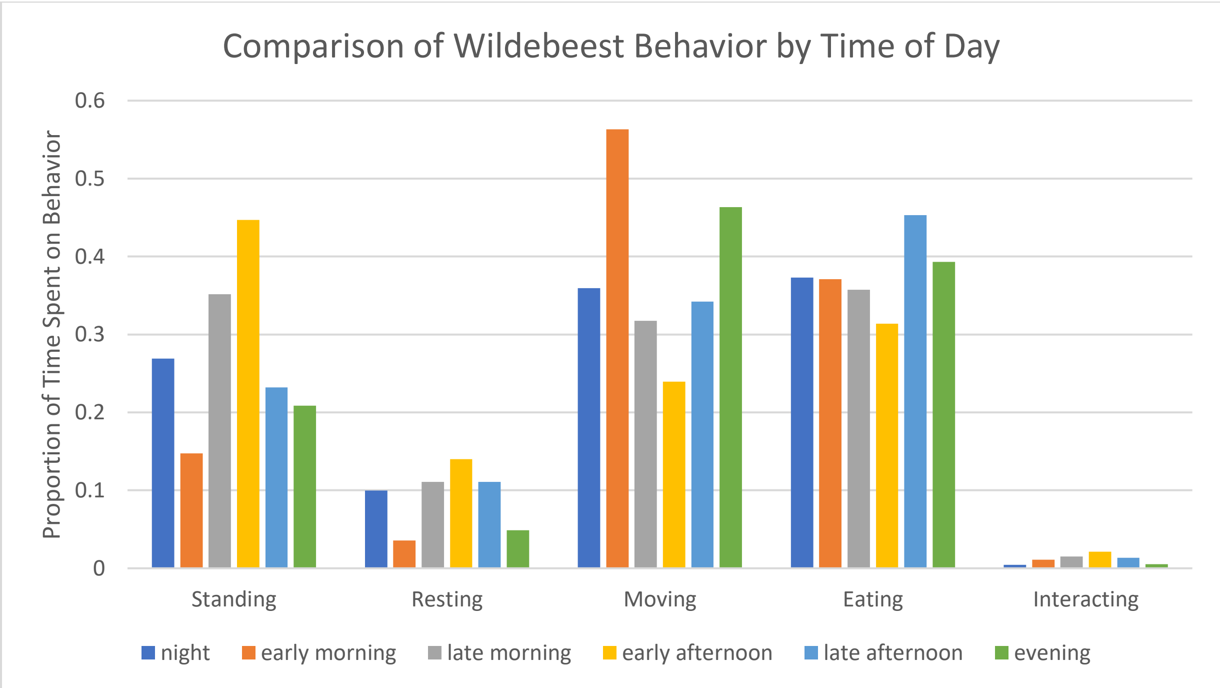

Figure 9: Proportion of wildebeest behaviors by time of day.

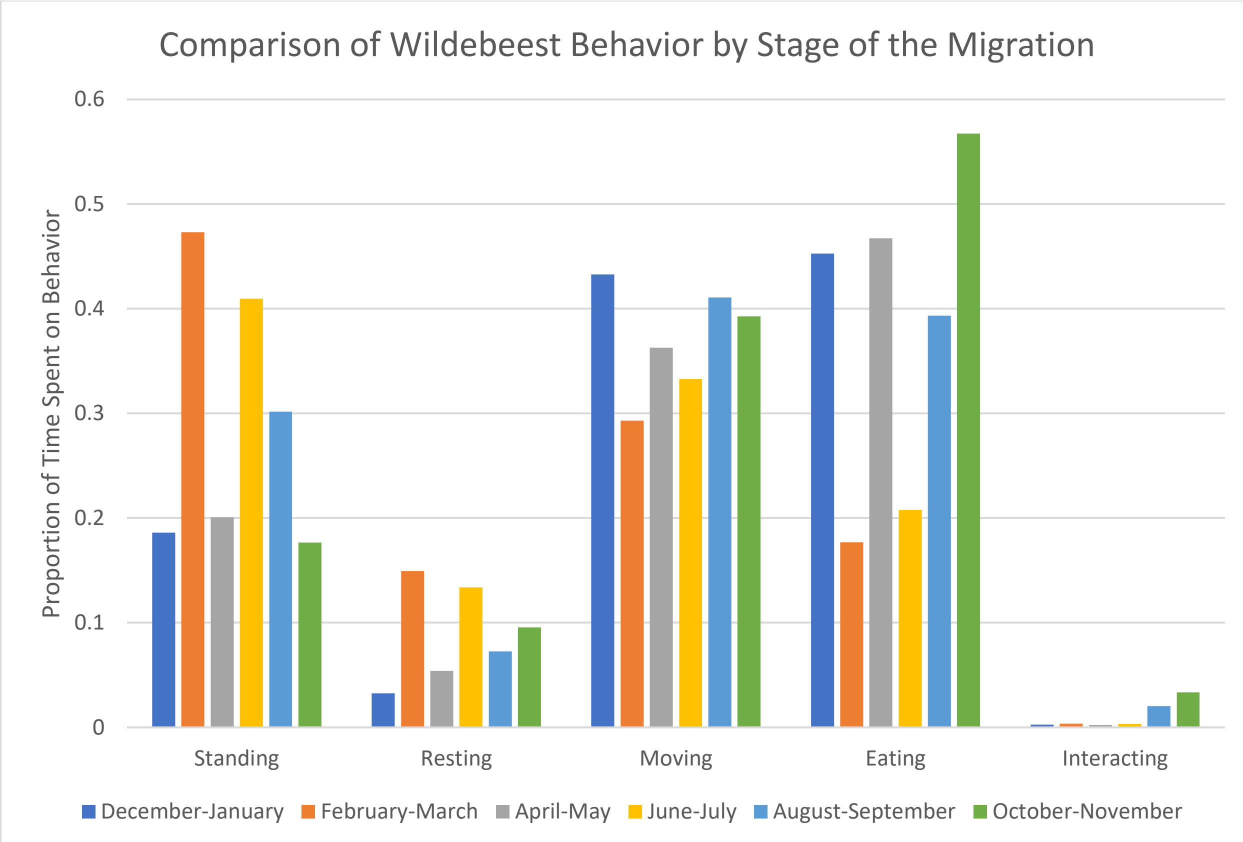

Figure 10: Proportion of wildebeest behaviors by stage of the migration.

95% confidence intervals were calculated for each behavior for each season, time of day, and stage of the migration (Tables 14-16).

Season	Behavior	Proportion of Behavior	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
Wet	Standing	0.283	0.277	0.288
Wet	Resting	0.098	0.094	0.101
Wet	Moving	0.347	0.341	0.353
Wet	Eating	0.407	0.401	0.413
Wet	Interacting	0.013	0.011	0.014
Dry	Standing	0.362	0.352	0.371
Dry	Resting	0.113	0.107	0.120
Dry	Moving	0.365	0.356	0.374
Dry	Eating	0.277	0.268	0.286
Dry	Interacting	0.008	0.006	0.010

Table 14: 95% confidence intervals for wildebeest behaviors by season.

Time of Day	Behavior	Proportion of Behavior	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
Night	Standing	0.269	0.256	0.282
Night	Resting	0.100	0.091	0.109
Night	Moving	0.359	0.345	0.374
Night	Eating	0.373	0.358	0.387
Night	Interacting	0.004	0.002	0.006
Early Morning	Standing	0.147	0.138	0.157
Early Morning	Resting	0.036	0.030	0.041
Early Morning	Moving	0.563	0.550	0.578
Early Morning	Eating	0.371	0.357	0.384
Early Morning	Interacting	0.011	0.008	0.014
Late Morning	Standing	0.352	0.341	0.362
Late Morning	Resting	0.111	0.104	0.118
Late Morning	Moving	0.318	0.307	0.328
Late Morning	Eating	0.357	0.347	0.368
Late Morning	Interacting	0.015	0.012	0.018
Early Afternoon	Standing	0.447	0.437	0.467
Early Afternoon	Resting	0.140	0.133	0.147
Early Afternoon	Moving	0.239	0.231	0.248
Early Afternoon	Eating	0.314	0.304	0.323
Early Afternoon	Interacting	0.021	0.018	0.024
Late Afternoon	Standing	0.232	0.222	0.242
Late Afternoon	Resting	0.111	0.103	0.118
Late Afternoon	Moving	0.342	0.331	0.353
Late Afternoon	Eating	0.453	0.441	0.465
Late Afternoon	Interacting	0.013	0.011	0.016
Evening	Standing	0.209	0.193	0.224
Evening	Resting	0.049	0.041	0.057
Evening	Moving	0.463	0.445	0.482
Evening	Eating	0.393	0.375	0.411
Evening	Interacting	0.005	0.002	0.008

Table 15: 95% confidence intervals for wildebeest behaviors by time of day.

Stage of Migration	Behavior	Proportion of Behavior	Lower Bound of 95% Confidence Interval	Upper Bound of 95% Confidence Interval
Dec/Jan	Standing	0.186	0.163	0.209
Dec/Jan	Resting	0.033	0.022	0.043
Dec/Jan	Moving	0.433	0.404	0.462
Dec/Jan	Eating	0.453	0.423	0.482
Dec/Jan	Interacting	0.003	0.000	0.006
Feb/March	Standing	0.473	0.463	0.483
Feb/March	Resting	0.149	0.142	0.156
Feb/March	Moving	0.293	0.284	0.302
Feb/March	Eating	0.177	0.169	0.184
Feb/March	Interacting	0.003	0.002	0.005
April/May	Standing	0.201	0.192	0.209
April/May	Resting	0.054	0.049	0.059
April/May	Moving	0.363	0.353	0.373
April/May	Eating	0.467	0.467	0.478
April/May	Interacting	0.002	0.001	0.003
June/July	Standing	0.410	0.398	0.425
June/July	Resting	0.134	0.124	0.143
June/July	Moving	0.333	0.320	0.346
June/July	Eating	0.208	0.197	0.219
June/July	Interacting	0.003	0.002	0.005
Aug/Sep	Standing	0.302	0.283	0.321
Aug/Sep	Resting	0.073	0.062	0.083
Aug/Sep	Moving	0.411	0.391	0.431
Aug/Sep	Eating	0.393	0.373	0.413
Aug/Sep	Interacting	0.020	0.015	0.016
Oct/Nov	Standing	0.177	0.168	0.185
Oct/Nov	Resting	0.095	0.089	0.102
Oct/Nov	Moving	0.393	0.383	0.403
Oct/Nov	Eating	0.567	0.557	0.578
Oct/Nov	Interacting	0.033	0.030	0.037

Table 16: 95% confidence intervals for wildebeest behaviors by stage of the migration.

Bibliography

Abay, G. Y. *et al.* (2011) 'Peri-urban spotted hyena (Crocuta crocuta) in Northern Ethiopia: Diet, economic impact, and abundance', *European Journal of Wildlife Research*, 57(4), pp. 759–765.

Abidin, C. and De Seta, G. (2020) 'Private Messages From The Field: Confessions on digital ethnography and its discomforts', *Journal Of Digital Social Research*, 2(1), pp. 1–19.

Aceves-Bueno, E. *et al.* (2017) 'The Accuracy of Citizen Science Data: A Quantitative Review', *The Bulletin of the Ecological Society of America*, 98(4).

Acharya, A. S. *et al.* (2013) 'Sampling: Why and How of it?', *Indian Journal of Medical Specialities*, 4(2), pp. 330–333.

Adams, B. N. (1974) 'Doing Survey Research Cross-Culturally: Some Approaches and Problems', *Journal of Marriage and the Family*, 36(3), pp. 568–573.

Adano, W. R. *et al.* (2012) 'Climate change, violent conflict and local institutions in Kenya's drylands', *Journal of Peace Research*, 49(1), pp. 65–80.

African People and Wildlife (2021) *Living Walls*. Available at: https://africanpeoplewildlife.org/living-walls/.

Aguirre, A. A. *et al.* (2020) 'Illicit Wildlife Trade, Wet Markets, and COVID-19: Preventing Future Pandemics', *World Medical and Health Policy*.

Ahmed, Z. *et al.* (2015) 'The Warrior's Dilemma: Can Maasai Culture Persist in a Changing World?', *Consilience: The Journal of Sustainable Development*, 13(1), pp. 300–310.

Ajmone-Marsan, P., Garcia, J. F. and Lenstra, J. A. (2010) 'On the origin of cattle: How aurochs became cattle and colonized the world', *Evolutionary Anthropology*, 19, pp. 148–157.

Ajzen, I. (1991) 'The Theory of Planned Behavior', *Organizational Behavior and Human Decision Processes*, 50, pp. 179–211.

Akama, J. S. (1998) 'The Evolution of Wildlife Conservation Policies in Kenya', *Journal of Third World Studies*, 15(2), pp. 103–117.

Akama, J. S., Maingi, S. and Camargo, B. A. (2011) 'Wildlife conservation, safari tourism and the role of tourism certification in kenya: A postcolonial critique', *Tourism Recreation Research*, 36(3), pp. 281–291.

Altmann, J. (1874) ‘Observation Study of Behavior: Sampling Methods’, *Behaviour*, 49(3/4), pp. 227–267.

Altmann, J. *et al.* (1977) ‘Life history of yellow baboons: Physical development, reproductive parameters, and infant mortality’, *Primates*, 18(2), pp. 315–330.

Altmann, S. A. (1974) ‘Baboons, Space, Time, and Energy’, *American Zoologist*, 14, pp. 221–248.

Amanfu, W. (2009) ‘Contagious bovine pleuropneumonia (lungsickness) in Africa’, *Onderstepoort Journal of Veterinary Research*, 76, pp. 13–17.

Andersen, K. G. *et al.* (2020) ‘The proximal origin of SARS-CoV-2’, *Nature Medicine*, 89(1), pp. 44–48.

Anderson, D. (2010) ‘Kenya’s Cattle Trade and the Economics of Empire, 1918 – 48’, in Brown, K. and Gilfoyle, D. (eds) *Healing the Herds*, pp. 250–268.

Anderson, E. C. *et al.* (1979) ‘The Pathogenesis of Foot-and-Mouth Disease in the African Buffalo (Syncerus caffer) and the Role of this Species in the Epidemiology of the Disease in Kenya’, *Journal of Comparative Pathology*, 89, pp. 541–549.

Anderson, E., Doughty, W. J. and Anderson, J. (1976) ‘The role of sheep and goats in the epizootiology of foot-and-mouth disease in Kenya’, *Journal of Hygiene*, 76, pp. 395–402.

Anderson, M. T. (2008) ‘Plant compositional change over time increases with rainfall in Serengeti grasslands’, *Oikos*, 117(5), pp. 675–682.

Anderson, T. M., Metzger, K. L. and McNaughton, S. J. (2007) ‘Multi-scale analysis of plant species richness in Serengeti grasslands’, *Journal of Biogeography*, 34(2), pp. 313–323.

Andres, L. (2012) *Designing & doing survey research*. Los Angeles, CA: Sage.

Arbieu, U. *et al.* (2019) ‘Attitudes towards returning wolves (*Canis lupus*) in Germany: Exposure, information sources and trust matter’, *Biological Conservation*, 234, pp. 202–210.

Archie, E. A., Moss, C. J. and Alberts, S. C. (2006) ‘The ties that bind: Genetic relatedness predicts the fission and fusion of social groups in wild African elephants’, *Proceedings of the Royal Society B: Biological Sciences*, 273(1586), pp. 513–522.

Armstrong Oma, K. (2010) ‘Between trust and domination: Social contracts between humans and animals’, *World Archaeology*, 42(2), pp. 175–187.

Augustine, D. J. (2003) ‘Long-term, livestock-mediated redistribution of nitrogen and phosphorus in an East African savanna’, *Journal of Applied Ecology*, 40(1), pp. 137–149.

Aureli, F., Cords, M. and Van Schaik, C. P. (2002) ‘Conflict resolution following aggression in gregarious animals: A predictive framework’, *Animal Behaviour*, 64(3), pp. 325–343.

Bagchi, S., Mishra, C. and Bhatnagar, Y. V. (2004) ‘Conflicts between traditional pastoralism and conservation of Himalayan ibex (*Capra sibirica*) in the Trans-Himalayan mountains’, *Animal Conservation*, 7, pp. 121–128.

Baird, T. D. *et al.* (2021) ‘Mobile phones and wrong numbers: How Maasai agro-pastoralists form and use accidental social ties in East Africa’, *Ecology and Society*, 26(2).

Baltar, F. and Brunet, I. (2012) ‘Social research 2.0: Virtual snowball sampling method using Facebook’, *Internet Research*, 22(1), pp. 57–74.

Bamalli, Z. *et al.* (2014) ‘Baobab tree (*Adansonia digitata L*) parts: nutrition, applications in food and uses in ethno-medicine - a review’, *Annals of Nutritional Disorder and Therapy*, 1(3), pp. 1–9.

Bartzke, G. S. *et al.* (2018) ‘Rainfall trends and variation in the Maasai Mara ecosystem and their implications for animal population and biodiversity dynamics’, *PLoS ONE*, 13(9).

Barua, M., Bhagwat, S. A. and Jadhav, S. (2013) ‘The hidden dimensions of human-wildlife conflict: Health impacts, opportunity and transaction costs’, *Biological Conservation*, 157, pp. 309–316.

Bastos, A. D. S. *et al.* (2000) ‘Natural transmission of foot-and-mouth disease virus between African buffalo (*Syncerus caffer*) and impala (*Aepyceros melampus*) in the Kruger National Park, South Africa’, *Epidemiology and Infection*, 124, pp. 591–598.

Bates, L. A. *et al.* (2007) ‘Elephants Classify Human Ethnic Groups by Odor and Garment Color’, *Current Biology*, 17, pp. 1938–1942.

Bauer, H. *et al.* (2017) ‘Financial compensation for damage to livestock by lions *Panthera leo* on community rangelands in Kenya’, *Oryx*, 51(1), pp. 106–114.

Baynes-Rock, M. (2013) ‘Local tolerance of hyena attacks in east Harar region, Ethiopia’, *Anthrozoos*, 26(3), pp. 421–433.

Baynes-Rock, M. (2015) *Among the Bone Eaters: Encounter with Hyenas in Harar*.

Beauchemin, C. and González-Ferrer, A. (2011) ‘Sampling international migrants with origin-based snowballing method: New evidence on biases and limitations’, *Demographic Research*, 25(3), pp. 103–134.

Beck, J. M. *et al.* (2021) ‘The application of reflexivity for conservation science’, *Biological Conservation*, 262.

Bedelian, C., Nkedianye, D. and Herrero, M. (2007) ‘Maasai perception of the impact and incidence of malignant catarrhal fever (MCF) in southern Kenya’, *Preventive Veterinary Medicine*, 78(3–4), pp. 296–316.

Beever, E. A. *et al.* (2017) ‘Behavioral flexibility as a mechanism for coping with climate change’, *Frontiers in Ecology and the Environment*.

Beja-Pereira, A. *et al.* (2006) ‘The origin of European cattle: Evidence from modern and ancient DNA’, *Proceedings of the National Academy of Sciences of the United States of America*, 103(21), pp. 8113–8118.

Belmain, S. (2015) *Rats may be disgusting, but it’s people who have made the world they thrive in*, *The Guardian*.

Bengis, R. G., Kock, R. A. and Fischer, J. (2002) ‘Infectious animal diseases: The wildlife/livestock interface’, *OIE Revue Scientifique et Technique*, 21(1), pp. 53–65.

Bennett, N. J. and Roth, R. (2019) ‘Realizing the transformative potential of conservation through the social sciences, arts and humanities’, *Biological Conservation*, 229.

Bennett, N. J. *et al.* (2017) ‘Conservation social science: Understanding and integrating human dimensions to improve conservation’, *Biological Conservation*, 205, pp. 93–108.

Bennett, N. J. *et al.* (2017) ‘Mainstreaming the social sciences in conservation’, *Conservation Biology*, 31(1), pp. 56–66.

Bennett, R. M. and Willis, K. G. (2008) ‘Public values for badgers, bovine TB reduction and management strategies’, *Journal of Environmental Planning and Management*, 51(4), pp. 511–523.

Ben-Shahar, N. and Fairall, R. (1987) ‘Comparison of the diurnal activity patterns of blue wildebeest and red hartebeest’, *South African Journal of Wildlife Research*, 17(2).

Bentley-Condit, V. K. (2009) ‘Food choices and habitat use by the Tana river yellow baboons (*Papio cynocephalus*): A preliminary report on five years of data’, *American Journal of Primatology*, 71(5), pp. 432–436.

Benton, C. H. *et al.* (2020) ‘Badger vaccination in England: Progress, operational effectiveness and participant motivations’, *People and Nature*, 2(3), pp. 761–775.

Berry, H. H. (1997) ‘Aspects of wildebeest *Connochaetes taurinus* ecology in the Etosha National Park - a synthesis for future management’, *Madoqua*, 20(1), pp. 137–148.

Berry, H. H., Siegfried, W. R. and Crowe, T. M. (1982) ‘Activity Patterns in a Population of Free-ranging Wildebeest *Connochaetes taurinus* at Etosha National Park’, *Zeitschrift für Tierpsychologie*, 59(3), pp. 229–246.

Bhatnagar, Y. V. *et al.* (2006) ‘Perceived conflicts between pastoralism and conservation of the kiang *Equus kiang* in the Ladakh Trans-Himalaya, India’, *Environmental Management*, 38, pp. 934–941.

Big Life Foundation (2021) *Maasai Olympics*. Available at: https://biglife.org/maasai-olympics/.

Billinis, C. (2013) ‘Wildlife diseases that pose a risk to small ruminants and their farmers’, *Small Ruminant Research*, 110(2–3), pp. 67–70.

Birkett, P. J. *et al.* (2012) ‘Animal perception of seasonal thresholds: Changes in elephant movement in relation to rainfall patterns’, *PLoS ONE*, 7(6).

Bixler, P.R. *et al.* (2015) ‘The political ecology of participatory conservation: Institutions and discourse’, *Journal of Political Ecology*, 22, pp. 164–182.

Blackburn, S. *et al.* (2016) ‘Human–wildlife conflict, benefit sharing and the survival of lions in pastoralist community-based conservancies’, *Journal of Applied Ecology*, 53(4), pp. 1195–1205.

Blanc, J. (2008) ‘Loxodonta africana. 2008 IUCN Red List of Threatened Species’, *Gland, Switzerland: http://www. Iucnredlist.org.*

Blicharska, M. *et al.* (2016) ‘Contribution of social science to large scale biodiversity conservation: A review of research about the Natura 2000 network’, *Biological Conservation*, 199, pp. 110–122.

Bobadoye, A. O. *et al.* (2016) ‘Assessing Climate Change Adaptation Strategies among Rural Maasai pastoralist in Kenya’, *American Journal of Rural Development*, 4(6), pp. 120–128.

Boellstorff, T. (2005) *Coming of Age in Second Life*. Princeton University Press.Boettiger, A. N. *et al.* (2011) ‘Inferring ecological and behavioral drivers of African elephant movement using a linear filtering approach’, *Ecology*, 92(8), pp. 1648–1657.

Böhm, M., Hutchings, M. R. and White, P. C. L. (2009) ‘Contact networks in a wildlife-livestock host community: Identifying high-risk individuals in the transmission of bovine TB among badgers and cattle’, *PLoS ONE*, 4(4).

Bohm, T. and Höner, O. (2015) '*Crocuta crocuta'*, *The IUCN Red List of Threatened Species*. Available at: http://dx.doi.org/10.2305/IUCN.UK.2015-2.RLTS.T5674A45194782.en.

Bonney, R. *et al.* (2009) 'Citizen science: A developing tool for expanding science knowledge and scientific literacy', *BioScience*, 59(11), pp. 977–984.

Boone, R. B., Thirgood, S. J. and Hopcraft, J. G. C. (2006) 'Serengeti wildebeest migratory patterns modeled from rainfall and new vegetation growth', *Ecology*, 87(8), pp. 1987–1994.

Boswell, C. (2009) *The Political Use of Expert Knowledge*. Cambridge University Press.

Bower, J. (1991) 'The Pastoral Neolithic of East Africa', *Journal of World Prehistory*, 5(1), pp. 49–82.

Bowler, G. M. (2010) 'Netnography: A method specifically designed to study cultures and communities online', *Qualitative Report*, 15(5), pp. 1270–1275.

Boydston, E. E. *et al.* (2003) 'Altered behaviour in spotted hyenas associated with increased human activity', *Animal Conservation*, 6(3), pp. 207–219.

Boydston, E. E. *et al.* (2003) 'Individual Variation in Space Use By Female Spotted Hyenas', *Journal of Mammalogy*, 84(3), pp. 1006–1018.

Boyer, D. (2005) 'The corporeality of expertise', *Ethnos*, 70(2), pp. 243–266.

Boyer, D. (2008) 'Thinking through the Anthropology of Experts', *Anthropology in Action*, 15(2), pp. 38–46.

Boynton, P. M. (2005) *The Research Companion: A Practical Guide for the Social and Health Sciences*. Psychology Press.

Bradley, D. G. *et al.* (1996) 'Mitochondrial diversity and the origins of African and European cattle', *Proceedings of the National Academy of Sciences of the United States of America*, 93, pp. 5131–5135.

Bradley, D. G. *et al.* (1998) 'Genetics and the origins of domestic cattle', *Evolutionary Anthropology*, pp. 79–86.

Bradley, N. (1999) 'Sampling for Internet surveys. An examination of respondent selection for Internet research', *International Journal of Market Research*, 41(4), pp. 387–395.

Bradshaw, G. A. *et al.* (2005) 'Elephant breakdown', *Nature*, 433(7028), p. 807.

Branco, P. S. *et al.* (2019) ‘An experimental test of community-based strategies for mitigating human–wildlife conflict around protected areas’, *Conservation Letters*, (September), pp. 1–8.

Branthwaite, A. and Patterson, S. (2011) ‘The power of qualitative research in the era of social media’, *Qualitative Market Research*, 14(4), pp. 430–440.

Bravo-Moreno, A. (2003) ‘Power Games between the Researcher and the Participant in the Social Inquiry’, *The Qualitative Report*, 8(4), pp. 624–639.

Broekhuis, F. *et al.* (2018) *Human-wildlife coexistence: attitudes and behavioural intentions towards predators in the Maasa Mara, Kenya*.

Broekhuis, F., Cushman, S. A. and Elliot, N. B. (2017) ‘Identification of human–carnivore conflict hotspots to prioritize mitigation efforts’, *Ecology and Evolution*, 7(24), pp. 10630–10639.

Brooks, J., Waylen, K. A. and Mulder, M. B. (2013) ‘Assessing community-based conservation projects: A systematic review and multilevel analysis of attitudinal, behavioral, ecological, and economic outcomes’, *Environmental Evidence*, 2(2), pp. 1–34.

Brown, L. H. (1971) ‘The biology of pastoral man as a factor in conservation’, *Biological Conservation*, 3(2), pp. 93–100.

Browne-Nuñez, C. and Jonker, S. A. (2008) ‘Attitudes toward wildlife and conservation across Africa: A review of survey research’, *Human Dimensions of Wildlife*, 13(1), pp. 47–70.

Browne-Nunez, C., Jacobson, S. K. and Vaske, J. J. (2013) ‘Beliefs, attitudes, and intentions for allowing elephants in group ranches around amboseli national park, Kenya’, *Wildlife Society Bulletin*, 37(3), pp. 639–648.

Brückner, G. K. *et al.* (2002) ‘Foot and mouth disease: The experience of South Africa’, *Revue scientifique et technique (International Office of Epizootics)*, 21(3), pp. 751–764.

Bruner, E. M. (2001) ‘The Maasai and the Lion King: Authenticity, Nationalism, and Globalization in African Tourism’, *American Ethnologist*, 28(4), pp. 881–908.

Burgess, H. K. *et al.* (2016) ‘The science of citizen science: Exploring barriers to use as a primary research tool’, *Biological Conservation*.

Burns, G. L. (2015) ‘Animals as tourism objects: Ethically refocusing relationships between tourists and wildlife’, *Animals and Tourism: Understanding Diverse Relationships*, pp. 44–59.

Buttke, D. *et al.* (2021) ‘Managing Wildlife Disease Under Climate Change’, *EcoHealth*.

Campbell, B. M., Sayer, J. A. and Walker, B. (2010) ‘Navigating trade-offs: Working for conservation and development outcomes’, *Ecology and Society*, 15(2).

Campbell, D. J. (1993) ‘Land as Ours, Land as Mine’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 258–272.

Campbell, E. L. *et al.* (2020) ‘Grazing cattle exposure to neighbouring herds and badgers in relation to bovine tuberculosis risk’, *Research in Veterinary Science*, 133, pp. 297–303.

Candea, M. (2010) ‘“I fell in love with carlos the meerkat”: Engagement and detachment in human-animal Relations’, *American Ethnologist*, 37(2), pp. 241–258.

Canelli, E. *et al.* (2010) ‘Encephalomyocarditis virus infection in an Italian zoo’, *Virology Journal*, 7(64), pp. 1–7.

Caplan, P. (2012) ‘Cull or vaccinate? Badger politics in Wales’, *Anthropology Today*, 28(6), pp. 17–21.

Carr, E. S. (2010) ‘Enactments of expertise’, *Annual Review of Anthropology*, 39, pp. 17–32.

Cassidy, A. (2012) ‘Vermin, Victims and Disease: UK Framings of Badgers In and Beyond the Bovine TB Controversy’, *Sociologia Ruralis*, 52(2), pp. 192–214.

Cassidy, A. (2017) ‘Badger-human conflict: An overlooked historical context for bovine tb debates in the UK’, in Hill, C. M., Webber, A. D., and Priston, N. E. C. (eds) *Understanding Conflicts about Wildlife: A Biosocial Approach*, pp. 65–94.

Cassidy, R. (2012) ‘Lives With Others: Climate Change and Human-Animal Relations’, *Annual Review of Anthropology*, 41(1), pp. 21–36.

Castles, D. L., Whiten, A. and Aureli, F. (1999) ‘Social anxiety, relationships and self-directed behaviour among wild female olive baboons’, *Animal Behaviour*, 58(6), pp. 1207–1215.

Catalano, A. S. *et al.* (2019) ‘Learning from published project failures in conservation’, *Biological Conservation*, 238.

Cerling, T. E. (1992) ‘Development of grasslands and savannas in East Africa during the Neogene’, *Palaeogeography, Palaeoclimatology, Palaeoecology*, 97, pp. 241–247.

Cerling, T. E., Harris, J. M. and Leakey, M. G. (1999) 'Browsing and grazing in elephants: The isotope record of modern and fossil proboscideans', *Oecologia*, 120(3), pp. 364–374.

Chamaillé-Jammes, S. *et al.* (2008) 'Resource variability, aggregation and direct density dependence in an open context: The local regulation of an African elephant population', *Journal of Animal Ecology*, 77(1), pp. 135–144.

Chambers, M. A. *et al.* (2014) 'Vaccination against tuberculosis in badgers and cattle: An overview of the challenges, developments and current research priorities in Great Britain', *Veterinary Record*, 175(4), pp. 90–96.

Chambers, M., Bliss, K. and Rambur, B. (2020) 'Recruiting Research Participants via Traditional Snowball vs Facebook Advertisements and a Website', *Western Journal of Nursing Research*, 42(10), pp. 846–851.

Chaminuka, P., Mccrindle, C. M. E. and Udo, H. M. J. (2012) 'Cattle farming at the wildlife/livestock interface: Assessment of costs and benefits adjacent to kruger National Park, South Africa', *Society and Natural Resources*, 25(3), pp. 235–250.

Cheetah Conservation Fund (2021) *Livestock Guarding Dog Program*. Available at: https://cheetah.org/canada/about-us/what-we-support/livestock-guarding-dogs-program/.

Cheetah Conservation Fund (2021) *Bushblok*. Available at: https://cheetah.org/bushblok/.

Cheung, S. F., Chan, D. K. S. and Wong, Z. S. Y. (1999) 'Reexamining the theory of planned behavior in understanding wastepaper recycling', *Environment and Behavior*, 31(5), pp. 587–612.

Chieni, T. and Spencer, P. (1993) 'The World of Telelia', in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 157–173.

Chongwa, M. B. (2012) 'The History and Evolution of National Parks in Kenya', *The George Wright Forum*, 29(1), pp. 39–42.

Christopoulos, D. (2009) 'Peer Esteem Snowballing: A methodology for expert surveys', *Eurostat Conference for New Techniques and Technologies for Statistics*.

Chuck, E. (2016) 'Harambe, Gorilla Killed at Cincinnati Zoo, "Had to Pay the Price"', *NBC News*.

Citino, S. B. (1995) *Encephalomyocarditis virus (EMCV)*.

Citino, S. B. *et al.* (1988) ‘Fatal Encephalomyocarditis Virus Infection in a Sumatran Orangutan (Pongo pygmaeus abelii)’, *The Journal of Zoo Animal Medicine*, 19(4), pp. 214–218.

Clayton, S., Fraser, J. and Burgess, C. (2011) ‘The role of zoos in fostering environmental identity’, *Ecopsychology*, 3(2), pp. 87–96.

Cleaveland, S. *et al.* (2001) *Assessing the Impact of Malignant Catarrhal Fever in Ngorongoro District, Tanzania*. Available at: http://www.participatoryepidemiology.info/MCF Report.pdf.

Clifford, J. and Marcus, G. E. (eds) (1986) *Writing Culture: The Poetics and Politics of Ethnography*. University of California Press.

Coast, E. (2006) ‘Maasai marriage: A comparative study of Kenya and Tanzania’, *Journal of Comparative Family Studies*, 37(3).

Codron, D. and Brink, J. S. (2007) ‘Trophic ecology of two savanna grazers, blue wildebeest *Connochaetes taurinus* and black wildebeest *Connochaetes gnou’*, *European Journal of Wildlife Research*, 53(2), pp. 90–99.

Cohen, J. M. *et al.* (2020) ‘Divergent impacts of warming weather on wildlife disease risk across climates’, *Science*, 370.

Cook, R. M. *et al.* (2018) ‘African honeybees as a mitigation method for elephant impact on trees’, *Biological Conservation*, 217(November), pp. 329–336.

Cooper, C. B. *et al.* (2007) ‘Citizen science as a tool for conservation in residential ecosystems’, *Ecology and Society*, 12(2).

Cooper, M. (2007) ‘Sharing Data and Results in Ethnographic Research: Why This Should Not Be An Ethical Imperative’, *Journal of Empirical Research on Human Research Ethics*, 3, pp. 3–19.

Cope-Watson, G. and Betts, A. (2010) ‘Confronting otherness: An e-conversation between doctoral students. Living with the Imposter Syndrome’, *Canadian Journal for New Scholars in Education*, 3(1), pp. 1–13.

Coulter, M. (2020) ‘Coronavirus latest: at a glance’, *The Guardian*.Couper, M. P., Traugott, M. W. and Lamias, M. J. (2001) ‘Web survey design and administration’, *Public Opinion Quarterly*, 65, pp. 230–253.

Couzin, I. D. (2006) ‘Behavioral ecology: Social organization in fission-fusion societies’, *Current Biology*, 16(5), pp. 169–171.

Creel, S., Christianson, D. and Schuette, P. (2013) ‘Glucocorticoid stress responses of lions in relationship to group composition, human land use, and proximity to people’, *Conservation Physiology*, 1(1), pp. 1–9.

Crichton, S.; Kinash, S. (2003) ‘Virtual Ethnography: Interactive Interviewing Online as Method’, *Canadian Journal of Learning and Technology*, 29(2).

Cronk, L. (2002) ‘From True Dorobo to Mukogodo Maasai: Contested Ethnicity in Kenya’, *Ethnology*, 41(1), pp. 27–49.

Cumming, D. H. M. (1982) ‘Influence of Large Herbivores on Savanna Structure in Africa’, *Ecological Studies*, 42, pp. 107–110.

Dalsgaard, S. (2016) ‘The Ethnographic Use of Facebook in Everyday Life’, *Anthropological Forum*, 26(1), pp. 96–114.

Davies, C. A. (1999) *Reflexive Ethnography: A Guide to Researching Selves and Others:Reflexive Ethnography: A Guide to Researching Selves and Others.* London: Routledge.

Davison, J. *et al.* (2011) ‘Assessing spatiotemporal associations in the occurrence of badger-human conflict in England’, *European Journal of Wildlife Research*, 57(1), pp. 67–76.

Dayer, A. A. *et al.* (2020) ‘Applying conservation social science to study the human dimensions of Neotropical bird conservation’, *Condor*, 122, pp. 1–15.

de Filippo, C., Bostoen, K., Stoneking, M., & Pakendorf, B. (2012). Bringing together linguistic and genetic evidence to test the Bantu expansion. *Proceedings of the Royal Society B: Biological Sciences*, *279*, 3256–3263.

De Garine-Wichatitsky, M. *et al.* (2013) ‘Coexisting with wildlife in transfrontier conservation areas in Zimbabwe: Cattle owners’ awareness of disease risks and perceptions of the role played by wildlife’, *Comparative Immunology, Microbiology and Infectious Diseases*, 36(3), pp. 321–332.

Denver Zoo (2021) *New Hope for the Tonkin Snub-Nosed Monkey*. Available at: https://denverzoo.org/vietnam/.

Denver Zoo (2021) *Conserving Lake Titicaca frogs and Junin giant frogs*. Available at: https://denverzoo.org/peru/.

De Seta, G. (2020) ‘Three lies of digital ethnography’, *Journal of Digital Social Research*, 2(1), pp. 77–97.

de Silva, A. (2008) *The status of the Saltwater crocodile (Crocodylus porosus) inhabiting the Nilwala River, Matara District and its impact on the community*.

De Wit, S. (2020) ‘What Does Climate Change Mean to Us, the Maasai? How Climate-Change Discourse is Translated in Maasailand, Northern Tanzania’, in Bruggemann, M. and Rodder, S. (eds) *Global Warming in Local Discourses: How Communities Around the World Make Sense of Climate Change*.

Dea, S. *et al.* (1991) ‘Outbreaks in Quebec pig farms of respiratory and reproductive problems associated with encephalomyocarditis virus’, *Journal of Veterinary Diagnostic Investigation*, 3(4), pp. 275–282.

Decker, C. *et al.* (2021) ‘Predicting uptake of a malignant catarrhal fever vaccine by pastoralists in northern Tanzania: Opportunities for improving livelihoods and ecosystem health’, *Ecological Economics*, 190.

Decker, J. E. *et al.* (2014) ‘Worldwide Patterns of Ancestry, Divergence, and Admixture in Domesticated Cattle’, *PLoS Genetics*, 10(3).

Delahay, R. J. *et al.* (2009) ‘Managing conflict between humans and wildlife: Trends in licensed operations to resolve problems with badgers Meles meles in England’, *Mammal Review*, 39(1), pp. 53–66.

Delise, N. N. (2014) ‘How Do You Facebook? The Gendered Characteristics of Online Interaction’, in Farris, N. D., Davis, M. A., and Compton, D. R. (eds) *Illuminating How Identities, Stereotypes and Inequalities Matter through Gender Studies*, pp. 9–28.

Di Silvestre, I., Novelli, O. and Bogliani, G. (2000) ‘Feeding habits of the spotted hyaena in the Niokolo Koba National Park, Senegal’, *African Journal of Ecology*, 38(2), pp. 102–107.

Dickinson, J. L. *et al.* (2012) ‘The current state of citizen science as a tool for ecological research and public engagement’, *Frontiers in Ecology and the Environment*, 10(6), pp. 291–297.

Dicks, F. *et al.* (2021) ‘Vaccination as a control tool in bovine tuberculosis: Social media monitoring to assess public response to government policy development and implementation’, *Vaccines*, 9, pp. 1–16.

Distefano, E. (2005) *Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices*.

Dolrenry, S., Hazzah, L. and Frank, L. G. (2016) ‘Conservation and monitoring of a persecuted African lion population by Maasai warriors’, *Conservation Biology*, 30(3), pp. 467–475.

Doran, D. M. (1997) ‘Ontogeny of locomotion in mountain’, *Journal of Human Evolution*, 32, pp. 323–344.

Doran, D. M. and McNeilage, A. (1998) ‘Gorilla ecology and behavior’, *Evolutionary Anthropology*, 6(4), pp. 120–131.

Douglas-Hamilton, I., Krink, T. and Vollrath, F. (2005) ‘Movements and corridors of African elephants in relation to protected areas’, *Naturwissenschaften*, 92(4), pp. 158–163.

Dragan, I.-M. and Isaic-Maniu, A. (2013) ‘Snowball Sampling Completion’, *Journal of Studies in Social Science*, 5(2), pp. 160–177.

Driscoll, C. and Gregg, M. (2010) ‘My profile: The ethics of virtual ethnography’, *Emotion, Space and Society*, 3, pp. 15–20.

Ducarme, F., Luque, G. M. and Courchamp, F. (2013) ‘What are “charismatic species” for conservation biologists?’, *BioSciences Master Reviews*, 1(July), pp. 1–8.

Duffy, K. J. *et al.* (2011) ‘) in Different Habitat Types’, *South African Journal of Wildlife Research*, 41(1), pp. 21–28.

Dunham, K. M. *et al.* (2010) ‘Human-wildlife conflict in Mozambique: A national perspective, with emphasis on wildlife attacks on humans’, *Oryx*, 44(2), pp. 185–193.

Edwards, C. J. *et al.* (2007) ‘Mitochondrial DNA analysis shows a Near Eastern Neolithic origin for domestic cattle and no indication of domestication of European aurochs’, *Proceedings of the Royal Society B: Biological Sciences*, 274, pp. 1377–1385.

Ekernas, L. S. *et al.* (2016) ‘Desert pastoralists’ negative and positive effects on rare wildlife in the Gobi’, *Conservation Biology*, pp. 1–9.

Eltringham, S. K. (1990) ‘Wildlife carrying capacities in relation to human settlement’, *Koedoe*, 33(2), pp. 87–97.

Estes, R. D. (1976) ‘The significance of breeding synchrony in the wildebeest’, *East African Wildlife Journal*, 14(2), pp. 135–152.

Estes, R. D. (2014) *The Gnu’s World: Serengeti Wildebeest Ecology and Life History*.

Estes, R. D. and Estes, R. K. (1979) ‘The Birth and Survival of Wildebeest Calves’, *Zeitschrift für Tierpsychologie*, 50, pp. 45–95.

Etikan, I., Alkassim, R. and Abubakar, S. (2015) ‘Comparision of Snowball Sampling and Sequential Sampling Technique’, *Biometrics & Biostatistics International Journal*, 3(1), pp. 1–2.

Evans, J. and Jones, P. (2011) ‘The walking interview: Methodology, mobility and place’, *Applied Geography*, 31(2), pp. 849–858.

Evans-Pritchard, E. E. (1962) *Social Anthropology and Other Essays*. Free Press.

Fentaw, T. and Duba, J. (2017) ‘Human-Wildlife conflict among the pastoral communities of southern rangelands of Ethiopia: The case of yabello protected area’, *Journal of International Wildlife Law and Policy*, 20(2), pp. 198–206.

Fernandez, C., Kodish, E. and Weijer, C. (2003) ‘Informing Study Participants of Research Results: An Ethical Imperative’, *IRB: Ethics & Human Research*, pp. 12–19. Available at: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.467.7167&rep=rep1&type=pdf

Fieldstadt, E. and Stelloh, T. (2016) ‘Outrage Grows After Gorilla Harambe Shot Dead at Cincinnati Zoo to Save Tot’, *NBC News*.

Filippo, C. *et al.* (2012) ‘Bringing together linguistic and genetic evidence to test the Bantu expansion’, *Proceedings of the Royal Society B: Biological Sciences*, 279, pp. 3256–3263.

Fleagle, J. G. (2013) *Primate Adaptation and Evolution*.

Forth, G. (2021) ‘Rare Animals as Cryptids and Supernaturals: The Case of Dugongs on Flores Island’, *Anthrozoos*, 34(1), pp. 61–76.

Found, R. and St. Clair, C. C. (2019) ‘Influences of Personality on Ungulate Migration and Management’, *Frontiers in Ecology and Evolution*, 7.

Fowler, F. and Cosenza, C. (2009) ‘Design and Evaluation of Survey Questions’, in Bickman, L. and Rog, D. (eds) *The SAGE Handbook of Applied Social Research Methods*. Thousand Oaks: SAGE Publications.

Fox, H. E. *et al.* (2006) ‘Perceived barriers to integrating social science and conservation’, *Conservation Biology*, 20(6), pp. 1817–1820. doi: 10.1111/j.1523-1739.2006.00598.x.

Fox, J. L. *et al.* (2004) ‘Modern wildlife conservation initiatives and the pastoralist/hunter nomads of northwestern Tibet’, *Rangifer*, 15, pp. 17–27.

Frank, B. (2016) ‘Human–Wildlife Conflicts and the Need to Include Tolerance and Coexistence: An Introductory Comment’, *Society and Natural Resources*, 29(6), pp. 738–743.

Fratkin, E. (1979) ‘A Comparison of the Role of Prophets in Samburu and Maasai Warfare’, *Senri Ethnological Studies*, 3, pp. 53–67.

Fratkin, E. (1993) ‘Maa-Speakers of the Northern Desert’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 273–289.

Fricker, R. D. (2016) ‘Sampling Methods for Online Surveys’, *The SAGE Handbook of Online Research Methods*, pp. 162–183.

Fritz, H. and Duncan, P. (1994) ‘On the carrying capacity for large ungulates of African savanna ecosystems’, *Proc. R. Soc. Lond. B*, 256, pp. 77–82.

Gachohi, J. *et al.* (2012) ‘Epidemiology of East Coast fever (Theileria parva infection) in Kenya: Past, present and the future’, *Parasites and Vectors*, 5, pp. 1–13.

Galaty, J. G. (1993) ‘“The Eye that Wants a Person, Where Can It Not See?”’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 174–194.

Gallana, M. *et al.* (2013) ‘Climate change and infectious diseases of wildlife: Altered interactions between pathogens, vectors and hosts’, *Current Zoology*, 59(3), pp. 427–437.

Garland, E. (2008) ‘The Elephant in the Room: Confronting the Colonial Character of Wildlife Conservation in Africa’, *African Studies Review*, 51(3), pp. 51–74.

Garnett, B. T., Delahay, R. J. and Roper, T. J. (2002) ‘Use of cattle farm resources by badgers (*Meles meles*) and risk of bovine tuberculosis (*Mycobacterium bovis*) transmission to cattle’, *Proceedings of the Royal Society B: Biological Sciences*, 269, pp. 1487–1491.

Gebauer, J., El-Siddig, K. and Ebert, G. (2002) ‘Baobab (*Adansonia digitata L*.): A Review on a multipurpose tree with promising future in the Sudan’, *Gartenbauwissenschaft*, 67(4), pp. 155–160.

Gehring, C. A. and Whitham, T. G. (1994) ‘Interactions between aboveground herbivores and the mycorrhizal mutualists of plants’, *Trends in Ecology and Evolution*, 9(7), pp. 251–255.

Gelinas, L. *et al.* (2017) ‘Using Social Media as a Research Recruitment Tool: Ethical Issues and Recommendations’, *Am J Bioeth*, 17(3), pp. 3–14.

Ghosh, B. (2020) ‘Digital ethnography during the covid-19 pandemic’, *Doing Sociology*.

Giblin, J. (1990) ‘Trypanosomiasis Control in African History: An Evaded Issue?’, *The Journal of African History*, 31(1), pp. 59–80.

Giblin, J. L. (1990) ‘East Coast Fever in Socio-Historical Context: A Case Study from Tanzania’, *The International Journal of African Historical Studies*, 23(3), pp. 401–421.

Gifford-Gonzalez, D. (2005) ‘Pastoralism and its Consequences’, in Stahl, A. B. (ed.) *African Archaeology A Critical Introduction*, pp. 187–224.

Gifford-Gonzalez, D. and Hanotte, O. (2011) ‘Domesticating Animals in Africa: Implications of Genetic and Archaeological Findings’, *Journal of World Prehistory*, 24(1), pp. 1–23.

Gillson, L. (2004) ‘Evidence of Hierarchical Patch Dynamics in an east African savanna?’, *Landscape Ecology*, 19(8), pp. 883–894.

Global Biodiversity Outlook 5 (2020). Montreal.*David Sheldrick Wildlife Trust* (2019). Available at: https://www.sheldrickwildlifetrust.org/orphans (Accessed: 11 March 2019).

Gobosho, L., Hunde, D. and Mekonnen, T. (2015) ‘Identification of Crop Raiding Species and the Status of Their Impact on Farmer Resources in Gera, Southwestern Ethiopia’, *International Journal of Sciences: basic and applied research*, 22(2), pp. 66–82.

Goldman, M. J., de Pinho, J. R. and Perry, J. (2010) ‘Maintaining complex relations with large cats: Maasai and lions in Kenya and Tanzania’, *Human Dimensions of Wildlife*, 15(5), pp. 332–346.

Goldman, M. J., De Pinho, J. R. and Perry, J. (2013) ‘Beyond ritual and economics: Maasai lion hunting and conservation politics’, *Oryx*, 47(4), pp. 490–500.

Goodwin, P. (1998) ‘“Hired hands” or “local voice”: Understandings and experience of local participation in conservation’, *Transactions of the Institute of British Geographers*, 23, pp. 481–499.

Góralska, M. (2020) ‘Anthropology from home advice on digital ethnography for the pandemic times’, *Anthropology in Action*, 27(1), pp. 46–52.

GRACE Gorillas (2021). Available at: https://gracegorillas.org/.

Graham, M. D., Adams, W. M. and Kahiro, G. N. (2011) ‘Mobile phone communication in effective human elephant-conflict management in Laikipia County, Kenya’, *Oryx*, 46(1), pp. 137–144.

Grant, C. and Osanloo, A. (2016) ‘Understanding, Selecting, and Integrating a Theoretical Framework in Dissertation Research: Creating the Blueprint for Your “House”’, *Administrative Issues Journal Education Practice and Research*, 4(2), pp. 12–26.

Graunke, K. L., Schuster, T. and Lidfors, L. M. (2011) ‘Influence of weather on the behaviour of outdoor-wintered beef cattle in Scandinavia’, *Livestock Science*, 136, pp. 247–255.

Gray, A. (2020) ‘Tighter wildlife disease monitoring needed to prevent future pandemics’, *Veterinary Record*.

Grevy’s Zebra Trust (2021) *Grevy’s Zebra Warriors*. Available at: https://www.grevyszebratrust.org/grevys-zebra-warriors/.

Gross, K., Pasinelli, G. and Kunc, H. P. (2010) ‘Behavioral plasticity allows short-term adjustment to a novel environment’, *The American Naturalist*, 176(4), pp. 456–464.

Grote, A. S. (2012) *Flaming on Facebook*. Available at: http://essay.utwente.nl/62439/.

Gruzd, A., Staves, K. and Wilk, A. (2012) ‘Connected scholars: Examining the role of social media in research practices of faculty using the UTAUT model’, *Computers in Human Behavior*, 28, pp. 2340–2350.

Guy, R. (2012) ‘The Use of Social Media for Academic Practice: a Review of Literature’, *Kentucky Journal of Higher Education Policy and Practice*, 1(2), pp. 1–20.

Hagen, R. L. Von (2018) *An Evaluation of Deterrent Methods Utilized to Prevent Crop Raiding by African Elephants (Loxodonta Africana) in the Kasigau Wildlife Corridor, Kenya*.

Haile, G. G. *et al.* (2020) ‘Projected Impacts of Climate Change on Drought Patterns Over East Africa’, *Earth’s Future*, 8.

Hair, N. and Clark, M. (2003) ‘An Enhanced Virtual Ethnography: The Role of Critical Theory’, *3rd Annual Critical Management Studies Conference*, 44.

Hall-Martin, A. J. (1987) ‘Role of musth in the reproductive strategy of the African elephant (*Loxodonta africana*)’, *South African Journal of Science*, 83(10), pp. 616–620.

Hamilton, J., Tilson, L. and Frank, L. (1986) ‘Sexual Monomorphism in Spotted Hyenas, *Crocuta crocuta’*, *Ethology*, 71, pp. 63–73.

Hanotte, O. *et al.* (2002) ‘African pastoralism: Genetic imprints of origins and migrations’, *Science*, 296, pp. 336–339.

Haraway, D. (2012) ‘Unruly Edges: Mushrooms as Companion Species’, *Environmental Humanities*, 1(1), pp. 141–154.

Hastrup, K. *et al.* (1990) ‘Anthropological Advocacy: A Contradiction in Terms?’, *Current Anthropology*, 31(3), pp. 301–311.

Haynes, G. (2012) ‘Elephants (and extinct relatives) as earth-movers and ecosystem engineers’, *Geomorphology*, 157–158, pp. 99–107.

Hazzah, L. *et al.* (2013) ‘The influence of park access during drought on attitudes toward wildlife and lion killing behaviour in Maasailand, Kenya’, *Environmental Conservation*, 40(3), pp. 266–276.

Hazzah, L. *et al.* (2014) ‘Efficacy of two lion conservation programs in Maasailand, Kenya’, *Conservation Biology*, 28(3), pp. 851–860.

Hazzah, L. *et al.* (2017) ‘From attitudes to actions: Predictors of lion killing by maasai warriors’, *PLoS ONE*, 12(1), pp. 1–13.

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(11), pp. 2428–2437.

Herskovits, M. J. (1926) ‘the Cattle Complex in East Africa’, *American Anthropologist*, 28(4), pp. 633–664.

Hickey, J. R. *et al.* (2018) ‘Gorilla beringei ssp. beringei’, *The IUCN Red List of Threatened Species 2018*. Available at: https://dx.doi.org/10.2305/IUCN.UK.2018-2.RLTS.T39999A17989719.en.

Hill, C. M. (2000) ‘Conflict of interest between people and baboons: crop raiding in Uganda’, *International Journal of Primatology*, 21(2), pp. 299–315.

Hill, C. M. and Webber, A. D. (2010) ‘Perceptions of nonhuman primates in human-wildlife conflict scenarios’, *American Journal of Primatology*, 72(10), pp. 1–6.

Hine, C. (2000) *Virtual Ethnography*. SAGE Publications.

Hine, C. (2016) ‘From Virtual Ethnography to the Embedded, Embodied, Everyday Internet’, in *The Routledge Companion to Digital Ethnography*.

Hoare, R. (2000) ‘African elephants and humans in conflict: The outlook for co-existence’, *Oryx*, 34(1), pp. 34–38.

Hoare, R. E. (1999) ‘Determinants of human-elephant conflict in a land-use mosaic’, *Journal of Applied Ecology*, 36(5), pp. 689–700.

Hodgson, D. L. (1999) ‘Women as Children: Culture, Political Economy, and Gender Inequality among Kisongo Maasai’, *Nomadic Peoples*, 3(2), pp. 115–130.

Hodgson, D. L. (2011) '"If We Had Our Cows" Community Perspectives on the Challenge of Change', in *Being Maasai, Becoming Indigenous*.

Holdø, R. M., Dudley, J. P. and McDowell, L. R. (2002) 'Geophagy in the African Elephant in Relation To Availability of Dietary Sodium', *Journal of Mammalogy*, 83(3), pp. 652–664.

Holekamp, K. E. *et al.* (1997) 'Hunting rates and hunting success in the spotted hyena (*Crocuta crocuta*)', *Journal of Zoology*, 242(1), pp. 1–15.

Holekamp, K. E. *et al.* (2015) 'Brains, brawn and sociality: A hyaena's tale', *Animal Behaviour*, 103, pp. 237–248.

Hollister-Smith, J. A. *et al.* (2007) 'Age, musth and paternity success in wild male African elephants, *Loxodonta africana*', *Animal Behaviour*, 74(2), pp. 287–296.

Homewood, K. *et al.* (2006) 'Livestock health and socio-economic impacts of a veterinary intervention in Maasailand: Infection-and-treatment vaccine against East Coast fever', *Agricultural Systems*, 89, pp. 248–271.

Honer, O. P. *et al.* (2002) 'The Response of Spotted Hyaenas to Long-Term Changes in Prey Populations: Functional Response and Interspecific Kleptoparasitism', *Journal of Animal Ecology*, 71(2), pp. 236–246.

Hope, K. R. (2014) 'Kenya's corruption problem: causes and consequences', *Commonwealth and Comparative Politics*, 52(4), pp. 493–512.

Hopmann, D. N. (2012) 'Using the Web to Snowball Discussants of Survey Respondents', *Communication Methods and Measures*, 6(3), pp. 145–162.

Hori, K. *et al.* (2007) 'Baobab tree (*Adansonia digitata L*) parts: nutrition, applications in food and uses in ethno-medicine - a review', *Oikos*, 36(4), pp. 251–255.

Howes, D. (2022) 'The misperception of the environment: A critical evaluation of the work of Tim Ingold and an alternative guide to the use of the senses in anthropological theory', *Anthropological Theory*, 0(0), pp. 1–24.

Hughes, L. (2010) '"They Give Me Fever" East Coast Fever and Other Environmental Impacts of the Maasai Moves', in Brown, K. and Gilfoyle, D. (eds) *Healing the Herds*, pp. 146–162.

Hunt, R. D. and Billups, L. H. (1979) 'Wildebeest-associated malignant catarrhal fever in Africa: A neoplastic disease of cattle caused by an oncogenic herpesvirus?', *Comparative Immunology, Microbiology and Infectious Diseases*, 2, pp. 275–283.

Hunter, N., Martin, E. and Milliken, T. (2004) ‘Determining the number of elephants required to supply current unregulated ivory markets in Africa and Asia’, *Pachyderm*, 36(36), pp. 116–128.

Huntsinger, L., Sayre, N. F. and Wulfhorst, J. (2012) ‘Birds, beasts and bovines: three cases of pastoralism and wildlife in the USA’, *Pastoralism: Research, Policy and Practice*, 2(12), pp. 1–28.

Hurn, S. (2012) *Humans and Other Animals*. London: Pluto Press.

Hurn, S. (2015) ‘Baboon Cosmopolitanism: More-Than-Human Moralities in a Multispecies Community’, in Nagai, K. et al. (eds) *Cosmopolitan Animals*.

Hurn, S. (ed.) (2016) *Anthropology and Cryptozoology: Exploring Encounters with Mysterious Creatures*. Routledge.

Hutan (2021). Available at: https://www.hutan.org.my/our-work/elephants/.

Igoe, J. (2006) ‘Measuring the Costs and Benefits of Conservation to Local Communities’, *Journal of Ecological Anthropology*, 10(1), pp. 72–77.

Imenda, S. (2014) ‘Is There a Conceptual Difference between Theoretical and Conceptual Frameworks?’, *Journal of Social Sciences*, 38(2), pp. 185–195.

Ingold, T. (1980) *Hunters, Pastoralists, and Ranchers*. Cambridge University Press.

Ingold, T. (1986) ‘Reindeer Economies: And the Origins of Pastoralism’, *Anthropology Today*, 2(4), pp. 5–10.

Ingold, T. (1996) ‘Hunting and gathering as ways of perceiving the environment’, in *Redefining Nature: Ecology, Culture and Domestication*. Routledge, pp. 117–155.

IUCN SSC Antelope Specialist Group, I. (2016) ‘*Connochaetes taurinus’*, *The IUCN Red List of Threatened Species*.

Jacob, M. O., Farah, K. O. and Ekaya, W. N. (2004) ‘Indigenous Knowledge: The Basis of The Maasai Ethnoveterinary Diagnostic Skills’, *Journal of Human Ecology*, 16(1), pp. 43–48.

Johnstone, B. (2016) ‘“Oral versions of personal experience”: Labovian narrative analysis and its uptake’, *Journal of Sociolinguistics*, 20(4), pp. 542–560.

Jones, M. (2022) *WellBeing News*. The UK Badger Cull: “Lies, Damned Lies and Statistics”’, *Wellbeing News*, 4(5).

Jori, F. and Etter, E. (2016) ‘Transmission of foot and mouth disease at the wildlife/livestock interface of the Kruger National Park, South Africa: Can the risk be mitigated?’, *Preventive Veterinary Medicine*, 126, pp. 19–29.

Kairu-Wanyoike, S. W. *et al.* (2014) ‘Control of contagious bovine pleuropneumonia: Knowledge, attitudes, perceptions and practices in Narok district of Kenya’, *Preventive Veterinary Medicine*, 115, pp. 143–156.

Kairu-Wanyoike, S. W. *et al.* (2014) ‘Willingness to pay for contagious bovine pleuropneumonia vaccination in Narok South District of Kenya’, *Preventive Veterinary Medicine*, 115, pp. 130–142.

Kamilar, J. M. (2006) ‘Geographic Variation in Savanna Baboon (*Papio*) Ecology and its Taxonomic and Evolutionary Implications’, in Kamilar, J. M. and Fleagle, J. (eds) *Primate Biogeography*.

Kansky, R., Kidd, M. and Knight, A. T. (2016) ‘A wildlife tolerance model and case study for understanding human wildlife conflicts’, *Biological Conservation*, 201(July), pp. 137–145.

Keesing, F. (2000) ‘Cryptic Consumers and the Ecology of an African Savanna’, *BioScience*, 50(3), p. 205.

Khumalo, K. E. and Yung, L. A. (2015) ‘Women, human-wildlife conflict, and CBNRM: Hidden impacts and vulnerabilities in Kwandu Conservancy, Namibia’, *Conservation and Society*, 13(3), pp. 232–243.

Kiage, L. M. (2013) ‘Perspectives on the assumed causes of land degradation in the rangelands of Sub-Saharan Africa’, *Progress in Physical Geography*, 37(5), pp. 664–684.

Kideghesho, J. R. (2008) ‘Co-existence between the traditional societies and wildlife in western Serengeti, Tanzania: Its relevancy in contemporary wildlife conservation efforts’, *Biodiversity and Conservation*, 17, pp. 1861–1881.

Kiik, L. (2018) ‘Wild-ing the Ethnography of Conservation: Writing Nature’s Value and Agency In’, *Anthropological Forum*, 28(3), pp. 217–235.

Kiik, L. (2019) ‘Conservationland: Toward the anthropology of professionals in global nature conservation’, *Critique of Anthropology*, 39(4), pp. 391–419.
Killion, A. K. *et al.* (2019) ‘Tracking a half century of media reporting on gray wolves’, *Conservation Biology*.

Killion, A. K., Melvin, T., Lindquist, E., & Carter, N. H. (2019). Tracking a half century of media reporting on gray wolves. *Conservation Biology*.

Kilungu, H. *et al.* (2017) ‘Climate Change Threatens Major Tourist Attractions and Tourism in Serengeti National Park, Tanzania’, in Leal Filho, W. et al. (eds) *Climate Change Adaptation in Africa*, pp. 375–392.

Kim, J. J. *et al.* (2021) ‘Digitally shaped ethnographic relationships during a global pandemic and beyond’, *Qualitative Research*, 0(0), pp. 1–16.

Kimaro, E. G. *et al.* (2017) ‘Seasonal occurrence of *Theileria parva* infection and management practices amongst Maasai pastoralist communities in Monduli District, Northern Tanzania’, *Veterinary Parasitology*, 246, pp. 43–52.

Kimaro, E. G. *et al.* (2018) ‘Occurrence of trypanosome infections in cattle in relation to season, livestock movement and management practices of Maasai pastoralists in Northern Tanzania’, *Veterinary Parasitology: Regional Studies and Reports*, 12, pp. 91–98.

King, L. E. (2009) ‘Bees help protect crops from damage by elephants in Kenya’, *Beecraft*, (September).

King, L. E. (2015) ‘Using honey bees to save elephants’, *Biological Sciences Review*, (September), pp. 16–19.

King, L. E. and Raja, N. (2016) ‘Busy and buzzing on the frontline of human-elephant conflict’, *Swara*, pp. 40–43.

King, L. E. *et al.* (2009) ‘Beehive fence deters crop-raiding elephants’, *African Journal of Ecology*, 47, pp. 131–137.

King, L. E. *et al.* (2010) ‘Bee threat elicits alarm call in African elephants’, *PLoS ONE*, 5(4).

King, L. E. *et al.* (2017) ‘Beehive fences as a multidimensional conflict-mitigation tool for farmers coexisting with elephants’, *Conservation Biology*, 00(0), pp. 1–10.

King, L. E., Douglas-Hamilton, I. and Vollrath, F. (2007) ‘African elephants run from the sound of disturbed bees’, *Current Biology*, 17(19).

King, L. E., Douglas-Hamilton, I. and Vollrath, F. (2011) ‘Beehive fences as effective deterrents for crop-raiding elephants: field trials in northern Kenya’, *African Journal of Ecology*.

Kingdon, J., Butynski, T. M. and De Jong, Y. (2008) ‘*Papio anubis*’, *The IUCN Red List of Threatened Species*.

Kingdon, J., Butynski, T. M. and De Jong, Y. (2016) ‘*Papio cynocephalus*’, *The IUCN Red List of Threatened Species*.

Kioko, J. *et al.* (2015) 'Ethnoecological knowledge of ticks and treatment of tick-borne diseases among maasai people in northern Tanzania', *Veterinary World*, 8(6), pp. 755–762.

Kioko, J. *et al.* (2015) 'Maasai people and elephants: values and perceptions Human-animal interactions form a central part of many society's existence', *Indian Journal of Traditional Knowledge*, 1(1), pp. 13–19.

Kioko, J., Kiringe, J. and Omondi, P. (2006) 'Human-elephant conflict outlook in the Tsavo-Amboseli ecosystem, Kenya', *Pachyderm*, (41), pp. 53–60.

Kiondo, K. J., Nachihangu, J. and Mgumia, F. (2019) 'Drivers of Conflict between Pastoralists and Wildlife Conservation Authority: A Case of Muhesi Game Reserve', *Asian Research Journal of Arts & Social Sciences*, 9(1), pp. 1–16.

Kirchherr, J. and Charles, K. (2018) 'Enhancing the sample diversity of snowball samples: Recommendations from a research project on anti-dam movements in Southeast Asia', *PLoS ONE*, 13(8), pp. 1–17.

Kiringe, J. and Omondi, P. (2006) 'Human-elephant conflict outlook in the Tsavo-Amboseli ecosystem, Kenya', *Pachyderm*, (41), pp. 53–60.

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(5), pp. 422–432.

Kleinsasser, A. M. (2000) 'Researchers, reflexivity, and good data: Writing to unlearn', *Theory into Practice*, 39(3), pp. 155–162.

Klumpp, D. and Kratz, C. (1993) 'Aesthetics, Expertise, and Ethnicity', in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 195–222.

Knapp, E. J. *et al.* (2010) 'A tale of three villages: Choosing an effective method for assessing poaching levels in western Serengeti, Tanzania', *Oryx*, 44(2), pp. 178–184.

Knight, J. (ed.) (2000) *Natural Enemies: People-Wildlife Conflicts in Anthropological Perspective*. Routledge.

Knowles, J. N. and Collet, D. P. (1989) 'Nature as myth, symbol and action: notes towards a historical understanding of development and conservation in Kenyan Maasailand', *Africa: Journal of the International African Institute*, 59(4), pp. 433–460.

Koch, P. L. *et al.* (1995) 'Isotopic tracking of change in diet and habitat use in African elephants', *Science*, pp. 1340–1343.

Kock, R. A. (2005) *What is this Infamous 'Wildlife/Livestock Disease Interface?' A Review of Current Knowledge for the African Continent*, *Conservation and Developmental Interventions at the Wildlife/Livestock Interface*.

Kock, R. A. (2006) 'Rinderpest and Wildlife', in Barrett, T., Pastoret, P.-P., and Taylor, W. (eds) *Rinderpest and Peste des Petits Ruminants*. Elsevier, pp. 143–162.

Kock, R. A. *et al.* (2006) 'Re-infection of wildlife populations with rinderpest virus on the periphery of the Somali ecosystem in East Africa', *Preventive Veterinary Medicine*, 75, pp. 63–80.

Kolowski, J. M. and Holekamp, K. E. (2007) 'Effects of an open refuse pit on space use patterns of spotted hyenas', *African Journal of Ecology*, 46(3), pp. 341–349.

Kolowski, J. M. and Holekamp, K. E. (2009) 'Ecological and anthropogenic influences on space use by spotted hyaenas', *Journal of Zoology*, 277(1), pp. 23–36.

Kolowski, J. M. *et al.* (2007) 'Daily Patterns of Activity in the Spotted Hyena', *Journal of Mammalogy*, 88(4), pp. 1017–1028.

KopeLion (2020) *KopeLion 2020 Impact Report*, *2020*. Available at: https://kopelion.org/wp-content/uploads/2021/05/KopeLion-2020-Impact-Report.pdf.

KopeLion (2021). Available at: https://kopelion.org/.

Korir, J. C. and Ngenoh, E. (2019) 'Factors Influencing the Adaptation Decisions to Impacts of Climate Change among the Maasai Pastoral Community in Narok County, Kenya', *Agricultural Sciences*, 10, pp. 689–705.

Kosmala, M. *et al.* (2016) 'Assessing data quality in citizen science', *Frontiers in Ecology and the Environment*, 14(10), pp. 551–560.

Kothari, C. R. (2004) *Research Methodology: Methods and Techniques*.Koudenoukpo, J. B. and Ferreira de Souza Dias, B. (2016) *State of Biodiversity on Africa*. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/9944/Biodiversity_Review_AFRICA.pdf?sequence=1&isAllowed=y.

Kozinets, R. (2009) *Netnography: Doing Ethnographic Research Online*. SAGE Publications.

Krebs, J. R. *et al.* (1998) 'Badgers and Bovine TB: Conflicts between Conservation and Health', *Science*, 279(5352), pp. 817–818.

Kruuk, H. (1972) *The Spotted Hyena*. Echo Point Books and Media.

Kullenberg, C. and Kasperowski, D. (2016) ‘What is citizen science? - A scientometric meta-analysis’, *PLoS ONE*, 11(1), pp. 1–16.

Kuriyan, R. (2004) *Linking local perceptions of elephants and conservation: Samburu pastoralists in northern Kenya*. Available at: https://cloudfront.escholarship.org/dist/prd/content/qt1wf778kk/qt1wf778kk.pdf.

Lado, C. (1992) ‘Problems of wildlife management and land use in Kenya’, *Land Use Policy*, pp. 169–184.

Langer, R. and Beckman, S. C. (2005) ‘Sensitive research topics: Netnography revisited’, *Qualitative Market Research*, 8(2), pp. 189–203.

Lankester, F. and Davis, A. (2016) ‘Pastoralism and wildlife: Historical and current perspectives in the East African rangelands of Kenya and Tanzania’, *Rev. Sci. Tech. Off. Int. Epiz.*, 35(2), pp. 473–484.

Lankester, F. *et al.* (2015) ‘Alcelaphine herpesvirus-1 (malignant catarrhal fever virus) in wildebeest placenta: Genetic variation of ORF50 and A9.5 alleles’, *PLoS ONE*, 10(5), pp. 1–14.

Lankester, F. *et al.* (2015) ‘The economic impact of malignant catarrhal fever on pastoralist livelihoods’, *PLoS ONE*, 10(1), pp. 1–21.

Lankester, F. *et al.* (2016) ‘A field vaccine trial in Tanzania demonstrates partial protection against malignant catarrhal fever in cattle’, *Vaccine*, 34(6), pp. 831–838.

Lanjouw, A. (2021) ‘De-colonizing conservation in a global world’, *American Journal of Primatology*, 83, pp. 1–7.

Lansing, S. W. *et al.* (2009) ‘Taphonomic and zooarchaeological implications of spotted hyena (*Crocuta crocuta*) bone accumulations in Kenya: a modern behavioral ecological approach’, *Paleobiology*, 35(2), pp. 289–309.

Lapidot-Lefler, N. and Barak, A. (2012) ‘Effects of anonymity, invisibility, and lack of eye-contact on toxic online disinhibition’, *Computers in Human Behavior*, 28, pp. 434–443.

Larkin, L. R. (2014) ‘Human-Wildlife Conflict in Maasai Mara National Reserve: Demonstrating the Need for an International Framework on Wildlife-Based Tourism’, *Journal of International Wildlife Law and Policy*, 17(1–2), pp. 1–31.

Laudati, A. (2010) ‘Ecotourism: The modern predator? implications of gorilla tourism on local livelihoods in Bwindi impenetrable national park, Uganda’, *Environment and Planning D: Society and Space*, 28, pp. 726–743.

Lea, S. E. G. *et al.* (2020) ‘Behavioral flexibility: A review, a model, and some exploratory tests’, *Learning and Behavior*, 48, pp. 173–187.

Leal Filho, W. *et al.* (2017) ‘Climate Change Responses among the Maasai Community in Kenya’, *Climate Change*, 145(1–2), pp. 71–83.

Lederman, N. G. and Lederman, J. S. (2015) ‘What Is A Theoretical Framework? A Practical Answer’, *Journal of Science Teacher Education*, 26, pp. 593–597.

Lee, P. C. and Priston, N. E. C. (2005) ‘Human Attitudes to Primates: Perceptions of Pets, Conflict, and Consequences for Primate Conservation’, *Commensalism and Conflict: The Human-Primate Interface*.

Leech, B. L. (2002) ‘Asking questions: Techniques for semi-structured interviews’, *PS - Political Science and Politics*, 35(4), pp. 665–668.

Lees, S. H. and Bates, D. G. (1974) ‘The Origins of Specialized Nomadic Pastoralism: A Systemic Model’, *American Antiquity*, 39(2), pp. 187–193.

Lewis, A. L., Baird, T. D. and Sorice, M. G. (2016) ‘Mobile Phone Use and Human–Wildlife Conflict in Northern Tanzania’, *Environmental Management*, 58(1), pp. 117–129.

Lewis, D. (1973) ‘Anthropology and Colonialism’, *Current Anthropology*, 14(5), pp. 581–602.

Lewis, E. A. (1943) ‘East Coast Fever and the African Buffalo, the Eland and the Bushbuck’, *The East African Agricultural Journal*, 9(2), pp. 90–92.

Lion Guardians (2021). Available at: http://lionguardians.org/.

Lichtenfeld, L. L., Trout, C. and Kisimir, E. L. (2015) ‘Evidence-based conservation: predator-proof bomas protect livestock and lions’, *Biodiversity Conservation*, 24(3), pp. 483–491.

Litchfield, C. A. (2008) ‘Responsible Tourism: A Conservation Tool or Conservation Threat?’, *Conservation in the 21st Century: Gorillas as a Case Study*, pp. 107–127.

Little, P. D. (1996) ‘Pastoralism, biodiversity, and the shaping of savanna landscapes in East Africa’, *Africa*, 66(1), pp. 37–51.

Little, P. D. (1998) ‘Maasai Identity on the Periphery’, *American Anthropologist*, 100(2), pp. 444–457.

Loarie, S. R., Aarde, R. J. Van and Pimm, S. L. (2009) ‘Fences and artificial water affect African savannah elephant movement patterns’, *Biological Conservation*, 142(12), pp. 3086–3098.

Longden, L. (2014) ‘Online disinhibition: Heightened potential for professional conduct issues among clergy in the Church of England?’, *Journal of Beliefs and Values*, 35(1), pp. 1–9.

López-Bao, J. V., Chapron, G. and Treves, A. (2017) ‘The Achilles heel of participatory conservation’, *Biological Conservation*, 212, pp. 139–143.

Losey, R. J. *et al.* (2020) ‘Domestication as Enskilment: Harnessing Reindeer in Arctic Siberia’, *Journal of Archaeological Method and Theory*.

Luh Sin, H. (2015) ‘“You’re Not Doing Work, You’re on Facebook!”: Ethics of Encountering the Field Through Social Media’, *Professional Geographer*, 67(4), pp. 676–685.

Lune, H. and Berg, B. L. (2017) *Methods for the Social Sciences Global Edition*.Lunnay, B. *et al.* (2014) ‘Ethical use of social media to facilitate qualitative research’, *Qualitative Health Research*, pp. 1–11.

Lunnay, B., Borlagdan, J., McNaughton, D., & Ward, P. (2014). Ethical use of social media to facilitate qualitative research. *Qualitative Health Research*, 1–11.

Lyamuya, R. D. *et al.* (2014) ‘Human-carnivore conflict over livestock in the eastern part of the Serengeti ecosystem, with a particular focus on the African wild dog *Lycaon pictus*’, *Oryx*, 48(3), pp. 378–384.

Lyamuya, R. D. *et al.* (2016) ‘Pastoralist herding efficiency in dealing with carnivore-livestock conflicts in the eastern Serengeti, Tanzania’, *International Journal of Biodiversity Science, Ecosystem Services and Management*, 12(3), pp. 202–211.

Mabele, M. B., Sandroni, L. T. and Collins, Y. A. (2021) ‘What Do We Mean By Decolonizing Conservation? A Response to Lanjouw 2021’.

Machila, N. *et al.* (2003) ‘Cattle owners’ perceptions of African bovine trypanosomiasis and its control in Busia and Kwale Districts of Kenya’, *Acta Tropica*, 86, pp. 25–34.

Machugh, D. E. *et al.* (1997) ‘Microsatellite DNA Variation and the Evolution, Domestication and Phylogeography of Taurine and Zebu Cattle (Bos taurus and Bos indicus)’, *Genetics*, 146, pp. 1071–1086.

Mackenzie, C. A. and Ahabyona, P. (2012) ‘Elephants in the garden: Financial and social costs of crop raiding’, *Ecological Economics*, 75, pp. 72–82.

Maclennan, S. D. *et al.* (2009) ‘Evaluation of a compensation scheme to bring about pastoralist tolerance of lions’, *Biological Conservation*, 142(11), pp. 2419–2427.

Madden, F. (2004) ‘Creating coexistence between humans and wildlife: Global perspectives on local efforts to address Human–Wildlife conflict’, *Human Dimensions of Wildlife*, 9(4), pp. 247–257.

Madden, F. M. (2008) ‘The growing conflict between humans and wildlife: Law and policy as contributing and mitigating factors’, *Journal of International Wildlife Law and Policy*, 11, pp. 189–206.

Magee, D. A., MacHugh, D. E. and Edwards, C. J. (2014) ‘Interrogation of modern and ancient genomes reveals the complex domestic history of cattle’, *Animal Frontiers*, 4(3), pp. 7–22.

Mahony, J. (2020) *Modelling the impact of climate change on the Wildebeest of the Serengeti-Mara Ecosystem*.

Maina, S. (2020). *These Are The Most Popular Social Media Platforms in Kenya*. [online] Gadgets Africa. Available at: https://gadgets-africa.com/2020/02/26/popular-social-media-platforms-kenya/.

Maisels, F. *et al.* (2018) ‘Gorilla gorilla ssp. gorilla’, *The IUCN Red List of Threatened Species*.

Manfreda, K.L., Batagelj, Z. and Vehovar, V. (2002) “Design of web survey questionnaires: Three basic experiments,” *Journal of Computer-Mediated Communication*, 7(3).

Marchini, S. (2014) ‘Who’s in Conflict with Whom? Human Dimensions of the Conflicts Involving Wildlife’, *Applied Ecology and Human Dimensions in Biological Conservation*, (March 2014).

Margules, C. *et al.* (2020) ‘Transdisciplinary science for improved conservation outcomes’, *Environmental Conservation*.

Maria van de Vijver, C. A. D. (1999) *Fire and Life in Tarangire Effects of Burning and Herbivory*.

Marker, L. *et al.* (2020) ‘Twenty-five years of livestock guarding dog use across Namibian farmlands’, *Journal of Vertebrate Biology*, 69(3).

Marshall, F. (1990) ‘Origins of Specialized Pastoral Production in East Africa’, *American Anthropologist*, 92(4), pp. 873–894.

Marshall, F. and Hildebrand, E. (2002) ‘Cattle Before Crops: The Beginnings of Food Production in Africa’, *Journal of World Prehistory*, 16(2), pp. 99–143.

Marshall, F. *et al.* (2018) 'Ancient herders enriched and restructured African grasslands', *Nature*, 561(7723), pp. 387–390.

Mascia, M. B. *et al.* (2003) 'Conservation and the social sciences', *Conservation Biology*, 17(3), pp. 649–650.

Masiga, W. N. and Domenech, J. (1995) 'Overview and epidemiology of contagious bovine pleuropneumonia in Africa', *Revue scientifique et technique (International Office of Epizootics)*, 14(3), pp. 611–630.

Mason, T. H. E. *et al.* (2014) 'Predicting potential responses to future climate in an alpine ungulate: Interspecific interactions exceed climate effects', *Global Change Biology*, 20, pp. 3872–3882.

Matarrita-Cascante, D., Sene-Harper, A. and Ruyle, L. (2019) 'A holistic framework for participatory conservation approaches', *International Journal of Sustainable Development and World Ecology*, 26(6), pp. 484–494.

Matheka, R. (2005) 'Antecedents to the community wildlife conservation programme in Kenya, 1946-1964', *Environment and History*, 11(3), pp. 239–267.

Matheka, R. M. (2008a) 'Decolonisation and wildlife conservation in Kenya, 1958-68', *Journal of Imperial and Commonwealth History*, 36(4), pp. 615–639.

Matheka, R. M. (2008b) 'The International Dimension of the Politics of Wildlife Conservation in Kenya, 1958–1968', *Journal of Eastern African Studies*, 2(1), pp. 112–133.

Mathevet, R. and Marty, P. (2020) 'Can Environmental and Conser-vation Research Do without Social Scientists? A Comment on Victoria Y. Martin (2019)', *BioScience*, 70(4), p. 277.

Maurice, H. *et al.* (2005) 'The occurrence of encephalomyocarditis virus (EMCV) in European pigs from 1990 to 2001', *Epidemiology and Infection*, 133(3), pp. 547–557.

Maurice, H. *et al.* (2007) 'Factors related to the incidence of clinical encephalomyocarditis virus (EMCV) infection on Belgian pig farms', *Preventive Veterinary Medicine*, 78(1), pp. 24–34.

Maye, D. and Chan, K. W. R. (2020) 'On-farm biosecurity in livestock production: Farmer behaviour, cultural identities and practices of care', *Emerging Topics in Life Sciences*, 4(5), pp. 521–530.

McCabe, J. T. (1997) ‘Risk and Uncertainty Among the Maasai of the Ngorongoro Conservation Area In Tanzania: A Case Study in Economic Change’, *Nomadic Peoples*, 1(1), pp. 54–65.

McCabe, J. T. (2004) *Cattle Bring Us to Our Enemies: Turkana Ecology, Politics, and Raiding in a Disequilibrium System*.

McCabe, J. T., Leslie, P. W. and DeLuca, L. (2010) ‘Adopting cultivation to remain pastoralists: The diversification of Maasai livelihoods in northern Tanzania’, *Human Ecology*, 38(3), pp. 321–334.

McComb, K. *et al.* (2000) ‘Unusually extensive networks of vocal recognition in African elephants’, *Animal Behaviour*, 59(6), pp. 1103–1109.

Mccomb, K. *et al.* (2001) ‘Matriarchs as Repositories of Social Knowledge in African Elephants’, *Science*, 292(April).

McComb, K. *et al.* (2003) ‘Long-distance communication of acoustic cues to social identity in African elephants’, *Animal Behaviour*, 65(2), pp. 317–329.

McComb, K. *et al.* (2011) ‘Leadership in elephants: The adaptive value of age’, *Proceedings of the Royal Society B: Biological Sciences*, 278(1722), pp. 3270–3276.

McTavish, E. J. *et al.* (2013) ‘New World cattle show ancestry from multiple independent domestication events’, *Proceedings of the National Academy of Sciences of the United States of America*, 110.

Mead, M. (1928) *Coming of Age in Samoa*.

Melubo, K. (2020) ‘Why are wildlife on the Maasai doorsteps? Insights from the Maasai of Tanzania’, *AlterNative*, 16(3), pp. 180–192.

Menzies, F. D. *et al.* (2021) ‘Test and vaccinate or remove: Methodology and preliminary results from a badger intervention research project’, *Veterinary Record*, 189, pp. 1–12.

Messmer, T. A. (2000) ‘The emergence of human-wildlife conflict management: turning challenges into opportunities’, *Internation Biodeterioration and Biodegradation*, 45, pp. 97–102.

Michel, A. L. (2002) ‘Implications of Tuberculosis in African Wildlife and Livestock’, *Annals of the New York Academy of Science*, 969, pp. 251–255.

Miguel, E. *et al.* (2017) ‘Drivers of foot-and-mouth disease in cattle at wild/domestic interface: Insights from farmers, buffalo and lions’, *Diversity and Distributions*, 23, pp. 1018–1030.

Miller, R. S., Farnsworth, M. L. and Malmberg, J. L. (2013) ‘Diseases at the livestock-wildlife interface: Status, challenges, and opportunities in the United States’, *Preventive Veterinary Medicine*, 110(2), pp. 119–132.

Miller, Z. D. (2017) ‘The Enduring Use of the Theory of Planned Behavior’, *Human Dimensions of Wildlife*, 22(6), pp. 583–590.

Minteer, B. A. and Miller, T. R. (2010) ‘The New Conservation Debate: Ethical foundations, strategic trade-offs, and policy opportunities’, *Biological Conservation*.

Mishra, C. (2001) *High altitude survival: Conflicts between pastoralism and wildlife in the Trans-Himalaya*. Available at: https://library.wur.nl/WebQuery/wurpubs/fulltext/199100.

Mishra, C. *et al.* (2002) ‘A theoretical analysis of competitive exclusion in a Trans-Himalayan large-herbivore assemblage’, *Animal Conservation*, 5, pp. 251–258.

Mkutu, K. (2001) ‘Pastoralism and conflict in the Horn of Africa’, *African Peace Forum/Safeworld University of Bradford*.

Mlilo, D. *et al.* (2015) ‘Perceptions on malignant catarrhal fever (MCF) by farmers close to Rhodes Matopos National Park, Zimbabwe’, *Internaitonal Journal of Developmental Research*, 5(12), pp. 6314–6319.

Mogensen, N. L., Ogutu, J. O. and 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), pp. 78–87.

Montana, J. *et al.* (2020) ‘The need for improved reflexivity in conservation science’, *Environmental Conservation*, 47, pp. 217–219.

Moon, K. and Blackman, D. (2014) ‘A Guide to Understanding Social Science Research for Natural Scientists’, *Conservation Biology*, 28(5), pp. 1167–1177.

Moon, K. *et al.* (2019) ‘Expanding the role of social science in conservation through an engagement with philosophy, methodology, and methods’, *Methods in Ecology and Evolution*, 10, pp. 294–302.

Moon, K., Adams, V. M. and Cooke, B. (2019) ‘Shared personal reflections on the need to broaden the scope of conservation social science’, *People and Nature*, 1, pp. 426–434.

Moore, L. J. (2017) *Catch and Release*. New York: New York University Press.

Morens, D. M. *et al.* (2011) ‘Global rinderpest eradication: Lessons learned and why humans should celebrate too’, *Journal of Infectious Diseases*, 204, pp. 502–505.

Mponzi, B. P., Lepczyk, C. A. and Kissui, B. M. (2014) ‘Characteristics and distribution of livestock losses caused by wild carnivores in Maasai Steppe of northern Tanzania’, *Human-Wildlife Interactions*, 8(2), pp. 218–227.

Msoffe, F. U. *et al.* (2011) ‘Drivers and impacts of land-use change in the Maasai Steppe of northern Tanzania: An ecological, social and political analysis’, *Journal of Land Use Science*, 6(4), pp. 261–281.

Mtui-Malamsha, N. J. (2009) *Contagious Bovine Pleuropneumonia (CBPP) in the Maasai ecosystem of south-western Kenya: Evaluation of seroprevalence, risk factors and vaccine safety and efficacy*.

Muhumuza, M., Sanders, M. and Balkwill, K. (2013) ‘A theoretical framework for investigating ecological problems associated with biodiversity conservation in national parks: A case of the Rwenzori Mountains National Park, Uganda’, *Open Journal of Ecology*, 3(2), pp. 196–204.

Mullins, G. R., Fidzani, B. and Kolanyane, M. (2006) ‘At the end of the day: The socioeconomic impacts of eradicating contagious bovine pleuropneumonia from Botswana’, *Annals of the New York Academy of Sciences*, 916(1), pp. 333–344.

Mullis, J. (2019) ‘Cryptofiction! Science fiction and the rise of cryptozoology’, *The Paranormal and Popular Culture: A Postmodern Religious Landscape*, pp. 240–252.

Muma, J. B. *et al.* (2006) ‘Prevalence of antibodies to Brucella spp. and individual risk factors of infection in traditional cattle, goats and sheep reared in livestock-wildlife interface areas of Zambia’, *Tropical Animal Health and Production*, 38(3), pp. 195–206.

Muraguri, G. R. *et al.* (1998) ‘Cost analysis of immunisation against East Coast fever on smallholder dairy farms in Kenya’, *Preventive Veterinary Medicine*, 34, pp. 307–316.

Murthy, D. (2008) ‘Digital ethnography: An examination of the use of new technologies for social research’, *Sociology*, 42, pp. 837–855.

Mushi, E. Z., Rurangirwa, F. R. and Karstad, L. (1981) ‘Shedding of malignant catarrhal fever virus by wildebeest calves’, *Veterinary Microbiology*, 6(4), pp. 281–286.

Muuka, G. *et al.* (2013) ‘Challenges of controlling contagious bovine pleuropneumonia in sub-
Saharan Africa: a Zambian perspective’, *Tropical Animal Health and Production*, 45, pp. 9–15.

Nader, L., 1972. *Up the Anthropologist: Perspectives Gained by Studying Up*. Distributed by ERIC Clearinghouse.

Naessens, J., Teale, A. J. and Sileghem, M. (2002) ‘Identification of mechanisms of natural resistance to African trypanosomiasis in cattle’, *Veterinary Immunology and Immunopathology*, 87, pp. 187–194.

Nakamichi, M. (1999) ‘Spontaneous use of sticks as tools by captive gorillas (*Gorilla gorilla gorilla)*’, *Primates*, 40(3), pp. 487–498.

Nández, G. and Borrego, Á. (2013) ‘Use of social networks for academic purposes: A case study’, *Electronic Library*, 31(6), pp. 781–791.

Nardi, PM 2013, Doing Survey Research, Routledge, London.

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 Woodroffe, R., Thirgood, S., and Rabinowitz, A. (eds) *People and Wildlife: Conflict or Coexistence?*

Naughton-Treves, L., Grossberg, R. and Treves, A. (2003) ‘Paying for Tolerance: Rural Citizens’ Attitudes toward Wolf Depredation and Compensation’, *Conservation Biology*, 17(6), pp. 1500–1511.

Naylor, R. *et al.* (2014) ‘Researching controversial and sensitive issues: using visual vignettes to explore farmers’ attitudes towards the control of bovine tuberculosis in England’, *Area*, 46(3), pp. 285–293.

Nelson, A., Bidwell, P. and Sillero-zubiri, C. (2003) ‘A review of human-elephant conflict management strategies’, *Wildlife Conservation*, (January 2003), p. 27.

Neuendorf, K. A. (2019) ‘Content analysis and thematic analysis’, in Brough, P. (ed.) *Research methods for applied psychologists: Design, analysis, and reporting*, pp. 211–223.

Newsinger, J. (1981) ‘Guilford Press Revolt and Repression in Kenya: The "Mau Mau" Rebellion, 1952-1960’, *Science and Society*, 45(2), pp. 159–185.

Newton, E. (1993) ‘My Best Informant’s Dress: The Erotic Equation in Fieldwork’, *Cultural Anthropology*, 8(1), pp. 3–23.

Ngongolo, K. *et al.* (2020) ‘Influence of Land Cover and Host Species on Trypanosome Infection in Cattle and its Socio-Economic Impacts to Pastoralists of the Maasai Steppe, Tanzania’, *Journal of Infectious Diseases and Epidemiology*, 6(1), pp. 1–12.

Niamir-Fuller, M. *et al.* (2012) ‘Co-existence of wildlife and pastoralism on extensive rangelands: competition or compatibility?’, *Pastoralism: Research, Policy and Practice*, 2(8), pp. 1–14.

Niemiec, R. M. *et al.* (2021) ‘Integrating social science into conservation planning’, *Biological Conservation*, 262.

Nnko, H. J. *et al.* (2017) ‘Pastoralists’ Vulnerability to Trypanosomiasis in Maasai Steppe’, *EcoHealth*.

Nosek, B. A., Banaji, M. R. and Greenwald, A. G. (2002) ‘E-Research: Ethics, Security, Design, and Control in Psychological Research on the Internet’, *Journal of Social Issues*, 58(1), pp. 161–176.

Nthiwa, D. *et al.* (2019) ‘A participatory epidemiological study of major cattle diseases amongst Maasai pastoralists living in wildlife-livestock interfaces in Maasai Mara, Kenya’, *Tropical Animal Health and Production*, 51, pp. 1097–1103.

Nyangito, H. O. *et al.* (1996) ‘Economic impacts of East Coast Fever immunization on smallholder farms, Kenya: a simulation analysis’, *Agricultural Economics*, 13, pp. 163–177.

Nyhus, P. J. (2016) *Human–Wildlife Conflict and Coexistence*, *Annual Review of Environment and Resources*.

Ofcansky, T. P. (1981) ‘The 1889-97 Rinderpest Epidemic and the Rise of the British and German Colonialism in Eastern and Southern Africa’, *Journal of African Studies*, 8(1), pp. 31–38.

Ogutu, J. O. *et al.* (2008) ‘Rainfall influences on ungulate population abundance in the Mara-Serengeti ecosystem’, *Journal of Animal Ecology*, 77(4), pp. 814–829.

Ogutu, J. O., Bhola, N. and Reid, R. (2005) ‘The effects of pastoralism and protection on the density and distribution of carnivores and their prey in the Mara ecosystem of Kenya’, *Journal of Zoology*, 265(3), pp. 281–293.

Ogutu, J. O., Piepho, H. P. and Dublin, H. T. (2014) ‘Reproductive seasonality in African ungulates in relation to rainfall’, *Wildlife Research*, 41(4), pp. 323–342.

Okech, R. (2010) ‘Wildlife-community conflicts in conservation areas in Kenya’, *African Journal on Conflict Resolution*, 10(2), pp. 65–80.

Okello, M. M. (2005) ‘Land use changes and human–wildlife conflicts in the amboseli area, kenya’, *Human Dimensions of Wildlife*, 10(1), pp. 19–28.

Onono, J. O., Wieland, B. and Rushton, J. (2014) ‘Estimation of impact of contagious bovine pleuropneumonia on pastoralists in Kenya’, *Preventive Veterinary Medicine*, 115, pp. 122–129.

Ormerod, W. E. (1976) ‘Ecological Effect of Control of African Trypanosomiasis’, *Science*, 191(4229), pp. 815–821.

Osano, P. (2011) ‘Life at the Crossroads: How Climate Change Threatens the Existence of the Maasai’, *Backgrounder*, 9.

Osborn, F. V. (2004) ‘Seasonal variation of feeding patterns and food selection by crop-raiding elephants in Zimbabwe’, *African Journal of Ecology*, 42(4), pp. 322–327.

Otieno, D. O. and Matoke, V. B. (2014) ‘Social Media as tool for Conducting Academic Research’, *International Journal of Advanced Research in Computer Science and Software Engineering*, 4(1), pp. 962–967.

Owaga, M. L. (1975) ‘The feeding ecology of wildebeest and zebra in Athi-Kaputei plains’, *East African Wildlife Journal*, 13(3–4), pp. 375–383.

Pahad, G. (2010) *Social Behaviour and Crop Raiding in Chacma Baboons of the Suikerbosrand Nature Reserve*. University of Witwatersrand.

Pampuro, A. (2019) *Humans Putting the Squeeze on Serengeti Ecosystem*, *Courtehouse News Service*.

Pangle, W. M. and Holekamp, K. E. (2010) ‘Lethal and nonlethal anthropogenic effects on spotted hyenas in the Masai Mara National Reserve’, *Journal of Mammalogy*, 91(1), pp. 154–164.

Patterson, F. G. P. and Cohn, R. H. (1990) ‘Language acquisition by a lowland gorilla: Koko’s first ten years of vocabulary development’, WORD, 41(2), pp. 97–143.

Peace, A. (2015) ‘Shark attack! A cultural approach’, *Anthropology Today*, 31(5), pp. 3–7.

Pearsall, W. H. (1956) *Report on an Ecological Survey of the Serengeti National Park Tanganyika*, *Fauna Preservation Society*.

Penzhorn, B. L., Robbertse, P. J. and Olivier, M. C. (1974) ‘The influence of the African Elephant on the vegetation of the Addo Elephant National Park’, *Koedoe*.

Perera, B. M. A. O. (2009) ‘The Human-Elephant Conflict: A Review of Current Status and Mitigation Methods’, *Gajaha*, 30, pp. 41–52.

Peterson, M. N. *et al.* (2010) ‘Rearticulating the myth of human-wildlife conflict’, *Conservation Letters*, 3(2), pp. 74–82.

Phang, S. C. *et al.* (2019) ‘Fishing for conservation of freshwater tropical fishes in the Anthropocene’, *Aquatic Conservation: Marine and Freshwater Ecosystems*, pp. 1–13.

Phyllis, C. L. and Moss, C. J. (1986) ‘Early maternal investment in male and female African elephant calves’, *Behavioral Ecology and Sociobiology*, 18, pp. 353–361.

Pinter-Wollman, N., Isbell, L. A. and Hart, L. A. (2009) ‘The relationship between social behaviour and habitat familiarity in African elephants (*Loxodonta africana*)’, *Proceedings of the Royal Society B: Biological Sciences*, 276(1659), pp. 1009–1014.

Pitt, D. *et al.* (2019) ‘Domestication of cattle: Two or three events?’, *Evolutionary Applications*, 12, pp. 123–136.

Plowright, W. (1986) ‘Malignant catarrhal fever’, *Scientific and Technical Review of the Office International des Epizooties*, 5(4), pp. 897–918.

Plumptre, A. J. *et al.* (2012) ‘The current status of gorillas and threats to their existence at the beginning of a new millenium’, in *The conservation status of gorillas*.

Pochron, S. T. (2000) ‘The core dry-season diet of yellow baboons (*Papio hamadryas cynocephalus*) in Ruaha National Park, Tanzania’, *Folia Primatologica*, 71(5), pp. 346–349.

Pokines, J. T. and Peterhans, J. C. K. (2007) ‘Spotted hyena (*Crocuta crocuta*) den use and taphonomy in the Masai Mara National Reserve, Kenya’, *Journal of Archaeological Science*, 34(11), pp. 1914–1931.

Poole, J. H. (1989) ‘Announcing intent: the aggressive state of musth in African elephants’, *Animal Behavior*, 37, pp. 140–152.

Poole, R. M. (2015) ‘Heartbreak on the Serengeti’, *Symphony in the Flint Hills Field Journal*.

Post, D. G. (1981) ‘Activity Patterns of Yellow Baboons (*Papio cynocephalus*) in the Amboseli National Park, Kenya’, *Animal Behaviour*, 29, pp. 357–374.

Post, D. G. (1982) ‘Feeding behavior of yellow baboons (*Papio cynocephalusin*) the Amboseli National Park, Kenya’, *International Journal of Primatology*, 3(4), pp. 403–430.

Potgieter, G. C. *et al.* (2013) ‘Why Namibian Farmers Are Satisfied With the Performance of Their Livestock Guarding Dogs’, *Human Dimensions of Wildlife*, 18(6), pp. 403–415.

Pressey, R. L., Weeks, R. and Gurney, G. G. (2017) ‘From displacement activities to evidence-informed decisions in conservation’, *Biological Conservation*, 212, pp. 337–348.

Price, S. J. *et al.* (2019) ‘Effects of historic and projected climate change on the range and impacts of an emerging wildlife disease’, *Global Change Biology*, 25(8).

Prins, H. H. t. (1992) ‘The Pastoral Road to Extinction: Competition Between Wildlife and Traditional Pastoralism in East Africa’, *Environmental Conservation*, 19(2), pp. 117–123.

Project Piaba (2021). Available at: https://projectpiaba.org/who-we-are/.

ProMed (2019) ‘Undiagnosed pneumonia - China (HU)’.

Rabionet, S. E. (2011) ‘How I learned to design and conduct semi-structured interviews: An ongoing and continuous journey’, *Qualitative Report*, 16(2), pp. 563–566.

Ranciaro, A. *et al.* (2014) ‘Genetic origins of lactase persistence and the spread of pastoralism in africa’, *American Journal of Human Genetics*, 94, pp. 496–510.

Rasmussen, L. E. L. and Schulte, B. A. (1998) ‘Chemical signals in the reproduction of Asian (Elephas maximus) and African (*Loxodonta Africana*) elephants’, *Animal Reproduction Science*, 53(1–4), pp. 19–34.

Reddacliff, L. A. *et al.* (1997) ‘Encephalomyocarditis Virus Infections in an Australian Zoo’, *Journal of Zoo and Wildlife Medicine*, 28(2), pp. 153–157.

Redford, K. H. (2011) ‘Misreading the conservation landscape’, *Oryx*, 45(3), pp. 324–330.

Redpath, S. M. *et al.* (2015) ‘An introduction to conservation conflicts’, in *Conflicts in Conservation: Navigating Towards Solutions*, pp. 3–18.

Reed, D. N. *et al.* (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(4), pp. 770–782.

Reeves, S., Kuper, A. and Hodges, B. D. (2008) ‘Qualitative research methodologies: ethnography’, *British Medical Journal*, 337(7668), pp. 512–514.

Reteti Elephant Sanctuary (2021). Available at: https://www.reteti.org/in-the-news.

Rhyan, J. C. and Spraker, T. R. (2010) ‘Emergence of diseases from wildlife reservoirs’, *Veterinary Pathology*, 47(1), pp. 34–39.

Riginos, C. and Young, T. P. (2007) ‘Positive and negative effects of grass, cattle, and wild herbivores on Acacia saplings in an East African savanna’, *Oecologia*, 153(4), pp. 985–995.

Ritvo, H. (2007) ‘On the Animal Turn’, *Daedalus*, pp. 118–122.

Robards, B. (2013) ‘Friending Participants: Managing the Researcher-Participant Relationship on Social Network Sites’, *Young*, 21, pp. 217–235.

Robbins, M. M. *et al.* (2011) ‘Extreme conservation leads to recovery of the virunga mountain gorillas’, *PLoS ONE*, 6(6).

Rode, K. D. *et al.* (2006) ‘Nutritional ecology of elephants in Kibale National Park, Uganda, and its relationship with crop-raiding behaviour’, *Journal of Tropical Ecology*, 22(4), pp. 441–449.

Roe, K., McConney, A. and Mansfield, C. F. (2014) ‘The role of zoos in modern society—A comparison of zoos’ reported priorities and what visitors believe they should be’, *Anthrozoos*, 27(4), pp. 529–541.

Roeder, P. and Rich, K. (2009) ‘Conquering the Cattle Plague’, in *The global effort to eradicate rinderpest*, pp. 109–116.

Roeder, P. L. (2011) ‘Rinderpest: The end of cattle plague’, *Preventive Veterinary Medicine*, 102, pp. 98–106.

Roeder, P., Mariner, J. and Kock, R. (2013) ‘Rinderpest: The veterinary perspective on eradication’, *Philosophical Transactions of the Royal Society B*, 368, pp. 1–12.

Rogei, D. S. (2015) *Impact of Climate Change on Indigenous Peoples’ Livelihoods: A Case of Loodokilani Maasai, Kajiado County*.

Rogers, M. E. *et al.* (2004) ‘Western gorilla diet: A synthesis from six sites’, *American Journal of Primatology*, 64(2), pp. 173–192.

Rose, L. M. (2000) ‘Behavioral Sampling in the Field: Continuous Focal versus Focal Interval Sampling’, *Behaviour*, 137(2), pp. 153–180.

Ross, K. (2017) ‘Making empowering choices: How methodology matters for empowering research participants’, *Forum Qualitative Social Research*, 18(3).

Rothman, J. M. *et al.* (2007) ‘Nutritional composition of the diet of the gorilla (*Gorilla beringei*): A comparison between two montane habitats’, *Journal of Tropical Ecology*, 23(6), pp. 673–682.

Rotich, L. K. *et al.* (2019) ‘Climate change effects on natural resources availability and tourism sustainability in Maasai Mara National Game Reserve, Kenya’, *African Journal of Hospitality, Tourism and Leisure*, 8(5), pp. 1–15.

Rubino, E. C. *et al.* (2020) ‘Viewing Bornean human-elephant conflicts through an environmental justice lens’, *Human-Wildlife Interactions*, 14(3), pp. 487–504.

Rust, N. A. *et al.* (2017) ‘Quantity Does Not Always Mean Quality: The Importance of Qualitative Social Science in Conservation Research’, *Society and Natural Resources*.

Rweyemamu, M. M. *et al.* (1974) ‘Malignant Catarrhal Fever Virus in Nasal Secretions of Wildebeest: A Probable Mechanism for Virus Transmission’, *Journal of Wildlife Diseases*, 10, pp. 478–487.

Salzani, C. (2017) ‘From Post-Human to Post-Animal Posthumanism and the “Animal Turn”’, *Lo Sguardo*, 24(II), pp. 97–109.

Sanborn, T. and Jung, J. (2021) ‘Intersecting Social Science and Conservation’, *Frontiers in Marine Science*, 8.

Sandlin, J. A. (2007) ‘Netnography as a consumer education research tool’, *International Journal of Consumer Studies*, 31, pp. 288–294.

Sangren, P. S. (2007) ‘Anthropology of anthropology? Further reflections on reflexivity’, *Anthropology Today*, 23(4), pp. 13–16.

Sankaran, M., Ratnam, J. and Hanan, N. (2008) ‘Woody cover in African savannas: The role of resources, fire and herbivory’, *Global Ecology and Biogeography*, 17(2), pp. 236–245.

Save the Elephants (2021) *Elephants and Bees*. Available at: https://elephantsandbees.com/.

Scantlebury, M. *et al.* (2004) ‘Risk of disease from wildlife reservoirs: Badgers, cattle, and bovine tuberculosis’, *Journal of Dairy Science*, 87(2), pp. 330–339.

Scheu, A. *et al.* (2015) ‘The genetic prehistory of domesticated cattle from their origin to the spread across Europe’, *BMC Genetics*, 16(54), pp. 1–11.

Schneider, B. (1987) ‘The People Make the Place’, *Personnel Psychology*, 40, pp. 437–453.

Schuette, P., Creel, S. and Christianson, D. (2013) ‘Coexistence of African lions, livestock, and people in a landscape with variable human land use and seasonal movements’, *Biological Conservation*, 157, pp. 148–154.

Secretariat of the Convention on Biological Diversity (2020) Global Biodiversity Outlook 5. Montreal.

Seno, S. K. and Shaw, W. W. (2002) ‘Land tenure policies, Maasai traditions, and wildlife conservation in Kenya’, *Society and Natural Resources*, 15(1), pp. 79–88.

Sera-Shriar, E. (2013) ‘What is armchair anthropology? Observational practices in 19th-century British human sciences’, *History of the Human Sciences*, 27(2), pp. 1–15.

Shereen, M. A. *et al.* (2020) ‘COVID-19 infection: origin, transmission, and characteristics of human coronaviruses’, *Journal of Advanced Research*, 24, pp. 91–98.

Shih, T. H. and Fan, X. (2009) ‘Comparing response rates in e-mail and paper surveys: A meta-analysis’, *Educational Research Review*, 4(1), pp. 26–40.

Shine, R. (2011) ‘How can we ensure that conservation policies are based on science, not emotion?’, *Pacific Conservation Biology*, 17(1), pp. 6–10.

Siiriäinen, A., Seitsonen, O. and Laurén, J. (2009) *Pastoralists in the northeastern Mara Plains, Kenya: archaeological investigations of the Pastoral Neolithic and the Pastoral Iron Age*, *Azania: Archaeological Research in Africa*.

Silk, J. B. *et al.* (2017) ‘Female–male relationships influence the form of female–female relationships in olive baboons, *Papio anubis’*, *Animal Behaviour*, 131, pp. 89–98.

Sillero-Zubiri, C. and Switzer, D. (2001) ‘Crop raiding primates: searching for alternative, humane ways to resolve conflict with farmers in Africa’, *People and Wildlife*.

Sillero-Zubiri, C. and Switzer, D. (2001) ‘Crop raiding primates: searching for alternative, humane ways to resolve conflict with farmers in Africa’, *People and Wildlife*, (January 2001), pp. 1–19.

Silvertown, J. (2009) ‘A new dawn for citizen science’, *Trends in Ecology and Evolution*, 24(9), pp. 467–471.

Simon, M. K. and Goes, J. (2020) ‘Developing a Theoretical Framework’, *Completing Your EdD: The Essential Guide to the Doctor of Education*, pp. 113–136.

Simpson, R., Page, K. R. and De Roure, D. (2014) ‘Zooniverse: Observing the world’s largest citizen science platform’, *WWW 2014 Companion - Proceedings of the 23rd International Conference on World Wide Web*, pp. 1049–1054.

Sinclair, A. R. E. *et al.* (2007) ‘Long-term ecosystem dynamics in the serengeti: Lessons for conservation’, *Conservation Biology*, 21(3), pp. 580–590.

Sinclair, A. R. E. *et al.* (2010) ‘Trophic Cascades in African Savanna: Serengeti as a Case Study’, in Terborgh, J. and Estes, J. A. (eds) *Trophic Cascades: Predators, Prey, and the Changing Dynamics of Nature*, pp. 225–274.

Sindiga, I. (1984) ‘Sleeping sickness in Kenya Maasailand’, *Social Science Medicine*, 18(2), pp. 183–187.

Sitati, N. W. and Walpole, M. J. (2006) ‘Assessing farm-based measures for mitigating human-elephant conflict in Transmara District, Kenya’, *Oryx*, 40(3), pp. 279–286.

Sitati, N. W. *et al.* (2003) ‘Predicting spatial aspects of human-elephant conflict’, *Journal of Applied Ecology*, 40(4), pp. 667–677.

Slenning, B. D. (2010) ‘Global climate change and implications for disease emergence’, *Veterinary Pathology*, 47(1), pp. 28–33.

Slotow, R. and Van Dyk, G. (2001) ‘Role of delinquent young “orphan” male elephants in high mortality of white rhinoceros in Pilanesberg National Park, South Africa’, *Koedoe*, pp. 85–94.

Smith, A. B. (1992) ‘Origins and spread of pastoralism in Africa’, *Annual Review of Anthropology*, 21, pp. 125–141.

Smith, A. B. (1992) *Pastoralism in Africa: Origins and Developmental Ecology*.

Smith, A. B. (2006) ‘Origins and Spread of African Pastoralism’, *History Compass*, 4(1), pp. 1–7.

Smith, J. E. *et al.* (2008) ‘Social and ecological determinants of fission-fusion dynamics in the spotted hyaena’, *Animal Behaviour*, 76(3), pp. 619–636.

Smuts, B. (2001) ‘Encounters with Animal Minds’, *Journal of Consciousness Studies*, 8(5–7), pp. 293–309.

Snares to Wares (2021). Available at: https://snarestowares.org/.*Proyecto Tití* (2021). Available at: https://www.proyectotiti.com/en-us/.

Soltis, J. *et al.* (2014) ‘African elephant alarm calls distinguish between threats from humans and bees’, *PLoS ONE*, 9(2).

Soule, M. E. (1985) ‘What is conservation biology?’, *BioScience*, pp. 727–734.

Spear, T. (1993) ‘Being “Maasai” but not “People of Cattle”’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 120–136.

Spencer, P. (1993) ‘Becoming Maasai, Being in Time’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 140–156.

Spencer, P. and Waller, R. (2017) ‘The Maasai age system and the Loonkidongi prophets’, *Journal of Eastern African Studies*, 11(3), pp. 460–481.

Spyrou, V. *et al.* (2004) ‘Transmission and pathogenicity of encephalomyocarditis virus (EMCV) among rats’, *Veterinary Research*, 35, pp. 113–122.

St John, F. A. V. *et al.* (2012) ‘Identifying indicators of illegal behaviour: Carnivore killing in human-managed landscapes’, *Proceedings of the Royal Society B: Biological Sciences*, 279, pp. 804–812.

St. John, F. A. V., Edwards-Jones, G. and Jones, J. P. G. (2010) ‘Conservation and human behaviour: Lessons from social psychology’, *Wildlife Research*, 37, pp. 658–667.

Stacey, P. B. (1986) ‘Group Size and Foraging Efficiency in Yellow Baboons Behavioral Ecology Group size and foraging efficiency in yellow baboons’, *Behavioral Ecology and Sociobiology Ecol Sociobiol*, 18(18), pp. 175–187.

Städele, V. *et al.* (2019) ‘Male–female relationships in olive baboons (*Papio anubis*): Parenting or mating effort?’, *Journal of Human Evolution*, 127, pp. 81–92.

Steinhart, E. I. (1989) ‘Hunters, Poachers and Gamekeepers: Towards a Social History of Hunting in Colonial Kenya’, *Journal of African History*, 30, pp. 247–264.

Steinmetz, K. F. (2012) ‘Message received: Virtual ethnography in online message boards’, *International Journal of Qualitative Methods*, 11(1), pp. 26–39.

Stelzner, J. K. (1988) ‘Thermal effects on movement patterns of yellow baboons’, *Primates*, 29(1), pp. 91–105.

Stephens, N. and Lewis, J. (2017) ‘Doing laboratory ethnography: reflections on method in scientific workplaces’, *Qualitative Research*, 17(2), pp. 202–216.

Steverding, D. (2008) ‘The history of African trypanosomiasis’, *Parasites and Vectors*, 1(3), pp. 1–8.

Stock, F. and Gifford-Gonzalez, D. (2013) ‘Genetics and African Cattle Domestication’, *African Archaeological Review*, 30(1), pp. 51–72.

Stokes, E. J. (2004) ‘Within-group social relationships among females and adult males in wild western lowland gorillas (*Gorilla gorilla gorilla*)’, *American Journal of Primatology*, 64(2), pp. 233–246.

Stokes, E. J., Parnell, R. J. and Olejniczak, C. (2003) ‘Female dispersal and reproductive success in wild western lowland gorillas (*Gorilla gorilla gorilla*)’, *Behavioral Ecology and Sociobiology*, 54(4), pp. 329–339.

Stokes, Y. *et al.* (2019) ‘Using Facebook and LinkedIn to Recruit Nurses for an Online Survey’, *Western Journal of Nursing Research*, 41(1), pp. 96–110.

Stoll-Kleemann, S., De La Vega-Leinert, A. C. and Schultz, L. (2010) ‘The role of community participation in the effectiveness of UNESCO Biosphere Reserve management: Evidence and reflections from two parallel global surveys’, *Environmental Conservation*, 37(3), pp. 227–238.

Streeton, R., Cooke, M. and Campbell, J. (2004) ‘Researching the researchers: using a snowballing technique.’, *Nurse researcher*, 12(1), pp. 35–46.

Strum, S. C. (2010) ‘The development of primate raiding: Implications for management and conservation’, *International Journal of Primatology*, 31(1), pp. 133–156.

Strum, S. C. and Fedigan, L. M. (1999) ‘Theory, method, gender, and culture: What changed our views of primate society?’, in *The New Physical Anthropology*, pp. 67–105.

Subramanian, K. R. (2017) ‘Product Promotion in an Era of Shrinking Attention Span’, *International Journal of Engineering and Management Research*, 7(2), pp. 85–91.

Suldovsky, B., Landrum, A. and Stroud, N. J. (2019) ‘Public perceptions of who counts as a scientist for controversial science’, *Public Understanding of Science*, pp. 1–15.

Sutmoller, P. *et al.* (2000) ‘The foot-and-mouth disease risk posed by African buffalo within wildlife conservancies to the cattle industry of Zimbabwe’, *Preventive Veterinary Medicine*, 44, pp. 43–60.

Suwa, M. (2008) ‘A cognitive model of acquiring embodied expertise through meta-cognitive verbalization’, *Transactions of the Japanese Society for Artificial Intelligence*, 23(3), pp. 141–150.

Swanson, A. *et al.* (2015) ‘Snapshot Serengeti, high-frequency annotated camera trap images of 40 mammalian species in an African savanna’, *Scientific Data*, 2, pp. 1–14.

Swanson, A. *et al.* (2016) ‘A generalized approach for producing, quantifying, and validating citizen science data from wildlife images’, *Conservation Biology*, 30(3), pp. 520–531.

Tambi, E. N. *et al.* (1999) ‘Economic impact assessment of rinderpest control in Africa’, *Revue scientifique et technique (International Office of Epizootics)*, 18(2), pp. 458–477.

Tambi, N. E., Maina, W. O. and Ndi, C. (2006) ‘An estimation of the economic impact of contagious bovine pleuropneumonia in Africa’, *Revue scientifique et technique (International Office of Epizootics)*, 25(3), pp. 999–1011.

Taylor, K. A. (1998) ‘Immune responses of cattle to African trypanosomes: Protective or pathogenic?’, *International Journal for Parasitology*, 28, pp. 219–240.

Taylor, W. P. and Watson, R. M. (1967) ‘Studies on the epizootiology of rinderpest in blue wildebeest and other game species of Northern Tanzania and Southern Kenya, 1965–7’, *Journal of Hygiene*, 65, pp. 537–545.

Theodory, T. F. and Malipula, M. (2014) ‘Climate Change and Socio-Economic Vulnerability among Maasai Pastoral Communities in Northern Tanzania’, *Journal of Policy and Leadership*, 2.

Thiaucourt, F. *et al.* (2000) ‘Contagious bovine pleuropneumonia: A reassessment of the efficacy of vaccines used in Africa’, *Annals of the New York Academy of Sciences*, 916, pp. 71–80.

Thomson, G. R., Vosloo, W. and Bastos, A. D. S. (2003) ‘Foot and mouth disease in wildlife’, *Virus Research*, 91, pp. 145–161.

Thouless, C. R. (1994) ‘Conflict between humans and elephants on private land in northern Kenya’, *Oryx*, 28(2), pp. 119–127.

Tieszen, L. L. *et al.* (1989) ‘An assessment of long-term food habits of Tsavo elephants based on stable carbon and nitrogen isotope ratios of bone collage’, *African Journal of Ecology*, 27, pp. 219–226.

Tilson, R. L. and Hamilton, W. J. (1984) ‘Social dominance and feeding patterns of spotted hyaenas’, *Animal Behaviour*, 32(3), pp. 715–724.

Topolovec-Vranic, J. and Natarajan, K. (2016) ‘The use of social media in recruitment for medical research studies: A scoping review’, *Journal of Medical Internet Research*, 18(11), pp. 1–13.

Tounkara, K., Nwankpa, N. and Bodjo, S. C. (2017) ‘Rinderpest experience’, *Revue scientifique et technique (International Office of Epizootics)*, 36(2), pp. 569–578.

Townsend, L. and Wallace, C. (2016) *Social Media Research: A Guide to Ethics*, *University of Aberdeen*.

Trinkel, M. (2010) ‘Prey selection and prey preferences of spotted hyenas *Crocuta crocuta* in the Etosha National Park, Namibia’, *Ecological Research*, 25(2), pp. 413–417.

Udris, R. (2014) ‘Cyberbullying among high school students in Japan: Development and validation of the Online Disinhibition Scale’, *Computers in Human Behavior*, 41, pp. 253–261.

Vaismoradi, M. *et al.* (2016) ‘Theme development in qualitative content analysis and thematic analysis’, *Journal of Nursing Education and Practice*, 6(5), pp. 100–110.

Vaismoradi, M., Turunen, H. and Bondas, T. (2013) ‘Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study’, *Nursing and Health Sciences*, 15(3), pp. 398–405.

van Beest, F. M. and Milner, J. M. (2013) ‘Behavioural Responses to Thermal Conditions Affect Seasonal Mass Change in a Heat-Sensitive Northern Ungulate’, *PLoS ONE*, 8(6).

van der Berg, R. (2014) ‘Facebook expands free access to Kenya’.

Van Dooren, T. (2022) ‘In Search of Lost Snails Storying Unknown Extinctions’, *Environmental Humanities*, 14(1), pp. 89–109.

Vidya, T. N. C. and Sukumar, R. (2005) ‘Social and reproductive behaviour in elephants’, *Current Science*, 89(7), pp. 1200–1207.

Vollrath, F. and Douglas-Hamilton, I. (2002) ‘African bees to control African elephants’, *Naturwissenschaften*, 89(11), pp. 508–511.

Vollrath, F. and Douglas-Hamilton, I. (2002) ‘Elephants, buzz off!’, *Swara*, 25(3).

von Essen, E. and Jansson, J. (2018) ‘Haters gonna hate? Anonymity, misogyny and hate against foreigners in online discussions on political topics’, *We are (not) anonymous: Essays on anonymity, discrimination and online hate*, pp. 1–80.

Vosloo, W. *et al.* (2002) ‘Review of the status and control of foot and mouth disease in sub-Saharan Africa’, *Revue scientifique et technique (International Office of Epizootics)*, 21(3), pp. 437–449.

Vrahimis, S. and Kok, O. B. (1993) ‘Daily activity of black wildebeest in a semi-arid environment’, *African Journal of Ecology*, 31(4), pp. 328–336.

Wachs, S. and Wright, M. F. (2018) ‘Associations between bystanders and perpetrators of online hate: The moderating role of toxic online disinhibition’, *International Journal of Environmental Research and Public Health*, 15, pp. 1–9.

Waithaka, J. (2004) ‘Maasai Mara - An ecosystem under siege: An African case study on the societal dimension of rangeland conservation’, *African Journal of Range and Forage Science*, 21(2), pp. 79–88.

Waller, R. (1976) ‘The Maasai and the British 1895-1905. the Origins of an Alliance’, *The Journal of African History*, 17(4), pp. 529–553.

Waller, R. (1993) ‘Acceptees and Aliens’, in Spear, T. and Waller, R. (eds) *Being Maasai*, pp. 226–257.

Wallman, S. *et al.* (1980) ‘Ethnography by Proxy: Strategies for research in the Inner City’, *Ethnos*, 45(1–2), pp. 5–38. doi: 10.1080/00141844.1980.9981187.

Walpole, M. and Wilder, L. (2008) ‘Disentangling the links between conservation and poverty reduction in practice’, *Oryx*, 42(4), pp. 539–547.

Ward, A. I., Tolhurst, B. A. and Delahay, R. J. (2006) ‘Farm husbandry and the risks of disease transmission between wild and domestic mammals: A brief review focusing on bovine tuberculosis in badgers and cattle’, *Animal Science*, 82(6), pp. 767–773.

Ward, M. P., Laffan, S. W. and Highfield, L. D. (2007) ‘The potential role of wild and feral animals as reservoirs of foot-and-mouth disease’, *Preventive Veterinary Medicine*, 80, pp. 9–23.

Warren, Y. (2008) ‘Crop-raiding baboons (*papio anubis*) and defensive farmers: A west african perspective’, *West African Journal of Applied Ecology*, 14, pp. 1–11.

Watts, D. P. (1984) ‘Composition and variability of mountain gorilla diets in the Central Virungas’, *American Journal of Primatology*, 7(4), pp. 323–356.

Watts, H. E. and Holekamp, K. E. (2007) ‘Hyena societies’, *Current Biology*, 17(16), pp. 657–660.

Watts, H. E. and Holekamp, K. E. (2008) ‘Interspecific competition influences reproduction in spotted hyenas’, *Journal of Zoology*, 276(4), pp. 402–410.

Watts, H. E. and Holekamp, K. E. (2009) ‘Ecological Determinants of Survival and Reproduction in the Spotted Hyena’, *Journal of Mammalogy*, 90(2), pp. 461–471.

Watts, J. (2018) ‘Stop biodiversity Loss or we could face our own extinction, warns UN’, *The Guardian*. Available at: https://www.theguardian.com/environment/2018/nov/03/stop-biodiversity-loss-or-we-could-face-our-own-extinction-warns-un.

Weber, K., 2018. *At Play In The Uncanny Valley: On Monkeys As Literary Device*. [online] Literary Hub. Available at: <https://lithub.com/at-play-in-the-uncanny-valley-on-monkeys-as-literary-device/> [Accessed 30 April 2020].

Wells, S. K. *et al.* (1989) ‘Encephalomyocarditis Virus: Epizootic in a Zoological Collection’, *Journal of Zoo and Wildlife Medicine*, 20(3), pp. 291–296.

Western, D. *et al.* (2019) ‘Variability and Change in Maasai Views of Wildlife and the Implications for Conservation’, *Human Ecology*, 47, pp. 205–216.

Whitaker, K. A. *et al.* (2007) ‘Outbreak of wildebeest-associated malignant catarrhal fever in Ankole cattle’, *Veterinary Record*, 161(20), pp. 692–695.

Whitehouse, A. (2009) ‘Where the wild things are now: domestication reconsidered’, *Social Anthropology*, 17(3), pp. 353–355.

Whiten, A. *et al.* (1991) ‘Dietary and Foraging Strategies of Baboons’, *Philosophical Transactions: Biological Sciences*, 334(1270), pp. 187–197.

WHO Coronavirus Dashboard (no date) *2022*. Available at: https://covid19.who.int/.

Wiles, R. *et al.* (2006) ‘Researching researchers: Lessons for research ethics’, *Qualitative Research*, 6(3), pp. 283–299.

Williams, K. J. *et al.* (1998) ‘Temporally Variable Rainfall Does Not Limit Yields of Serengeti Grasses’, *Oikos*, 81(3), p. 463.

Williamson, E. A. and Fawcett, K. A. (2008) ‘Long-term research and conservation of the Virunga mountain gorillas’, in *Science and Conservation in African Forests: The Benefits of Long-Term Research*, pp. 213–229.

Wilmshurst, J. F. *et al.* (1999) ‘Spatial distribution of Serengeti wildebeest in relation to resources’, *Canadian Journal of Zoology*, 77(8), pp. 1223–1232.

Wilson, G. J., Carter, S. P. and Delahay, R. J. (2011) ‘Advances and prospects for management of TB transmission between badgers and cattle’, *Veterinary Microbiology*, 151(1–2), pp. 43–50.

Wilson, R. S. (2008) ‘Balancing emotion and cognition: A case for decision aiding in conservation efforts’, *Conservation Biology*, 22(6), pp. 1452–1460.

Wilson, S. M. and Peterson, L. C. (2002) ‘The anthropology of online communities’, *Annual Review of Anthropology*, 31, pp. 449–467.

Wittemyer, G. *et al.* (2007) ‘Social dominance, seasonal movements, and spatial segregation in African elephants: A contribution to conservation behavior’, *Behavioral Ecology and Sociobiology*, 61(12), pp. 1919–1931.

Wittemyer, G., Douglas-Hamilton, I. and Getz, W. M. (2005) ‘The socioecology of elephants: Analysis of the processes creating multitiered social structures’, *Animal Behaviour*, 69(6), pp. 1357–1371.

Wolanski, E. *et al.* (1999) ‘Water, Migration and the Serengeti Ecosystem’, *American Scientist*, 87, pp. 526–533.

Wright, D. K. (2019) ‘Long-term dynamics of pastoral ecology in northern Kenya: An old model for new resilience’, *Journal of Anthropological Archaeology*, 55, pp. 1–15.

Yamagiwa, J., Kahekwa, J. and Basabose, A. K. (2009) ‘Infanticide and social flexibility in the genus Gorilla’, *Primates*, 50(4), pp. 293–303.

Yirga, G. and Bauer, H. (2010) ‘Livestock depredation of the spotted hyena (*Crocuta crocuta*) in Southern Tigray, Northern Ethiopia’, *International Journal of Ecology and Environmental Sciences*, 36(1), pp. 67–73.

Yirga, G. *et al.* (2012) ‘Adaptability of large carnivores to changing anthropogenic food sources: diet change of spotted hyena (*Crocuta crocuta*) during Christian fasting period in northern Ethiopia’, *Journal of Animal Ecology*, 81, pp. 1052–1055.

Yirga, G. *et al.* (2013) ‘Spotted hyena (*Crocuta crocuta*) coexisting at high density with people in Wukro district, northern Ethiopia’, *Mammalian Biology*, 78(3), pp. 193–197.

Yudina, O. and Grimwood, B. S. R. (2016) ‘Situating the wildlife spectacle: ecofeminism, representation, and polar bear tourism’, *Journal of Sustainable Tourism*, 24(5), pp. 715–734.

Zentall, T. R. (2002) ‘A cognitive behaviorist approach to the study of animal behavior’, *Journal of General Psychology*, 129(4), pp. 328–363.