LIVING AMONG LIONS (*PANTHERA LEO*): COEXISTENCE OR KILLING? COMMUNITY ATTITUDES TOWARDS CONSERVATION INITIATIVES AND THE MOTIVATIONS BEHIND LION KILLING IN KENYAN MAASAILAND

by

Leela N. Hazzah

A thesis submitted in partial fulfillment of the requirements for the degree of

Masters of Science

Conservation Biology and Sustainable Development

at the

UNIVERSITY OF WISCONSIN-MADISON

2006

Acknowledgments

There are so many people, both in Kenya and the US, whose support has been fundamental to the success and completion of this thesis. Unfortunately it is not possible to include the numerous who lent a helping hand in the process; so to those unmentioned, please know your contributions are not forgotten.

Let me first begin with those who engaged at the heart of my research in Kenya. I would like to recognize two people who were crucial at all stages of the research. Jacob Mayiani, my research partner and great friend who has taught me so much about Maasai life and customs. Thank you for your patience, expertise and devotion to the many levels of our work together. Ole Lepencha thank you for introducing me to everyone in the community, for your selflessness and goodwill along the way, and most of all for your sincere friendship—Ashe Oleng'.

Next, I would like to thank the Living with Lions team. Laurence Frank, our great fearless leader, many thanks for taking a risk on a biologist to do social-science work and helping me to find my path in the field of carnivore conservation. Your unremitting encouragement, lively debates and friendship has been invaluable to the success of this thesis and no doubt, future endeavors. Seamus Maclennan, your love for lions and conservation has provided a wonderful foundation to work from. Our collaboration of biology and sociology has truly allowed for further development in our area, especially the manifestation of Lion Guardians. Stephanie Dolrenry, my partner in crime, I thank you for putting up with me through some of the more tumultuous stages, and for talking about "mitigation measures for human-carnivore conflict" every waking moment. Also a special thanks to Ogeto Mwebi, Alayne Mathieson, Shari Rodriquez for suggestions and collaboration. You are all amazing scientists and it has been such a privilege to work with you. In addition, much gratitude to Rosemary Groom, who helped with endless edits and taught me a lot about grammar. Many thanks to Richard Bonham, and Tom Hill for all your support, ideas, and excitement for future work in the A-T ecosystem. Also, thank you to everyone at camp for your assistance and friendship.

This research would not have been possible without the consent from the Mbirikani Group Ranch committee and complete cooperation of all members of the study communities; specifically, Center, Oltiasika, Olibili, Lemasusu, Lenkiloriti, Ol Donyo Wuas, and Orngosua. I can't thank you enough for not only accepting me in the community, but making me feel at home. You have truly touched my life with knowledge, laughter, and genuine friendship.

Monique Borgerhoff-Mulder, my endless appreciation for your enthusiastic support, anthropological guidance, and friendship along the way. Many thanks to Shivani Bhalla, Bilal Butt, Mary Wykstra, and Cosmas Wambua for helping me maintain my sanity in Nairobi. I owe a special thanks to Joana Roque de Pinho for helping me to develop my questionnaire and allowing me use of her questions. Mara Goldman for passing on their Maasai knowledge, and Amy Dickman for sharing her vast literature source and endnotes.

In addition, I would like to thank Craig Packer and the Savannas Forever team in Tanzania for allowing me to bounce off ideas and providing guidance to my work. Also not forgotten is the Kenyan Government for allowing me to conduct research on their soil.

In the US, I would like to first start by thanking my advisor, Lisa Naughton, who encouraged me to stay focused and helped me discover the significance of my work within academia. I would also like to thank my committee members, Stanley Temple for his patience and passion for conservation biology, Mathew Turner for his keen interest in understanding Maasai husbandry and teaching me about the importance of theory, and Adrian Treves for passing on his statistical knowledge and putting up with my haphazard emails and phone calls during the analysis stage. They all provided me with the foundation to carry out and produce this thesis. I also thank Doug Hemken and Ted Gerber for their help with data analysis and expertise in SPSS.

I could not have completed this research without the financial support from the Wildlife Conservation Society--the Great Cat/Panthera Kaplan Awards and Luke Hunter, and the African Small Grants programs, the Zoological Society of Milwaukee, and funding from the Gaylord Nelson Institute for Environmental Studies. I am also extremely grateful to the University of Wisconsin-Madison African Studies program for providing incredible Swahili language support through one and half years of Title VI (FLAS) fellowship and to the University of Wisconsin- Madison Graduate School for providing two years of the Advanced Opportunity Fellowship.

I could not express the magnitude of appreciation that I owe to my family and friends. Your ability to support me when I abscond every year to Africa amazes me. Trina, my twin sister and accomplished veterinarian—thank you for always understanding when I miss your important events. May, your nomadic being allows us to keep in contact even when I am a far. My mother, Mona El-Emary, whose unconditional love and support has allowed me to discover my dreams and persist with my curiosities in Africa. My father, Abu-Bakr Hazzah, has never once doubted my ability and passion, and who's example of strength and endless encouragement has allowed me to follow my heart---however great the distance. Finally, my work would not be completed without the support of my friends. In Madison, Nicole, Ellen, and Elizabeth, thank you for your companionship and humor. Much love to Mary who has helped me tremendously with maps and Lugard who has been there prior to the onset of this venture and to all the "Gulls", Aaron Noel and my friends from hometown D.C. and around the world you all have been a blessing to me with each step, thank you.

ABSTRACT

African lion (*Panthera leo*) populations are in decline throughout most of Africa, but the problem is particularly acute in Kenyan Maasailand, where local Maasai are spearing and poisoning lions at a rate which will ensure local extinction within a decade. In order to understand this phenomenon, it is essential to recognize its foundations embedded within Maasai perception of livestock depredation by lions, socio-economic causes, and the complex Maasai-conservation relationship. These aspects all affect tolerance of Maasai towards lions and consequently impact their behavior towards conservation initiatives and carnivores in general. In an attempt to halt lion killings by Maasai a compensation program was initiated in early 2003 to increase local people's tolerance of carnivores by paying them for their lost livestock. In this study, performed on Mbirikani ranch in Kenyan Maasailand, I use an in-depth quantitative questionnaire and multiple participatory rural appraisals (PRAs) to identify the predictors associated with my two primary thesis questions: 1) How do socioecological variables shape an individual's propensity to kill lions? and 2) What are local citizens' attitudes towards the current compensation scheme on Mbirikani Ranch and how do they affect people's attitudes towards conservation and tolerance of carnivores? My results indicate that individuals who have a greater proportion of livestock lost to predators relative to their overall livestock lost, those affiliated with the evangelical church, and those whose dependence on livestock is mainly for sale purposes all have a higher reported propensity to kill carnivores. Without a better understanding of the nuances of human-carnivore conflict and a concerted effort to unreservedly address appropriate cultural and community-level institutions, chiefly by encouraging local people to participate in conservation, the future of carnivore conservation may be jeopardized.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF MAPS

ACROYNOMS AND ABBREVATIONS

KLCP	Kilimanjaro Lion Conservation Project
MGR	Mbirikani Group Ranch
CHNP	Chyulu Hills National Park
ANP	Amboseli National Park
PA	Protected Area
PCF	Predator Compensation Fund
ODWT	Ol Donyo Wuas Trust
CBC	Community-Based Conservation
KWS	Kenyan Wildlife Service
AWF	African Wildlife Foundation
KAG	Kenyan Assemblies of God
TAG	Tanzanian Assemblies of God
NARC	The National Rainbow Coalition Government (Kenyan Government)
GR	Group Ranch
PRA	Participatory Rural Appraisals
SHOAT	Sheep and Goat combined
KSH	Kenyan Shillings

Glossary of Maa and Swahili Terms

Murran	Warrior (youngest age-set)
Olamayio	Ritual lion hunts carried out by *murrans*
Olkiyioi	Retaliatory killings of lions (or other carnivores) in response of livestock attacks (includes all age-sets participating)
Maendeleo	Development
Mzungu/Wazungu	Person/s of European descent
Boma or En-kang'	Traditional Maasai homestead built using thorn bush surrounding the entire enclosure with additional thorn bush enclosures inside for livestock. Within this area there are *in-kajijik (* homes)
Shamba	Farm
Enkiguena	Meeting
Mzee/Wazee	Elder/s

Chapter I: Introduction

Studies have indicated that lion numbers are declining at a rapid rate in southern Kenya due to ongoing conflict with local Maasai communities (Ikanda & Packer *in press;* Frank et al. unpublished data). Over 130 lions may have been killed since 2001 in the Amboseli-Tsavo ecosystem (see Frank et al. unpub.). This thesis attempts to uncover the possible driving forces of lion killings on communities adjacent to Chyulu Hills National Park. To understand the significance of this issue and theoretical underpinnings for addressing Maasai-lion conflict, I will briefly review the literature emerging from various fields including: current lion and carnivore conservation efforts, the theoretical context of vulnerability and risk (specifically for pastoral communities), the role of community conservation, and finally an overview of the determinants of human-wildlife conflict. This chapter concludes by describing the rationale for the study and the overall aims and questions tested.

1.1 Background on the conservation status of lions

This section will briefly describe global carnivore decline, specifically focused on lions, and how human-carnivore conflict has contributed immensely to these populations decreasing in Africa. Conservationists indicate that Africa's large carnivore populations have decreased substantially over the past 30 years (Ginsberg & Macdonald 1990; Nowell & Jackson 1996; Mills & Hofer 1998). There is no reliable data from earlier periods, but scientists confidently estimate that Africa's population prior to colonization would have been at least one million, falling steadily to perhaps 500,000 by 1950, perhaps 200,000 by 1975, (Myers 1975), and less than 100,000 by the early 1990's (Nowell and Jackson, 1996).

Current estimates of continent-wide numbers range from 23,000 (Bauer & Van Der Merwe 2004) to 39,000 (Chardonnet 2002). The most recent, and probably most accurate estimate, is less than 29,000 (Eastern and Southern African Lion Conservation Workshop Jan. 8-13, 2006unpublished). All estimates agree that more than half of Africa's surviving lions are in Tanzania, which has large wilderness areas without livestock and a robust trophy hunting industry which places high value on lions. Historically lions occupied a range in Africa of over 22,211,900 km². That range has now been reduced to less than 3,802,873 km²--a reduction of 83% (Ray et al. 2005). The African lion is classified as Vulnerable on the Red List of Threatened Species of the World Conservation Unions (IUCN); the main threats listed were agriculture, human settlement and poisoning (Hilton-Taylor 2000). In December 2005, Ray et al. stated that without question the number one problem facing carnivores in Africa is conflict with humans; followed by habitat loss and interspecific conflict (Ray et al. 2005). In addition, Stander (1997) concluded that the impact of pastoralists on lions is highly detrimental, as suitable habitat is lost due to increasing stocking rates. Studies in East Africa provide similar evidence that lion populations are declining in areas where pastoralism persists (Frank 1998; Ogada et al. 2003; Kissui 2006; Ikanda & Packer *in press*).

Unfortunately, there are only a handful of protected areas in Africa large enough to support viable lion populations (Brashares et al. 2001; Loveridge et al. 2001). Ogutu et al. (2004) defined a viable population of lions in the Maasai Mara ecosystem to be one lion per 10 km². Some scholars attribute human-wildlife conflict to the movement of lions outside protected areas in search of prey (Stander 1990, 1997). Others ascribe conflict to rapidly increasing rural populations living adjacent to protected areas or moving into wilderness areas (Baldus 1988; Balakrishnan & Ndhlovu 1992; Pitkin 1995; Stander 1997). However,

Neumann (1998), challenges this interpretation of conflict surrounding parks being driven by population growth, and argues instead that the effects of nature protection on rural livelihoods is immense and local communities response to the insecurity of land tenure and historical policies of land management is at the root of conflict. Regardless, leading conservationists posit that conflict with local people and their livestock is the most significant reason for lion number decline (Nowell & Jackson 1996; Woodroffe & Ginsberg 1998; Linnell et al. 1999). Moreover, carnivore conservation depends on the sociopolitical landscape as much as the biological landscape (Treves & Karanth 2003; Naughton-Treves & Treves 2005).

For instance, in much of Eastern Africa, a semi-arid climate makes livestock production the only viable economic pursuit (Galaty & Johnson 1991), although in the last 20 years agropastoralism has been increasing in Maasailand (Barrow et al. 1993; Campbell 2000; Western & Nightingale 2002). Traditionally pastoralists have 'tolerated' a certain percentage of livestock loss due to predation, but conservation practitioners today claim that available technology (i.e., guns, poison) has improved their ability to kill suspected livestock predators (Ogada et al. 2003). It is well documented that people have killed carnivores to protect themselves and their livestock for centuries (Guggisberg 1975; Mishra 1997; Treves & Naughton-Treves 1999) and Kenya is no exception (Ogada et al. 2003; Woodroffe & Frank 2005; Frank et al. unpublished data). There have been few studies of the individual, household, and community variables that underlie the tendency to retaliate lethally against lion depredation. This is especially interesting in a Maasai context because the highest density of lions in Kenya inhabit Maasailand today (Frank et al. unpublished data). Therefore, understanding information on tolerance and attitudes is essential to lion

conservationists, policy-makers, and managers who implement conservation projects. In addition, understanding the root causes of social change in Maasailand could provide explanations of changes in husbandry and attitudes. For example, guarding livestock may no longer be feasible if men migrate to cities for jobs or young boys of herding age begin attending school (Naughton-Treves 1997; Knight 2000; Jackson & Wangchuk 2001). More fundamentally, resentment over government intrusion in local land use policies or traditional ways of managing wildlife may have led to resentment toward lions as a symbol of land alienation or 'eco-imperialism' of conservationists (Lindsay 1987).

In the past 10 years, large carnivore conservation has moved from a 'fences and fines' approach, to the integration of local people (Kiss, 1990; Wells et al., 1992; Western and Wright, 1994; Alpert, 1996; Hulme and Murphree, 1999, 2001). Conservation strategies in response to ongoing conflict with predators target high-level community participation in an effort to increase local tolerance of carnivores. However, some critics believe big cat conservation is irreconcilable with long-term sustainable use of resources because economic aspirations of rural communities are incompatible with conservation of natural resources (Barrett & Arcese 1995; Oates 1995; Barrett & Arcese 1998; Oates 1999). I will discuss this in much more detail in the following section. Missing from this debate are data on tolerance, attitudes and causal factors of killings.

In the next section I will discuss three bodies of literature: 1) how environmental risk and vulnerability are shaped by physical and social conditions and how communities cope with these risks; 2) how communities are made vulnerable by conservation interventions and how community-based conservation aims to remedy this; and 3) a thorough explanation of the determinants of human-wildlife conflict.

1.2 Vulnerability and Risk Theory as related to Maasai pastoralism

Studies have documented that local people living in risky areas have been forced to utilize traditional coping mechanisms to reduce their vulnerability to environmental pressures on their livelihoods (Naughton-Treves 1997; Western & Nightingale 2002). Geographers' writings on risk and vulnerability offer important insights. Much of this writing is directed at large-scale environmental hazards (Cutter et al. 2000), but there are important findings related to rural communities as well. Concepts and ideologies driving vulnerability and risk theories, specifically in small communities' ability to cope, have received increased attention in environmental disciplines (Liverman 1990; Turner et al. 2003; Eriksen et al. 2005). This is largely due to increased occurrences of environmental hazards in the past decade (Cutter et al. 2000). I will briefly discuss vulnerability, as it is a key component for understanding the social significance of livestock loss due to conflict with wildlife.

The definition of vulnerability has been defined as "the degree to which a system, subsystem, or system component is likely to experience harm due to exposure of hazard, either perturbation [i.e., hurricane] or stress [i.e., erosion]" (White 1974: 1). A hazard is understood as any threat to a system (comprised of perturbation or stressors) and the consequences they produce (Turner et al. 2003). By contrast, risk is the "probability or magnitude of consequences after a hazard" (Turner et al. 2003: 8074). Cutter et al. (2000), argue that the degree to which humans are vulnerable to hazards is not solely due to the physical environment, but social factors also play a vital role in determining vulnerability (for example, wealth, livelihoods, mobility, gender).

An understanding of these social factors is critical to uncovering how local people cope with risk. Turner et al. (2003) noted that three major concepts underpin vulnerability

theory: 1) entitlement, 2) coping, and 3) resilience. Entitlement focuses on legal or customary rights and access to resources. For example, during droughts or famines, communities with access to water or food via customary entitlement will in turn reduce their risk of starvation. However, other communities who lack the "privilege" or "authority" to access resources are much more vulnerable to these hazards. Entitlement also explains why certain social groups are more sensitive to specific risks. Coping strategies differ between social groups; i.e., response levels to harm and risk differ and ultimately play a role in community or individual vulnerability to hazards (Turner et al. 2003). In sub-Saharan Africa, 'safety nets' in terms of wealth, social, and political networks play a role in a person's ability to cope (Eriksen et al. 2005). Lastly, resilience is defined as the ability of an ecosystem or environment to "bounce back" and recover to its original state or productive state (Turner et al. 2003). Accordingly, social resilience can be understood as the flexibility of a social system to adapt or learn in response to disturbances (Liverman 1990; Cutter et al. 2000; Turner et al. 2003). The social components of entitlement, coping and resilience help to explain vulnerability theory. Moreover, both biophysical and social factors play a role in determining vulnerability of human populations.

Vulnerability risk theory can be directly applied to pastoral systems. Nomadic pastoralism is a highly specialized system, one that has evolved specific coping strategies to survive in harsh ecological and social conditions (Galaty 1982). Campbell (1999) states that pastoral communities (specifically Maasai) utilize various strategies to cope with environmental changes such as: movement of livestock in search of water and pasture, prayer, acceptance of food relief, sale of livestock, income from tourism, and lastly exploitation of the environment through hunting or gathering activities. McPeak (2005)

suggests that accumulation of large herds is the key coping strategy utilized by pastoral communities. Others argue against McPeak's conjecture, indicating that herd accumulation at the household level may jeopardize collective ability to cope—as it only provides benefits at the individual level (Homewood & Rogers 1987; Hellden 1991).

To further elucidate pastoral coping abilities I will explain how these strategies are utilized within Maasai society (specifically in southern Kenya). Western and Nightingale (2002) state that the Maasai in Kajiado district, Kenya face two types of environmental hazards. First, the biophysical component, specifically drought and climate change. Second, the Maasai have experienced such immense transformation in land use due to sociopolitical forces, and their traditional techniques enabling them to cope with environmental hazards are not sufficient enough to deal with new forms of land use (i.e., agriculture). Maasai use a variety of traditional strategies and methods to increase the survival rate of their livestock and reduce their vulnerability to environmental risks (Western & Nightingale 2002). For instance, seasonal movements of livestock and habitat selection by herders enable extended use of dry season pasture (Owen 1979; Grandin & Lembuya 1987). Maasai follow the rains and that mobility allows them to respond to fluctuating resource availability. Secondly, the Maasai have developed specialized breeds (i.e., larger Zebu cattle) that can withstand extreme conditions (Galaty 1982). Thirdly, herders often choose settlement sites that are in close proximity to vital resources, like water, pasture, and market (Western & Dunne 1979). Permanent settlements are used during most of the year while temporary sites are set up only during the dry season and change yearly depending on water and pasture availability (Waller 1985). These tactics have allowed Maasai (and many other pastoral communities) to adopt a pastoral lifestyle by reducing their vulnerability to environmental hardships and variability.

Some argue that "pastoralism" in itself is an adaptation of climatic variability (Turner, M, pers comm.).

The continued use of these risk aversion methods by the Maasai is noted by some observers (Campbell et al. 2003a), but other scholars argue that the traditional coping methods of high mobility and positioning settlements near resources are no longer working in modern conditions, consequently leaving the Maasai in a much more vulnerable state (Western & Nightingale 2002). An explanation on the specific changes will be discussed in Chapter 3. This is especially true at the individual family level; the poorest (those with very small herds, little available labor, and few rights to entitlement of land) are at a higher risk of losing their pastoral identity and way of life (Galaty & Johnson 1991; Campbell 1993; Homewood 1995). The less affluent class, usually characterized by small herds, are more vulnerable to drought and other stochastic events, as they have less livestock to buffer them from these conditions (Starr 1987). Moreover, amidst sedentarization and individualization (loss of communality), smallholders are particularly vulnerable to environmental hazards.

Anthropologists argue that pastoralists' desire for larger herds is in response to economic uncertainty in risky environments (Dyson-Hudson & Dyson-Hudson 1972; Sanford 1983; Ahmed et al. 2002; McPeak 2005). Traditional coping strategies beget the necessity for herd accumulation for economic viability and survival, and less as a status symbol. Additionally, as the Maasai move towards an individualized market economy (rather than a communal market as was common in the past), their social network enabling access to land and sharing of household resources is becoming increasingly restricted (Grandin 1988; Talle 1988). Items like milk are becoming more of an economic commodity and less a social exchange (Homewood 1995). These changes in social and livelihood

structures will undoubtedly alter Maasai ability to cope with environmental risks in the future (Western & Nightingale 2002; McPeak 2005).

1.3 Community Conservation Interventions

This section will discuss how communities can be made vulnerable by conservation interventions, and how current community conservation have attempted in various ways to prevent or resolve this.

Over the last decade, policies and practices of conservation in Africa have shifted from protectionism towards a more community-centered approach (Hulme & Murphree 1999; Hulme & Murphree 2001). Many perceive this 'new conservation' as a push towards placing 'community in conservation' (Agrawal 1997), which is generally referred to as community-based conservation (Western & Wright 1994). This form of conservation involves more than just the devolution of responsibility and control from the state to the community (Hulme & Murphree 1999). Experts identify this inclusive people-oriented approach to conservation as a reaction to the failures of exclusionary neo-colonial "fortress conservation" (Ghimire & Pimbert 1997).

The greatest challenge of community-based conservation (CBC) is to design a 'new conservation' that incorporates utilization, decentralization, and market access as the main strategy towards promoting conservation agendas (Hulme & Murphree 1999). This requires governance processes that allow all three strategies to work together towards conservation and development goals, and which are adaptable enough to allow for policy and practice to evolve as economic, social, and environmental conditions change (Hulme & Murphree 1999). Other CBC advocates are more cautious about the role of markets and think the most

fundamental aspect is a shift in locus of power to local communities by increasing participation in conservation activities (Berger 1993; Western & Wright 1994; Brooks et al. 2006) and emphasizing the importance of sustainable use of resources over preservation (Berkes 2004). Overall, CBC has made progress; from emphasizing large-scale community participation (Western & Wright 1994; Getz et al. 1999), using compensation payouts to increase tolerance (Kiss 1990), offering development opportunities for local communities (Abbot et al. 2001; Salafsky et al. 2001) and highlighting the importance of co-management opportunities for local communities (Murphree 1994; Berkes 2004).

Despite such attempts as those mentioned above, CBC has been criticized for being ineffective (Wells et al. 1992; Barrett & Arcese 1995; Oates 1999) and lacking the role of local institutions in its framework (Agrawal & Gibson 1999). I use the word institutions as being the set of working rules and values a community follows (Ostrom 1990). The notion that communities are a homogenous social structure and that community is an autonomous spatial entity (i.e. small area and/or small number of individuals), which results in desirable resource management, is seldom an accurate or complete portrait. Agrawal (1999) argues that greater attention needs to focus on the various actors and interests of a community, the process of interrelation between these actors, and finally the institutions that frame these interactions. This movement of placing communities at the forefront of conservation is a sign of successful evolution of conservation theory and application, but many worry that by holding on to this idea of "homogenized community" or "mythic community" it will not allow for the necessary processes of conservation to take place locally (Agrawal & Gibson 1999). In summary, the conventional model of CBC does not focus enough on the differences within communities, or how these differences affect conservation processes (Agrawal &

Gibson 1999). In essence, it may be easy for a homogenized community to make decisions collectively, but the threat of external influences will be difficult to tackle without the cooperation of multiple actors and institutions. In addition, Ostrom and Burger (1999) argue that if local authority is not recognized by outside actors then enforcement of rules may be complicated; however, if rules are implemented or introduced by outsiders without local community consultation or participation the results may be detrimental as well. Moreover, conservation goals become increasingly difficult to achieve when they are not in line with local institutional rules and values (Becker 1999).

For CBC initiatives to achieve their set goals the complete devolution of authority and power toward local groups needs to take place fully (Neumann 1998). Programs that attempt to place local communities at the forefront while simultaneously maintaining power over allotments of funds, implementation of rules and regulations, and overall decision-making processes will not achieve sustainable use (Agrawal & Gibson 1999; Hussain 2000). Rather, emphasizing the importance of multilayered interests and decision-making of actors within the community, and understanding how local and outside institutions can aid in shaping the decision making process, will allow for more sustainable and holistic (and realistic) goals for the future of CBC (Agrawal & Gibson 1999).

There are two broad critiques of CBC: one from social scientists criticizing CBC on the grounds that communities are not truly empowered, nor are their environment agendas respected (Neumann 1998), which I have discussed above. The other critique questions the viability of sustainable use. Little (1994) and Hackel (1999) argue that CBC ideals cannot be fully accepted, and that by using the tools provided by CBC to build better relations with rural communities rather than the programs themselves will provide the practical value in

remote areas in Africa. In addition, Hackel (1999) affirms that CBC is being oversold and protectionism is being underestimated. He believes that by modifying conventional protectionists' policies in today's conservation crisis in Africa could provide the needed avenue for successful conservation. In Kenya, CBC programs need to be flexible enough to cope with local people's demands and needs, but many argue that this is difficult because of the growing human population and pressure to convert pasture to agricultural lands (Pagiola et al. 1998; Okello 2005). In addition, conservation can inadvertently reduce peoples' land options forever because large areas of land need to be conserved (Hackel 1999). This type of ideology is what Goodland (1982) characterizes as "forced primitivism", essentially forcing local people to remain in a static lifestyle and restricting them from engaging in other economic opportunities. Confining rural people to traditional lifestyles could be seen as a "poverty trap" rather than a beneficial long-term process (Norton-Griffiths 1995). Moreover, it will be very difficult for conservationists to find a CBC program that meets the needs of the people and wildlife in an ever-changing economic, social and political environment.

A compromise of sorts between these two CBC critiques can be achieved through the process of adaptive co-management strategies. Folke et al. (2002: 438) define adaptive co-management as "a process by which institutional arrangements and ecological knowledge are tested and revised in an ongoing process of trial and error." The main points here are that it allows for sharing of management power and more importantly responsibility through multiple institutional linkages and through feedback and trust building (Berkes 2004). Adaptive co-management is a bottom up approach but is facilitated by external institutions (i.e., government or NGOs) and allows for training and capacity-building by external actors to increase the capabilities of local authorities, and places power and decision-making in the

community's hands, with the support of external institutions (Treves et al. 2006). One of the key elements of Treves et al. scheme is that scientific and technical knowledge underlie each step from planning to implementation to monitoring of conservation projects. Also their framework explicitly allows the balancing of conservation and development goals. This type of CBC is "adaptive" in nature in that it allows for necessary modifications of structure and governance to take place when needed.

Overall success and performance of CBC projects fall below expectations (Kellert et al. 2000; Barrett et al. 2001), because although communities, specifically Maasai, are now gradually included in politics and polices of conservation, they continue to remain a marginalized stakeholder in discussions regarding perceptions of conservation and appropriate management strategies (Goldman 2003). A reason for this continued marginalization could be persistent conventional stereotypes associating rural people as backward and ignorant among some conservationists (Hobart 1993; Homewood & Brockington 1998). In addition, there has been skepticism in the ability of East African pastoralists to manage their own natural resources, because historically pastoralists were perceived to overuse their land and cause extensive desertification, due to cultural values and land use practices (Pratt & Gwynne 1977; Doran et al. 1979; Jarvis 1980). On the other hand, observers argue that past community conservation initiatives have also failed due to the lack of commitment by communities and ubiquitous corruption and embezzlement of conservation funds by higher level appointed local members (Nyhus et al. 2003) .

Nevertheless, there is unanimous agreement that in today's human-dominated world it is essential to integrate the dynamic interaction between people and the environment into conservation programs (Berkes 2004); they can no longer be viewed as separate

commodities. There is extensive recent literature on the importance of local participation in natural resource management (Ingles et al. 1999; Turner 1999; Kellert et al. 2000; Moore et al. 2000; Barrett et al. 2001; Jackson & Wangchuk 2001; Ribot 2002). Allowing local people to manage their own land without technical or legal support may fail as they lack academic training and germane experience; however, local people's knowledge of their environment is a vital tool that needs to be utilized in formulating and facilitating sustainable conservation policy (Neumann 1998; Goldman 2003). Moreover, in order for CBC programs to succeed it requires a better understanding of the questions of equity, empowerment and institutions.

1.4 Introduction to Human-Wildlife Conflict Literature

Up to this point, I have discussed how pastoral communities cope with environmental risks, and how conservation interventions have attempted to resolve the divide between local people and wildlife conservation goals. This section will delve into the literature of human-wildlife conflict, while specifically focusing on carnivore conflict.

Conflict between people and wildlife is a widespread problem faced by a diverse group of communities, particularly those abutting protected areas containing megafauna and large carnivores. This conflict can take various forms, including: carnivores that attack and kill livestock (Saberwal et al. 1994; Mishra 1997; Hussain 2003; Musiani et al. 2003; Ogada et al. 2003; Nyhus & Tilson 2004; Woodroffe 2005b), crop raiding species (Dey 1991; Hill 1998; Naughton-Treves 1998), attacks on humans (Saberwal et al. 1994; Nowell & Jackson 1996), competition for game and/or resources (Thirgood et al. 2005), and wildlife transmission of diseases (Yuill 1987; Peterson 1991). Conflict involves species such as African elephants (*Loxondonta africana*) destroying farmers crops (Naughton-Treves 1997;

Hill 1998; Hoare 1999), wolves (*Canis lupus)* in Portugal and North America and snow leopards (*Uncia uncia*) in the Himalayas killing livestock and affecting the livelihoods of many people (Jackson 1979; Mishra 1997; Hussain 2000; Vos 2000; Phillips et al. 2004).

The economic significance of these conflicts is generally minor relative to losses to disease, rodent or invertebrate pests (Knight 2000). However, the implications for conservation are significant because livestock-predator conflict and ensuring retaliation by people has been noted as being a primary source of population decline of carnivores (Woodroffe & Ginsberg 1998) and livestock losses to predators are the least tolerated among human-wildlife conflict situations (Naughton-Treves 1997). Although losses may not be economically significant at a regional scale, for the affected household, they could be damaging (Oli et al. 1994; Mishra 1997). Therefore understanding the economic strain of conflict on local peoples' livelihoods is central to abating this conflict. In addition, recognizing the importance of local attitudes, experiences with carnivores and protected areas, and the various form of conflict is essential.

Ongoing conflict between people and wildlife is attributed to exponential human population growth, habitat loss, and an increase in local wildlife populations, in areas that have seen wildlife recovery (Rogers 1989; Saberwal et al. 1994) such as elephants in Shimba Hills National Park in Kenya. Conflict emerges in various situations, from people who move into wildlife habitats (i.e., Chyulus Hills N.P. or Shimba Hills N.P in Kenya), or when wildlife recovers and recolonizes human occupied areas (i.e., Mkomazi N.P. in Tanzania). Local peoples' attitudes towards conservation and protected areas have been influenced by problems with nearby wildlife (Newmark & Leonard 1991, 1993). As a conjecture to my research, people who endure conflict and feel they are ineffective in ameliorating or

controlling the problem are more inclined to retaliate or hold very negative attitudes toward wildlife and conservation initiatives (Newmark & Leonard 1993; Mills & Hofer 1998; Marker et al. 2003). The majority of conflict occurs outside protected areas in Kenya (Norton-Griffiths 2003) and poses a great challenge for many conservationists, often forcing a decision between focusing conservation efforts in human-dominated landscapes or inside protected areas (Woodroffe 2005b). Lastly, the broader factors of geography, society, culture, history, economics, and politics all influence rates of conflict and people's coping capacity (Osborn & Parker 2003) and the potential for sustainable solutions.

1.5 Factors Affecting Human-Wildlife Conflict and Local Response

There is an assemblage of underlying factors that predispose some communities to higher rates of conflict (Woodroffe 2005a) and therefore an in-depth understanding of these specific factors will prove instrumental in conservation planning and management. What drives conflict? What specific variables (external and internal) result in higher levels of human-wildlife conflict? How do history, culture and tradition beget conflict? I focus on those that directly relate to human-carnivore conflict in Maasailand and so the primary research questions of this thesis.

1.5.1 Pattern and Intensity of Livestock Losses to Carnivores

The first factor I will discuss, and probably the most significant type of conflict in Maasailand today, is livestock depredation. In the past some observers considered depredation on domestic livestock by carnivores as an aberrant form of behavior, something done by only old, injured or infirm animals (Finn 1929). Guggisberg (1975) stated that

predation on livestock by large carnivores is an ancient conflict. Today local people, especially those living near protected areas, lose livestock to predators and less commonly people are killed. Rural communities are particularly vulnerable to the establishment of new protected areas because they reside in remote areas that are prime habitat for wildlife and their livelihoods are dependent on such areas designated for protection (Sekhar 1998). Livestock farmers are heavily reliant on the resources within these protected areas, especially during times of hardships (i.e. drought) and as a result come into conflict with wildlife, such as the Maasai entering national parks during drought season in southern Kenya (Ngethe et al. 1994; Okello 2005).

Seasonal variation in conflict between livestock and carnivores may be due to changes in herding strategies and carnivore movements. Butler (2000) noted that rates of livestock loss to predators in agro-pastoral communities in Zimbabwe were highly seasonal, with 80% occurring in the dry season and 20% in the wet season months. Rudnai (1979) and Ikanda (2005) found similar results in Kenya and Tanzania where they documented lions attack livestock more often during the dry season. This could be attributed to the long distances herders travel in search of water and fodder, lack of strong structured boma (use of temporary bomas), unfamiliarity of carnivore territories, carnivore movements—specifically following wild ungulates, and weakness of livestock due to disease making them more vulnerable to predator attacks (Ogada et al. 2003). Additional studies have shown that predation levels and season are highly correlated. For example, in the Northern Areas of Pakistan snow leopards kill livestock mostly during the winter months when prey is scarce (Hussain 2000). Saberwal (1994) showed that Asiatic lion (*Panthera leo persica*) predation increased during monsoon season because skies are often overcast and temperatures

remained cool allowing lions to be active throughout the day alongside people. Moreover, studies have shown that depredation is highly correlated with seasonal variation and local prey availability in Kenya (Patterson et al. 2004; Woodroffe & Frank 2005). Thus, whether wet or dry season increases depredation events is highly likely to be associated to a regional relationship between rain fall and prey availability (Kolowski & Holekamp 2006).

Additional studies have shown that when livestock exceed the number of wild ungulates within protected areas, conflict rates tend to rise (Mishra 1997). For example, on Mbirikani Ranch in Kenya the number of livestock owned by the Maasai is two and half times the viable commercial stocking rate (Ntiati 2002), and thus this unbalanced ratio of wild and domestic ungulates results in high levels of livestock depredation by carnivores (Rao 1996). Low levels of wild prey has been linked to increases in predation on livestock in wolves (*Canis lupus)* in southern Europe (Meriggi & Lovari 1996) and areas in North America (Mech et al. 1988) and with lions in northern Kenya (Frank et al. 2005). However, a few studies have shown that predation can still occur if wild prey population is high (Thirgood et al. 2000; Stahl et al. 2001; Treves et al. 2004). Another reason for high rates of livestock depredation has been attributed to the possibility of 'problem animals'. Linnell et al. (1999) defines a 'problem animal' as an individual that kills more livestock/encounters than other individuals. Debates on whether 'problem animals' exist is still under question (Linnell et al. 1999); however, there is some evidence that suggests that they may occur in some carnivore species, including lions and tigers (Stander 1990; Woodroffe & Frank 2005).

As indicated above, depredation is a major problem for local communities living adjacent to parks. However, local peoples' perception of conflict often outweighs actual rates of conflict (Frank 1998). For instance, many studies in Africa have shown that livestock loss

to wildlife predation is minimal relative to the total stock holdings (Rudnai 1979; McShane & Grettenberger 1984). In northern Kenya, Mizutani (1993) documented that wild carnivores killed 2% of total sheep and only 0.8% of total cattle numbers, respectively, whereas disease killed 2.2% of the total cattle population. In Laikipia District in Kenya, each year carnivores kill approximately 0.8% of cattle and 2.1% of sheep on commercial ranches, and 0.7% of cattle and 1.4% of sheep and goats on pastoralist group ranches as compared to 2.4% of livestock lost to disease (Frank 1998).

Conflict with pastoral farmers over livestock depredation has been a major reason for large carnivore population decline (Woodroffe & Ginsberg 1998; Treves & Karanth 2003), but it has been argued that it is perceived conflict that drives retributive killings not actual levels of conflict (Mishra 1997; Marker et al. 2003). Individual perceptions of human-wildlife conflict are not only shaped by severity and frequency of loss but also by a variety of social and environmental factors (Treves et al. *in press*). Tolerance towards carnivores and conservation interventions are likely formed by a combination of both perceptions and past experiences (Jackson & Wangchuk 2001; Treves et al. *in press*). Conservation managers are integrating various methods to measure local perceptions of human-wildlife conflict (for details see Treves et al. *in press*). It is most useful to investigate why individuals perceive disproportionate conflict with carnivores rather than attempting to test the accuracy of their risk perceptions (Treves et al. *in press*).

1.5.2 Human Population Density and Habitat Conditions

Another factor affecting human-carnivore conflict is the influence of human populations and 'hot-spot' conflict areas. For example, the most highly populated areas usually experience less conflict with wildlife then sparse, marginalized communities (Newmark et al. 1994; Boomgaard 2001). In Kenya, Parker and Graham (1989) estimate that in agricultural areas where human population exceeds 82.5 people per square kilometer elephants are not present. In addition, wild ungulates are less likely to be abundant in areas of high human densities (Matzke 1975). Therefore, people and elephants can coexist up to a threshold of human population density, but once humans reach this level then elephants disappear (Hoare & du Toit 1999).

Furthermore, experts report that conflict is not evenly distributed and chronic sites ('hot-spots') exist (Naughton-Treves 1998; Sekhar 1998). Communities that suffer continual conflict with wildlife are commonly located in very remote regions (Sekhar 1998) and are generally characterized by a 'hard edge' boundary abutting protected areas (Osborn & Parker 2003). Thus, locations of communities significantly influence rates of conflict between people and wildlife. Nyhus and Tilson (2004) propose that the highest levels of human-tiger conflict in Sumatra are greatest in 'hard" or 'diffuse' edge areas where humans and carnivores overlap and are lowest in 'soft' edges where there is a distinct spatial separation between the two. Also, environmental risk theory suggests that the most vulnerable people reside in the most precarious locations (Susman et al. 1983). On the other hand, many communities bordering protected areas benefit from resources, like fuelwood; which on an average, are worth more than crops lost to wildlife at one site (Naughton-Treves 1997). Moreover, economic gains from resources and knowledge about ecosystem services may

eventually allow communities to cope with wildlife, specifically those communities living in very remote areas.

In addition to economic benefits of human-wildlife conflict, strategies to attenuate the pressure on local communities residing near protected areas have been attempted but limitations exist. For instance, although wildlife officers have been hired to aid in conflict situations many people residing in these areas are often unable to report claims due to the great distance between officers and household. In addition, in many regions, most game officers do not have access to vehicles and thus cannot respond quickly to community concerns (Newmark et al. 1994; Osborn & Parker 2003). In remote communities, people may need to walk for days to reach a wildlife officer (pers. obser.). In addition, effective wildlife control measures are less frequent in remote communities because labor requirements may be intensive and most problematic species are abundant and large in size making them very difficult to control (Newmark et al. 1994). Conservationists have discussed the possibility of creating or increasing buffer zones to minimize the interface of people and wildlife (Taylor 1999), but with increasing human population pressures and encroachment onto fertile lands, this may prove too difficult to implement. Moreover, a specific type of conflict characterized by low population density and hard boundaries in remote areas requires a special understanding that is critical for designing protected areas where carnivores and humans can coexist (Naughton-Treves 1997; Woodroffe & Ginsberg 1998).

1.5.3 Livestock Husbandry

A third factor which can mitigate conflict is improvements in livestock husbandry techniques. In many parts of the world, livestock depredation can be prevented or reduced by improving husbandry. Examples include studies in Portugal with wolves (Vos 2000), in Namibia with cheetahs (Marker et al. 2003), and in Kenya with wild dogs (Woodroffe 2005b) and other top carnivores (Ogada et al. 2003), which all illustrate that improving methods of livestock husbandry are critical in reducing rates of predation. Suggested improvements include low-tech solutions such as traditional methods of boma construction by using natural resources (i.e., acacia thorn fences), use of guard dogs, reducing herd size, and hiring vigilant night watchmen (Ogada et al. 2003), to high technology solutions such as use of electric fencing and conditioned taste aversion methods and acoustic deterrents (Landry 1999; Vos 2000; Ogada et al. 2003). Another traditional method that has been tested is scaring predators by smell and sound of local people (Osborn & Parker 2003). For instance, it has been noted that the smell and sound of Maasai has deterred lions from approaching highly utilized Maasai areas (Western, D. ; Murua, S, pers. comm.). In addition, in a study near Amboseli N.P., Kangwana (1993) demonstrated that playing recordings of Maasai cattle noises repelled elephants from the area.

Many communities cannot afford high-tech husbandry solutions and thus can only rely on traditional methods to safeguard their livestock. But, Sekhar (1998) suggests that traditional guarding was the most effective measure against predation; even though it involves much hardship and time, it does not entail any financial investment by individual households and thus is readily accepted and practiced. In addition, researchers have suggested that by conserving wild ungulates in conjunction with proper husbandry,

depredation on livestock by carnivores can be minimized (Vos 2000; Ogada et al. 2003; Woodroffe 2005b).

Another challenge, which is regularly observed in Maasailand and other regions, is livestock that are left unattended to freely range in open pasture and are therefore more likely to suffer predation by carnivores (Conforti & De Azevedo 2003). Properly implemented husbandry techniques could have the dual effect of reducing livestock killed by predators and in the long term, preventing carnivores from acquiring a "taste" for livestock (Ogada et al. 2003). Therefore, developing effective livestock management strategies is critical for alleviating conflict between human and carnivores.

1.5.4 Local Response to Human-Carnivore Conflict

Another factor that is central to my research questions is understanding how local people respond to livestock loss, specifically how retributive killings manifest from conflict with carnivores. Persecution by humans in response to livestock depredation has eliminated many carnivore species, including the puma (*Felis concolor),* tiger (*Panthera tigris)* and the lion (*Panthera leo*) from significant portions of their former range (Nowell & Jackson 1996). Today, most carnivore mortality can be attributed to deliberate killings by people who perceive large carnivores as a threat to their livelihood (Mishra 1997; Ogada et al. 2003; Ikanda 2005).

Several studies suggest that livestock farmers are increasingly intolerant of livestock lost to carnivores (Mishra 1997; Hussain 2000). In India, villagers in the Himalayas capture wolf pups from dens and parade them around the community, where people give the captors money as a reward. Subsequent to celebrations the live pups are destroyed, often using

dynamite (Mishra 1997). Interestingly, most of the community members are Buddhist (who abhor killing living things) but see wolves as a major threat to their livelihood. Persecution of snow leopards in Pakistan by local farmers, as a result of depredation on livestock, has been described as the greatest threat to the survival of the species (Jackson 1979; Schaller et al. 1987; Fox et al. 1991; Nowell & Jackson 1996). Studies suggest that retaliation on carnivores is driven by the proportion of livestock lost, not necessarily frequency of conflict (Oli et al. 1994; Mishra 1997). As one of my major research questions in this thesis, I will investigate if a single depredation event is perceived to be more devastating to a person who owns fewer livestock as compared to an owner of large herds, and if those individuals would be more likely to retaliate (Oli et al. 1994; Mishra 1997; Dickman 2005).

In an effort to curtail furtive killings of carnivores, numerous countries sanction the killing of 'problem animals' that either threaten the life of a human or destroy property (Nowell & Jackson 1996). Although, this allows individuals to protect their property, there is also a worry that local people abuse this right to justify the pre-emptive killings of wild animals. There are laws in place to stop the open persecution of wild animals, but they do not necessarily prevent people from killing wildlife in secret. Examples of unlawful killings are seen with snow leopards in Nepal (Mishra 1997; Hussain 2003) and lions in Kenya (Frank et al. 2006).

As stated above, the most prevalent solution to livestock predation is killing nuisance animals in order to deter the rest from returning (Osborn & Parker 2003). However, many agree that eliminating 'problem animals' may only cure the proximate problem for a short time, but regardless of how many animals are killed the 'problem component' still exists and thus the animals that are removed will eventually be replaced by others (Hoare 1999). In

addition, specifically in high conflict areas, the majority of problem animals cannot be identified, so a token animal is killed instead. Communities believe that persecution and subsequent death of a problem animal means a reduced threat to communities and greater economic gains (Hussain 2003); however, the demographic impacts on small wildlife populations are potentially significant (Nyhus & Tilson 2004).

1.5.5 Compensation Schemes as a Potential Conflict Reduction Strategy

One possibility to attenuate or eliminate retributive killings of predators is by compensating local people for their loss due to carnivores. Compensation programs aim to better balance the distribution of costs and benefits coupled with conserving large carnivores (Naughton-Treves et al. 2003). Many conservationists believe that once local people are compensated for their loss due to depredation by predators this will in turn deter them from killing carnivores in retaliation (Wagner et al. 1997; Nyhus et al. 2005).

Challenges exist to compensation that need to be addressed and further studied, particularly in a developing world context. Globally, compensation schemes are meant to reduce the economic hardships of local people by paying them for their lost livestock; it is often hoped that payments will raise tolerance so as to conserve carnivores (Naughton-Treves et al. 2003). Many programs have failed due to corruption (Hussain 2000) and delays in delivery of monies (Saberwal et al. 1994; Treves et al. 2002). Programs that are implemented without consulting or allowing local communities to participate can cause friction or engender negative attitudes of local people towards compensation programs (Hussain 2000; Nyhus et al. 2003) or could be viewed as imposing western values on developing nations (Ferraro & Kiss 2002). In addition, compensation schemes have been criticized because as

local people are paid for their livestock lost to predators they may abandon conventional practices of good husbandry as they know they will receive reparation for their loss (Wagner et al. 1997; Nyhus et al. 2003). Very few studies have examined the effect of compensation on livestock husbandry (Nyhus et al. 2005).

Other concerns with compensation programs exist; for instance, Wells et al. (1992) suggested that the presence of a wildlife compensation scheme could increase rates of human immigration and in turn cause additional problems in an area. More fundamentally, Doremus (1999a) is concerned that compensation programs perpetuate local residents' perceptions that wildlife belong to the government and bolster the assumption that a predator-free landscape is the default landscape. Yet Doremus, and most other critics, acknowledge that compensation programs may be politically necessary (Doremus 1999b; Naughton-Treves et al. 2003; Nyhus et al. 2003).

Some of the problems with compensation programs might be alleviated through community participation and a development approach that integrates community and cultural institutions in the design and management of these schemes (Hussain 2000; Hotte 2001; Hussain 2003; Linnell & Broseth 2003; Mishra et al. 2003; Montag et al. 2003). In Pakistan, reacting to the failure of a compensation program, a snow leopard (*Uncia uncia*) project introduced an insurance scheme that was designed to be self-sustaining and locally managed (Hussain 2000). If designed appropriately insurance schemes favor collective coverage of livestock farmers' individual risk and encourages local people to set aside a collective pool of money or livestock equal to the value of the annual average depredation rate (Hussain 2000). This assures that the overall impact of predation is spread throughout the community instead of felt at an individual level (Hussain 2000). One benefit of such a scheme could be that it is

very difficult to abuse—unless the entire community decides to violate the agreement. This type of initiative might remove the prospect of 'free-riders' and promotes collective action by the entire community (Hussain 2000). Little research has been done on the effectiveness of insurance schemes, and they should be further studied.

Overall, compensation programs have had wavering success (Mishra et al. 2003; Naughton-Treves et al. 2003; Nyhus et al. 2005); however, it would be detrimental to stop ongoing programs as this could engender additional retaliatory actions by communities against carnivores (Naughton-Treves et al. 2003; Nyhus et al. 2005). Few studies have analyzed the effect of compensation programs on reducing retributive killings on problem carnivores in remote areas in Africa, Asia, and Latin America (Nyhus et al. 2003; Nyhus et al. 2005). Moreover, if compensation schemes are implemented efficiently, they still hold promise to resolve one of the basic challenges of wildlife (and biodiversity) conservation, that is, the economic burden of carnivores moves away from the locals and onto conservationists (Naughton-Treves et al. 2003; Nyhus et al. 2003).

1.5.6 Cultural and Traditional Values towards Wildlife

The final component that I will discuss affecting conflict and predictors of behavior are the systems embedded within people's values, norms, beliefs, perceptions, and attitudes. As different cultures and communities hold different values and beliefs, it is essential to recognize how specific values are interpreted within a society and in turn, how they influence attitudes and thus ultimately behavior (Roque de Pinho 2002).

Klatenborn et al. (1998) illustrates that attitudes towards large carnivores are highly correlated with environmental beliefs and traditional behavior. Also, Knight (2000) suggests

that attitudes toward specific wildlife are deeply rooted in cultural values. For example, in Maasai society, hyenas are loathed and are associated with negative connotations like greed, ignorance, and malevolence; although hyena kills represent a very small percentage of livestock loss compared to predation by other carnivores in northern Kenya (Frank 1998; Maddox 2002). A study in India (Mishra 1997) illustrated that Buddhist communities resent living with carnivores, but they do not actively persecute all of them because of the religious and cultural beliefs embedded within their society. For example, wolves are highly persecuted in India because of negative cultural beliefs, but snow leopards, responsible for the majority of livestock kills (Mishra 1997), are rarely persecuted. In addition, there are many examples that illustrate how existing cultural norms impede locals from destroying their environment. Communities in northern India worship animals and plants and although they lose ample livestock to carnivores, they still retain a positive attitude towards wildlife and conservation (Sekhar 1998). Also, the Bishnois people, living in western Rajasthan, have strong cultural norms against killing endemic deer and cutting down indigenous trees that are commonly offered to a religious deity (Matowanyika 1989; Dorm-Adzobu & Veit 1991; in Agrawal & Gibson 1999).

Studies have shown that political representation of carnivores also shape peoples' attitudes and tolerance levels toward carnivores and subsequently towards conservation initiatives (Gibson 1999; Naughton-Treves et al. 2003). An example is the ubiquitous lion-symbol in Kenya; lions are found on money notes and are the emblem of many tour companies and NGOs in Africa. The Maasai, who have endured altercations with the government and have lost land to wildlife (Parkipuny 1991; Berger 1993; Adams & McShane 1996), may resent lions not only because they kill their livestock, but also because

they have lost land to the establishment of protected areas purely for wildlife use (Berger 1993).

Considering the above, gaining a deeper understanding of how cultural and traditional value systems are involved in conflict will help conservationists design socially appropriate resolution methods. For example, Jackson et al. (2001) illustrated that in Mongolia and the Himalaya the most sound conservation investment includes direction linkages between biodiversity conservation, economic assistance, large-scale local community participation, and incorporation of local values into conservation programs. In addition, building local capacity, self-reliance, and stewardship of the land through grassroots conservation initiatives is key to resolving conflict between local people and carnivores (Western & Wright 1994; Jackson & Wangchuk 2001).

A further understanding and appreciation of local culture and religion can contribute to the design and implementation of conservation initiatives that connect conservation beliefs and goals for the benefit of wildlife (Ale 1998). Many studies have emphasized the importance of quantifying perceptions and attitudes of polarized stakeholders in order to find meaningful solutions to human wildlife conflict issues (Harcourt et al. 1986; Messmer 2000; Noss & Cuellar 2001; Conover 2002; Treves et al. *in press*), because currently the idea of using local traditional values as a conservation tool in the developing world is often overlooked (Infield 2001). Moreover, recognizing and developing traditional beliefs and local aesthetic values embedded within cultures would be invaluable to conservation efforts in Africa.

1.5.7 Other Contributing Factors

Certainly, determinants of conflict are site and situation specific, and in addition to those mentioned above, other factors have been identified as significant aspects in human-wildlife conflict. Examples include ecological and habitat characteristics (Vos 2000; Treves et al. 2004), carnivore densities and behavior (Linnell et al. 1999; Ogutu & Dublin 2004), and local economic reliance and diversification of livestock (Stander 1997; Butler 2000; Sillero-Zubiri & Laurenson 2001). Lastly, a key aspect of this thesis will focus on how attitudes and tolerance of communities affect local coping mechanisms to deal with carnivore conflict.

1.6 Importance of Study

To reiterate from the above discussion, human-carnivore conflicts present an urgent challenge worldwide because often these conflicts engender problems between communities and conservationists who seek to preserve wildlife populations (Karanth & Madhusudan 2002). The World Bank (1994) estimates that 65-80% of wildlife in Kenya live outside designated protected areas. As mentioned, when people and wildlife compete for resources, the risk of conflict is high. Kenya has lost over 50% of its wildlife in the last 25 years and is continuing at this pace (Norton-Griffiths 2003). The 50% loss of wildlife is attributed to myriad factors but chiefly results from habitat loss, population growth, and encroachment of local people into protected areas—leading to conflict between people and wildlife (Frank 1998; Woodroffe & Ginsberg 1998; Norton-Griffiths 2003). While a great deal is known about conflict issues between wildlife and agriculturists (Hill 1998; Naughton-Treves 1998;

Hussain 2000), pastoralists also share a large part of their land with wildlife, but less research has been conducted on their views and attitudes towards wildlife (Gadd 2005).

1.7 Project Aims

The primary intent of this thesis is to contribute to the growing body of research on human-carnivore conflict by investigating the factors contributing to the high rates of lion killings, including retaliatory killings in response to livestock losses. I also examine variation in Maasai tolerance towards carnivores around Chyulu Hills N.P. and the effect of compensation on Maasai attitudes towards carnivores and conservation. As I have illustrated above, many studies focus on human-carnivore conflict (from carnivore behavior to risk of depredation, and community attitudes) but few have explored the specific variables that lead communities and/or individuals to retaliate and kill carnivores. This study will measure people's reported propensity to kill carnivores as a proxy index for tolerance. An understanding of these driving forces is critical in reducing carnivore killings and increasing local people's tolerance toward predators and conservation.

More specifically, I will aim to elucidate the following:

1) How do social and ecological variables shape propensity of Maasai to kill lions?

2) What are local citizens' attitudes toward the current compensation scheme on Mbirikani Ranch and how does it affect people's attitudes toward conservation and their tolerance of carnivores?

The answers to these questions can aid in the development of a community-based conservation scheme, one that is primarily focused on empowering Maasai to conserve lions.

The Living with Lions project led by Dr. Laurence Frank, which includes the Laikipia Predator Project (LPP) and the Kilimanjaro Lion Conservation Project (KLCP), has been studying the biology of lions and hyenas in human-dominated landscapes in Kenya since 1997, and attempts to integrate scientifically–informed predator management strategies with livestock husbandry practices in Laikipia and Maasailand. The Living with Lions approach attempts to understand the multifaceted nature of human-carnivore conflict, by addressing the role of the three top predators in Kenya--man, lion, and hyena. Based on our understanding of the conflict between the three, we are testing and implementing community-based conservation projects to benefit rural people from predators and other wildlife. This collaborative approach aims to answer questions that could not be confronted from a single perspective. I am part of this ongoing project, with the specific aim of examining the human and ecological factors involved in carnivore depredation on livestock, lion mortality, and possible mitigation measures

Chapter II: Maasai History and Wildlife Conservation in Kenya

"Eishorua opa Enkai inkishu o nkujit, mikior intokitin neishoo iyiook Enkai"
God gave us cattle and grass; we do not separate the things God gave us.
-Maasai Proverb

The purpose of this chapter is not to retell Maasai history or literature, but rather to outline the social and historical context of the Maasai (specifically those in southern Kenya), in an effort to further elucidate current Maasai attitudes towards wildlife and conservation initiatives. I will outline the key historical transitions in Maasai land-use and ecology, namely the period of colonialism and post-independence.

Maasai have long been viewed by historians as "people of cattle" (Spear & Waller 1993) where life depends on vast stretches of pasture and access to water year-round for long-term survival. Historians and anthropologists alike, describe Maasai as one of the most prominent and powerful communities in East Africa up until the mid 19th century--the period known as "new pastoralism"(Spear & Waller 1993). Goldman's (2006) synthesis of changing Maasai political ecology reveals that historical, social, and political processes resulted in a change in Maasai cultural structure, and in a decline of Maasai control of their land and overall tribal autonomy. During the late 19th century the Maasai endured internal tribal conflicts as well as natural catastrophes that reduced their population and livestock numbers significantly and in turn made them increasingly vulnerable to British rule (Waller 1976; Adams & McShane 1996; Goldman 2006). Later imposition of protected areas curtailed Maasai homeland further (Anderson & Grove 1987). From the early 1900's, when the British arrived in Kenya, to the present, Maasai land has been carved up and reorganized making it difficult for the Maasai to continue a truly pastoral lifestyle (Goldman 2006). Although, Maasai did experience tribal discord and devastating epidemics prior to

colonization, the period during British occupation and post independence was particularly detrimental.

Maasai increasing vulnerability to change from outsiders resulted in extensive land-use change, mainly driven by European needs, but later as a result of wildlife conservation efforts in the form of protected areas. As wildlife became a politicized economic commodity for the Kenyan government, the Maasai were perceived as a hindrance to conservation progress (Adams & McShane 1996). Ole Parkipuny and Berger (1993) state that wildlife became more important to colonialist and post-independent government than were the rights and well-being of the Maasai. Pastoralists in East Africa are often seen as a major threat to wildlife conservation because of their demands for land and water resources (Sindiga 1984). It is perceived wisdom that the alienation of Maasai pasture for exclusive wildlife use engendered a myriad of problems from land degradation to increased human-wildlife conflict, and eventually to Maasai resentment of wildlife conservation initiatives (Berger 1993).

For over a century, the Maasai have been politically marginalized and physically displaced by both the colonial power and their own countrymen in the name of "*maendeleo*" (development) (Berger 1993; Lovatt Smith 1997). This section will highlight major historical events that have triggered feelings of mistrust by the Maasai (particularly in Kajiado district) due to land alienation, failed government programs, and wildlife conservation initiatives (Hughes 2005). To understand the current conflict between wildlife and Maasai, it is necessary to consider their historical context. Specifically, I argue that broader processes of confinement and containment, political marginalization and displacement have undermined

traditional Maasai ecology and have resulted in reluctance by the Maasai to accept environmental programs and wildlife conservation.

2.1 Background on Maasai History

The Maasai have dominated the pastoral niche in East Africa for the past four centuries (Spear & Waller 1993). They developed a rotational rangeland system and other resilient and adaptable methods to ensure long-term use of their environment and decrease vulnerability and risk of environmental pressures (Grandin & Lembuya 1987; Galaty 1993a; Sutton 1993). They reared humped Zebu or Sanga cattle, as they were better adapted to the semi-arid environment than other breeds (Galaty 1982; Western & Nightingale 2002). In addition, the Maasai increased their herds as an insurance strategy during adverse times, and occasionally relied on their agricultural neighbors to provide food (Spear 1993; McPeak 2005). Lastly, the Maasai age-set system allowed *murrans* (warriors) to secure ample pasture and water through traditional tactics like cattle raids and fierce combat (Galaty 1993a in Goldman 2006).

2.2 Vulnerability to British Rule

Although the Maasai utilized various tactics to safeguard themselves from environmental risks, social discord—specifically intertribal conflict with other Maasai sections weakened them. The *Iloikop* Wars of the 1820's-1870 was the earliest documented period of Maasai decline (Waller 1979). Until then, the Maasai were the dominant force in the interior of Kenya and Northern Tanzania during the late 18th century (Waller 1976; Spear & Waller 1993). The *Iloikop* Wars were a series of conflicts between various Maa-speakers over control of the Rift Valley—more specifically for continued access to water resources

and pasturage (Sutton 1993). Most importantly, the losers (*Iloikop or* Laikipiak Maasai) were forced to abandon pastoralism and adopt new production systems (i.e., agriculture). These production systems were viewed as demeaning by the Maasai (Galaty 1982; Spear 1993). Although they defeated the *Iloikop*, the victorious Maasai sections were later weakened by the long years of warfare and were unable to effectively occupy the areas where which they had expelled the *Iloikop* (Waller 1976). There was a need for a continual balance between the available pasture and the number of people utilizing this land. Too little pasture caused internal conflict over resources, yet unused pasture beckoned encroachment from outside communities (Galaty 1993b). The *Iloikop* Wars were driven by the former but resulted in the latter. Maasai slowly began to lose control of their natural environment, as well as their exalted status over the other communities in East Africa (Waller 1976). The *Iloikop* Wars are just one example of how the Maasai slowly began to lose power in Kenya, which made them increasingly vulnerable to British rule.

Another example occurred between the years of 1884-1893; the Maasai suffered a series of severe droughts and widespread outbreak of diseases. This time period, known as *enkidaaroto* "the disaster" or "when the cattle died", reduced the Maasai population by half and is estimated to have killed 90% of the cattle (Waller 1976; Adams & McShane 1996). These amalgams of misfortunes, specifically warfare, disease, and drought, weakened Maasai power and allowed the British to penetrate into Maasailand.

Scholars argue (Waller 1976; Sindiga 1984; Sutton 1993; Lovatt Smith 1997) that the initial relationship between the British and the Maasai was somewhat symbiotic in that the British were eager to draw on the military resources of the Maasai in order to gain access to other tribe's resources (generally through levies), but more importantly, they needed Maasai

protection during the completion of the Uganda Railway (Halderman 1987). At the same time, the Maasai were still recovering from the epidemics of the late 19th century and the British were viewed as nothing more than an ally to gain back control of their land and rebuild their livestock numbers (Waller 1976). Undoubtedly, the British approached the Maasai with caution as the Maasai were well known to be a fierce tribe (Lovatt Smith 1997). In 1901 the Commissioner of the East Africa Protectorate wrote:

> "I regard the Masai as the most important and dangerous of the tribes with whom we have to deal in East Africa, and I think it will long be necessary to maintain an adequate military force in the districts which they inhabit….it would, of course, be unwise to irritate them, and there is always some danger of misunderstanding…"
> (Eliot 1901: 9 in Halderman, J 1987)

This quote illustrates the respect the British had for the Maasai as a powerful tribe, but one that requires vigilant observation.

2.3 The Impact of Land Alienation on Maasai

By 1905, the British fully established itself as a dominant power in the area and forged alliances with many tribes. As a result, their relationship with the Maasai became less important amidst the demands of a developing colonial policy (Waller 1976). The British were eager to offer the most fertile lands to either European settlers or South Africans for potential investment opportunities (Halderman 1987). In 1903 the British commissioner stated:

> "As a matter of principle, I cannot admit that wandering tribes have a right to keep other and superior races out of large tracts merely because they have acquired a habit of straggling over far more land than they can utilize"
> (Eliot 1903:21 cf Sanford 1919 in Halderman 1987).

The above quote is notable in that the British, who traveled ('wandered") from a far distance to occupy Maasailand, used the word "wandering" when referring to the Maasai's pastoralist culture, though Maasai are a people who had been utilizing their land for many centuries, and the British had only recently arrived.

This type of ideology pushed forth the 1904 treaty, which created two separate Maasai Reserves, one in the south (Kajiado) and one in the north (Laikipia). The treaty stated that the Maasai must be "satisfied" with the agreement and would decide of their "own free will" to vacate the Rift Valley and move to one of the two designated reserves (Halderman 1987). Contrary to treaty rules and regulations, a British officer in Kenya stated "finally under heavy pressure the Maasai surrendered, much against their will, to the wishes of the Government….the whole episode was an eviction and nothing else" (Ross 1927: 134). This quote suggests that Maasai were forced by the British to relinquish their land for European needs and I believe these acts only exacerbated ongoing mistrust between the Maasai and external actors.

In 1911, the British displaced additional Maasai from surrounding areas and relocated them to the prescribed reserves. An estimated "10,000 people, 200,000 cattle, and 550,000 sheep and goats were evicted from the alienated land and moved into the southern Maasai reserve" (Sanford 1919: 36 in Sindiga 1984). These numbers only added to the population already living there, and as a result of overpopulation, indications of land degradation and overuse emerged (Sindiga 1984; Berger 1993). The Maasai were not able to fully utilize these reserves as much of it was too arid for grazing, tsetse infested, and/or allotted to wildlife reserves (Sindiga 1984). "Prior to colonization, about 45,000 Maasai inhabited over 200,000 sq. km. By contrast, by 1961 around 117,000 Maasai were limited to some 93,000

km² (a 5.5 fold increase in population density)"(Talbot 1986: 445). Consequently, signs of land degradation manifested, likely due to intensified pressure on the ecosystem due to increased livestock and the restriction of human population in contained reserves.

Recognizing the enmity mounting from the Maasai, the British attempted to legitimize this second displacement in 1911 by using the 1904 Anglo-Maasai agreement that was signed by the illiterate Olonana ole Mbatian, then chief *laibon* for all Maasai sections (total of five sections). Politically, Maasai are an acephalous society, lacking a distinct ruler or king and divided into autonomous territorial section; each section had a leader known as a *Laibon* (spiritual leader) (Tignor 1972). Aggravated by the perceived deception, the Maasai went to court in 1913 ("The Maasai Case") to appeal the high courts for their land to be returned. The Court of Appeals of East Africa denied the Maasai the rights to their land as they had already signed the agreement to vacate the Rift Valley.

2.4 The Impact of Government Programs in Maasailand

By 1915 the British became aware of the impact of Maasai land-use on the environment, and attributed this problem to overstocking by Maasai herds. At this time the colonial government began implementing programs to reduce livestock numbers as they identified Maasai grazing as a major threat to wildlife (Collett 1987). In 1917 the British imposed livestock quarantine regulations to prevent Maasai stock from mixing with European stock (Sindiga 1984). Maasai have always been dependent on livestock trade, which enabled them to practice selective breeding and to gain income during times of hardships (Spear & Waller 1993). Due to the sudden halt in the livestock market, Maasai livestock numbers grew rapidly and caused additional adverse affects on the ecosystem. By

the mid to late 1930's desertification was a serious problem in Maasailand (Campbell 1986). The British acknowledged these issues, but held the Maasai responsible because of their need for "exorbitant" numbers of livestock, rather than recognizing that desertification is most likely a result of limited dry season grazing (Campbell & Migot-Adhola 1979; Collett 1987). Moreover, the negative impacts on the environment probably resulted from exceeding carrying-capacity limits in constrained areas rather than just the issue of overstocking. British attempts to reduce Maasai livestock numbers were inconceivable to Maasai because eliminating cattle from their life was analogous to stripping away their pastoral identity (Campbell 1986; Spear 1993) and would increase their vulnerability to environmental risks.

Resulting from these conjectures, the government pursued a policy of destocking herds by encouraging supplementary 'sustainable' livelihoods like cultivation (Sindiga 1984). However, due to Maasai aversion of participating in agriculture, the Maasai attempted to reopen a market for off-take of stock, but due to the European monopoly over the market it was extremely difficult for the Maasai to gain access (Sindiga 1984). Again reacting to previous failed program, the government attempted to establish water sources in various areas of the reserve to reduce intense land use in areas abut water points; however, these efforts were of no use and only led to additional overgrazing and land degradation (Campbell 1986). By 1945, many areas of Maasailand had very little pasture left, and officials estimate that there was "a livestock density of one beast to every 4.05 hectares on land that could not carry more than one beast to 8.1 hectares" (Britain 1934a :1211 in Sindiga 1984).

By the early 1950's the government realized its passed failures and once again attempted to improve services and conditions for the Maasai. The African Land Development

(ALDEV) was introduced in the 1950's and focused on various veterinary techniques (i.e., dipping stock), rotational grazing, tsetse fly control, construction of water points, and most importantly limiting herds to the carrying capacity of the land (Sindiga 1984). Although the ALDEV scheme tried to transform Maasai grazing patterns to reduce stress on the ecosystem, it was not successful in that the core aims of the program were analogous to previous failed initiatives but with slightly modified methods (Sindiga 1984). Most importantly, it did not take into account the problem of limited land and eventually, through additional veterinary measures, livestock numbers continued to grow and cause additional stress on the land (Adams & McShane 1996). In 1955, the Narok District Development Plan declared:

> "In their attitudes to progress the Masai are utterly supine. Their distrust of government and of the European, which to them are the same, has led them into the false belief that if they hold fast to that which theirs by tradition, they may discount at will all that passes beyond their borders" (ALDEV 1962: 2)

This quote provides a very good example of how Maasai obduracy to change engendered additional hostility towards external groups and thus impeded opportunities for tribal advancement. Moreover, the many schemes created to reduce erosion and land degradation were simply aimed at reducing the problem of overstocking instead of focusing on the root of the issues which was the reduction of land (Sindiga 1984). Colonial programs attempting to alter Maasai livestock husbandry and cultural ecology contributed to lasting land degradation (Sindiga 1984; Adams & McShane 1996).

Moreover, it has been noted that the source of land degradation in Maasailand was a direct cause of reserve restrictions that were exacerbated by failed development programs and the loss of trade markets monopolized by Europeans (Campbell 1986; Collett 1987). Most importantly, during the implementation of all the above programs, the Maasai were not

consulted on the design, execution, or feasibility on any of the propositions (Berger 1993). The British implemented these ephemeral programs that related little to Maasai culture, but instead attempted to transform Maasai into what the British deemed acceptable (Berger 1993). Scholars argue that these failures engendered additional mistrust of the Maasai toward governmental policies and later conservation initiatives (Berger 1993; Adams & McShane 1996).

2.5 The Impact of Wildlife Interventions

In 1945 the Kenyan government began gazetting a series of national parks and protected areas for wildlife purposes at the request of European hunters and conservationists, which only furthered the loss of Maasai land—although at a much smaller scale than past events (Halderman 1987). As stated above, Maasai resources were depleting at exponential rates due to overgrazing and, as a result, they were forced to enter protected areas to acquire adequate water and forage for their livestock (Lindsay 1987). In 1948, Amboseli National Reserve (ANR) was created, covering an area of 392 km². The Maasai were still permitted to use this area as the government policy at the time was "not to interfere with indigenous peoples or stand in the way of legitimate human development" (Kenya 1946: 6 in Lindsay 1987). However, ANR brought many problems for the Maasai; most notably from wildlife competition for water and fertile pasture (Campbell et al. 2003b), disease transmission (i.e., Malignant Catarrhal Fever), and depredation of livestock (Lindsay 1987; Lovatt Smith 1997).

Disregarding the problems incurred by wildlife on Maasai livelihoods, the Kenyan government supported ongoing protection of ANR, as they realized that wildlife was a lucrative commodity, since the income generated from tourism was increasing steadily.

Consequently, additional restrictions were imposed on the Maasai. A section of central Amboseli was demarcated as a "livestock free zone" and *murran* (warrior) activities were controlled by game officials (i.e., banning of cattle raids). However, *Olamayio* (lion hunts) were still clandestinely maintained throughout Maasailand (Lovatt Smith 1997). "Maasai could not understand why, in some areas of their own land, white people could go out and kill lions with their guns while the *morani* were severely punished. If a lion attacked their cattle, it was surely only right that they should be able to protect their livestock" (Lovatt Smith 1997: 42). Historians and conservationists concur that up until this time period the Maasai rarely killed wildlife malevolently (Berger 1993; Lovatt Smith 1997) but rather only in the interest of protecting their livestock or for traditional reasons.

Subsequent to independence, revenues generated from tourism and hunting were increasing fast and a small portion was allocated to the Kajiado African District Council in an effort to encourage Maasai to accept the Reserve for primarily wildlife use. The government used money to entice the Maasai to reduce livestock numbers from the interior basin. However, this tactic was short-lived because the money that was awarded to the county council was not reaching the Maasai who depended on this area for their livestock and who were enduring the brunt of the conflict with wildlife, but instead was pocketed by the community elected council (Lindsay 1987). In response, *murrans* began killing rhinoceroses and elephants as a form of political protest against lost dry season grazing (Lindsay 1987) and for fear that Amboseli would soon be designated a National Park, which would only further limit their access to resources.

As was predicted by the Maasai, in 1974 the Amboseli Game Reserve was gazetted as a National Park. In a nationwide program of land adjudication, Maasai were to move into

predetermined group ranches (see Chapter III, Section 3.5). Realizing that past conservation schemes failed, the 1977 Park agreement offered a number of benefits to the Maasai subsequent to agreeing to move. These benefits included: guaranteed access to water supplies, compensation for tolerating wildlife (cost equal to the market value of cattle that could have been reared instead of the equivalent density of wild herbivores), increased infrastructure (i.e. schools, clinics), and direct benefits from tourism (Lindsay 1987). In June 1977, the Maasai agreed to leave Amboseli in return for the benefits stated above. This time the Maasai did not sign an agreement but instead insisted on a verbal agreement (which was culturally appropriate), since singed agreements where not honored in the past (Western, D 2006 pers. comm.). Observers often question why, after experiencing decades of broken promises and unwarranted displacements, the Maasai agreed to once again, move off their land with nothing more than the hope that their government would comply with the terms of the agreement (Berger 1993; Lovatt Smith 1997).

Following the previously set precedent, the government failed to provide the Maasai the long-term benefits promised. For example, the pipeline worked for only a couple of years (lack of maintenance), wildlife fees became sporadic and stopped after 1981, and direct benefits were almost non-existent (Lindsay 1987). Moreover, Maasai had little reason or incentive to stay out of the park as their own government had chosen wildlife over the well-being of their own people. On the other hand, Western (1982) indicates that since Amboseli was gazetted into a national park, wildlife numbers have increased, poaching was reduced, and agriculture has expanded while pastoralism has decreased—thus alleviating competition between livestock and wild herbivores. In addition, it has been noted that tourism from

Amboseli National Park benefits the national citizenry of Kenya, albeit imposing local costs on the surrounding Maasai communities (Western et al. 1998).

In 1993, Richard Leakey (head of Kenyan Wildlife Service at the time) attempted to provide additional benefits to the Kisongo Maasai who were sharing their resources with wildlife from Amboseli, in an effort to increase their tolerance towards wildlife. He promised to pay them 25% of entrance fees paid by tourist visiting Amboseli in order to curtail wildlife killings. However, this promise was not honored (Lindsay 1987). Towards the end of 1993 the amount owed to the communities (their 25% share of gate revenue) was almost one million US dollars—about fifty million Kenyan shillings (Lovatt Smith 1997). In response to the lack of benefits and loss of habitat and resources, the local Maasai communities decimated the lion population in the early 1990's around Amboseli National Park, leaving only two lions in the entire reserve (Chardonnet 2002). Retaliation and persecution of wildlife in political protest is not new to the Maasai, especially those living in rural areas that cannot voice their objection and frustration in other ways (Standring 2004). Indeed, ongoing killing of wildlife (specifically those species targeted for tourism purposes) are not uncommon in Maasailand today. Conservationists in Africa conclude that conservation of wildlife is unlikely to succeed unless community needs are jointly met (Neumann 1998; Western 2003).

In conclusion, the intertwined processes of land alienation, ineffectiveness of government aid programs, lack of reparation for tolerating wildlife, and broken promises have resulted in Maasai distrust and so a dissonant policy towards wildlife conservation. Others argue that the colonial era left a lasting mark on African conservation well ahead of the advent of similar practices around the world and that many protected areas and legislation

was passed during colonialism (Grove 1987; Western 2003). Nevertheless, in the past 30 years the Maasai have developed increasingly hardened feelings toward wildlife. As a result, the majority of Maasai have little interest in conservation or wildlife on their land. “Relentless cultural defacement, wanton shooting of wildlife living in their territory, and land fragmentation for more than 100 years have divorced the Maasai from wildlife” (Ole Parkipuny & Berger 1993). In addition, the misinterpretation of the Anglo-Maasai agreement has only exacerbated Maasai resentment toward the government and further development projects. On August 15, 2004 the Anglo-Maasai agreement was due to expire and the Maasai were under the impression that they were to reclaim their homeland. But the illiterate *laibon* Olonana ole Mbatian, had signed in 1904 a 999-year lease instead of one for 99 years, which was the understanding by all the Maasai (Kabukuru 2004). In the Nanyuki Declaration of 2004, a handful of elders in Nanyuki stated, "We are the elders of the Laikipia district and we are the legitimate landowners …which the colonial British regime took away fraudulently by entering us into the so called Anglo-Maasai treaties" (Kabukuru 2004: 49). The Maasai have vowed to take any necessary measures to reclaim their stolen land as well as fight for years of lost compensation (Kabukuru 2004).

The Maasai have undergone enormous transformation since the emergence of colonialism through the past three decades of sovereign rule in Kenya, and have experienced continual interference of their indigenous cultural ties to their environment (Ole Parkipuny & Berger 1993). Nineteenth century Maasai life brought on relentless hardships, from the *Iloikop* Wars to years of drought and disease which reduced livestock by up to 90% and cut the human population by half. The episodes in the 19th century did not cause the ultimate decline of the Maasai people, it only hindered them. Rather, many argue that it was British

and governmental actions, through expropriation of rangelands, that led to present environmental disasters and Maasai intolerance of wildlife and conservation initiatives (Sindiga 1984; Adams & McShane 1996). Still decades after independence, whites remain in control of wildlife, for both scientific and economic purposes (Bonner 1993). Currently, however, there is an increase in Kenyan involvement in environmental and conservation agendas. Nonetheless, the number of Maasai who actually play a central role in conservation management or policy in Kenya is infinitesimal (Katoo, M, MP of Kajiado District, pers, comm.).

This chapter is not intended to place the blame of Maasai intolerance of wildlife conservation solely on specific policies and practices during and after colonialism. Instead the purpose is to explore the effect of the processes of confinement and containment, political marginalization, and displacement in an effort to further understand current Maasai attitudes and behavior regarding wildlife, conservation and conflict. At present, political tensions still exist between Maasai, their government, and whites. Therefore, this chapter sought to examine the root of this antagonism and how these feeling of mistrust altered attitudes and overall resentment towards wildlife conservation in southern Kenya. I argue that today, as in the past, Maasai are reacting to the opportunities and restrictions imposed by the constant changes in politics, economy, and social structure. Moreover, Maasai intransigence to environmental schemes and wildlife conservation is shown to be, in part, a result of past historical events (Ole Parkipuny & Berger 1993).

Chapter III: Study Site and Background

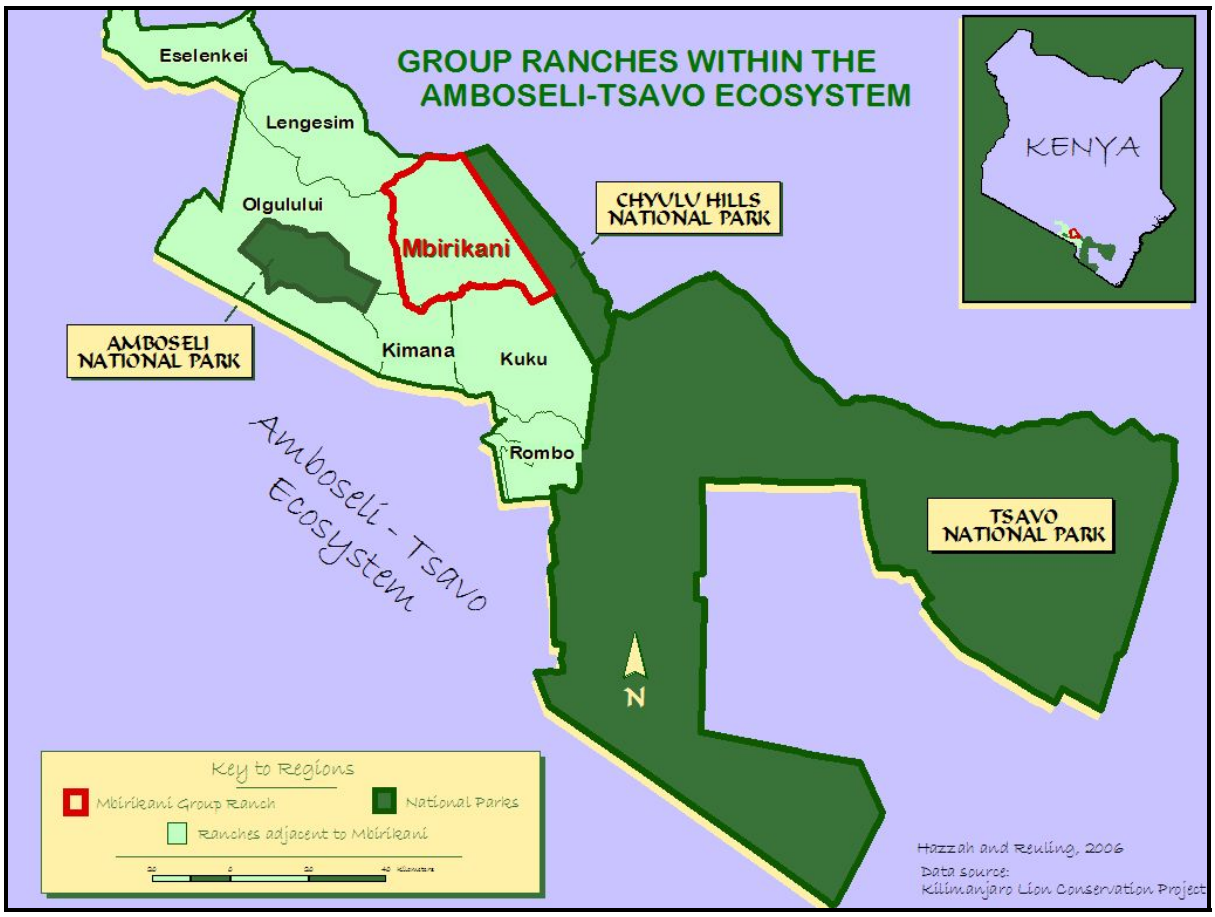
3.1 Regional characteristics

I carried out my research on the eastern side of Mbirikani Group Ranch (MGR) along Chyulu Hills National Park (CHNP). The ranch is approximately 1,258 km² and is in close proximity to the 392km² Amboseli National Park (ANP) to the west and borders CHNP to the east, which is approximately 471km² (Mbogoh et al. 1999). The ranch thus acts as a dispersal area for wildlife from the two parks (Muthiani & Wandera 2000). MGR lies in the heart of the greater Amboseli-Tsavo ecosystem, which covers 4,000 km² and plays a central role for subsistence pastoralism and biological conservation of various keystone and flagship species (Western & Wright 1994). MGR is an important corridor for migration of various herbivores during the wet season, which in turn attracts carnivores and subsequently increases conflict between local Maasai livestock and predators (Western 1982).

Formed in 1969, MGR was one of the first group ranches in Kenya to be adjudicated and is the second largest ranch in the Kajiado district after Olalarrashi/Olgulului Group Ranch (Mbogoh et al. 1999). MGR is located in the Loitokitok Division of Kajiado District (MAP 3.1) and falls along the Emali-Loitokitok road. There are six group ranches surrounding MGR: Eselenkei, Olgulului/Olalarrashi, Lenkisem, Kimana, Kuku, and Rombo (MAP 3.2). Together these ranches cover 5,063 km², which is approximately 32% of the total area of the Kajiado district (Ntiati 2002). The impetus to create group ranches in Kenya was to provide land security for Maasai communities by providing communal lands and preventing the immigration of outsiders (Kimani & Pickard 1998). The group ranches (especially those that have not yet been subdivided) are critical sites for wildlife migration

during the wet season but also support a diversity of wildlife living outside of protected areas year-round (Sinclair & Norton-Griffiths 1979; Western 1982; McNaughton & Georgiadis 1986; Ntiati 2002).

Map 3.1: Mbirikani Ranch within Kajiado District and Kenya



Map 3.2: Mbirikani Group Ranch within the Amboseli-Tsavo Ecosystem

3.2 Biophysical Characteristics

MGR encompasses a multitude of diverse ecological zones from dry arid savanna and swamps to highly elevated forest regions near the CHNP. This diverse habitat houses a wide variety of herbivores, carnivores, bird life, and vegetation. Ecologists have categorized the vegetation zones into eight specific habitats.

The largest zone is the dense-bush, which has been described as "fairly overgrazed, since the pipeline providing water runs through the middle of it" (Groom, R, PhD candidate, pers. comm.) and thus livestock herds are commonly smaller due to limited resources in this

zone (pers. obser.). Additional habitat zones found on the ranch are the Thinly Bushed Grassland, Wooded Grassland, and Bushland, dominated by *Acacia* spp. Also occurring along the higher elevation eastern border of the MGR and the CHNP are the well-known Lava Forests. This vegetation zone is characterized by highly alkaline lava soils. Dense Mist Forest habitat grows atop the hills (in CHNP) that decorate the eastern region of MGR. Lastly, the Swampland is found along the southernmost boundary of MGR and the neighboring Kimana Group Ranch (Hurt 1999).

Two perennial rivers, the Isinet and the Kimana, traverse this southern region, contributing to the irrigation of the fertile swamp habitat and also providing the essential water source for many agriculturalists (Hurt 1999). There is no entrapment of surface water on the Chyulu Hills, because of the highly porous nature of the volcanic soil, and therefore no rivers flow from the Chyulus down to the group ranch (Berger 1993). The diversity of habitats on MGR allows for pastoralism to persist as well as agriculture in areas adjacent to the swamps. The largest livestock herds are found near the eastern boarder along the Chyulu Hills, as it offers year-round pasture and easy access to the national park. The Lava Forests adjacent to the Chyulu Hills are prime habitat for lions and other carnivores, such as leopards (*Panthera pardus)* and spotted-hyenas (*Crocuta crocuta* (pers. obser.). Subsequently, herders and carnivores come into conflict over shared resources (Bonham, R, owner of Ol Donyo Wuas Lodge, pers comm; pers obser.).

3.3 History of Lion Killing in the Amboseli-Tsavo Ecosystem

The intent of this section is to explain the pattern of lion killings in the Amboseli-Tsavo ecosystem over the past five years. Between the years of 1998 and 2004, KWS biologists reported 87 lions killed in and around Nairobi National Park, an event decried in international press (BBC 2003). A similar outbreak in lion killings occurred in the region between Amboseli and Tsavo West National Parks, but this received less attention (Frank et al. unpublished data).

One of the few reports written about lion killings in this region concerns the 1990 decimation of the lion population in ANP, when local Maasai communities were reported to have poisoned lions in response to livestock predation and loss of habitat and resources (specifically swamp lands), leaving only two lions in the entire reserve (Chardonnet 2002). Between the subsequent years of 1991 and 1993, Maasai eliminated lions from Amboseli entirely (Chardonnet 2002). In 1994, two lions entered ANP from Chyulu Hills and other surrounding areas, which allowed for a tentative rebuilding of the lion population in ANP (Chardonnet 2002). As a continuation of the 1990's crisis in Amboseli, between 2001 and December 2006, people living in the Amboseli-Tsavo ecosystem killed a minimum of 130 lions (Frank et al. unpublished data). As of December 2006, only three adult females, five cubs under 6 months old, and two cubs between 1 and 1.5 years of age remain on MGR (Maclennan, S. from KLCP, pers. comm.) and an estimated 49 lions remain in ANP (Watts & Holekamp 2005 unpub.)

Frank et al. (2006 unpub.) suggest that both retaliation (*Olkiyoi*) for livestock predation and traditional lion hunts (*Olamayio*) are the main reasons for these killings. The Maasai practice *Olkiyoi* ("war cry"), which is a form of retaliatory killing that involves all

age-groups converging as a community to eliminate a problem carnivore (a similar practice called *chaku* is seen today in the Bolivian highlands: Morales, A unpub.). Most often, it does not entail prior organization, as does *Olamayio* (ritual lion hunts), but rather is a spontaneous act tacitly sanctioned by the community elders. In addition, *Olkiyoi* is frequently carried-out without the knowledge of wildlife officials. Maasai either spear problem animals or, less commonly, use poison (Ikanda & Packer *in press;* Frank et al. unpublished data).

Although there are no data on lion population numbers for the rest of the Amboseli-Tsavo ecosystem, data from Mbirikani Group Ranch has been extrapolated to derive a rough estimate of the Kajiado district lion population where the current resident population of MGR is three adults and seven cubs on an area of 1200 km², for a density of 0.005/km² (Frank et al. unpublished data). However, given that the activities of the Predator Compensation Fund and the Kilimanjaro Lion Conservation Project have apparently reduced the level of killing on MGR, compared to neighboring group ranches, suggesting that the MGR density might be higher than most areas of Kajiado District. Thus, assuming that the entire district is still all wildlife habitat, the 18,000 km² of Kajiado would hold fewer than 90 lions of all ages, or 60 adults and subadults (Frank et al. unpublished data).

There are even fewer data for Narok District (22,000 km²), so it is more difficult to estimate possible lion numbers. Ogutu et al (2005) estimated the density outside the Masai Mara Game Reserve as about 12.5% of that inside. Applying Ogutu et al. (2005) figure to Dloniak's (2006) density estimate of 0.18/ km² for the Reserve, Frank et al. (unpub.) reports 0.0225 lions/km², or fewer than 500 adult and subadult lions in Narok District.

Evidence points to a recent increase in lion killings and a precipitous drop in lion populations in Kenyan Maasailand. The estimates given above suggest fewer than 560, in

addition to the 270 Dloniak estimates for the Maasai Mara Game Reserve (Frank et al. unpublished data). Frank et al. (unplub.) estimates a total of 825 lions in Kenyan Maasailand, which accounts for 41% of the total lion population in Kenya. Although proximity to Serengeti National Park may help lions persist in the Masai Mara Game Reserve, elsewhere in Narok and in Kajiado districts lions appear to be declining.

The full scope of the lion killings in the Amboseli-Tsavo Ecosystem between the years of 2001 and 2006 is uncertain because our figures represent only known killings (i.e., cases where lion carcasses were retrieved). Many other killings are likely to have gone undetected. The majority of research on this topic is emerging from the Kilimanjaro Lion Conservation Project, a project initiated in 2004 that has focused most of its efforts around on Mbirikani Group ranch adjacent to CHNP. Although data are not complete, lion killing appears to be increasing (see Table 3.1 below).

Year	**Lions Killed**
2001 *	20.5
2002 *	20.5
2003	11
2004	19
2005	17
2006 (through December)	42
TOTAL	**130**

Table 3.1: Known Lion Killings in Amboseli-Tsavo Ecosystem, 2001-2006. * Accurate dates were not recorded in 2001-2002, so the 41 known killings were averaged for those two years (Frank et al. unpublished data)

Figure 3.1 shows trends in lion killings on the group ranches in Maasailand and in ANP. The reason for the decline in lion killings for Mbirikani over the past 3 years is a subject of intense debate. Some observers attribute this decline to the low population of lions remaining

on the group ranch (Frank et al. unpublished data). A more optimistic interpretation is the coincidence of the decline with the 2003 onset of the Predator Compensation Fund (PCF). This debate has great significance for any evaluation of conservation measures. I do not have detailed data to test whether lion killing has decreased simply because there are fewer lions surviving. Nor do I have full documentation of lion killings before and after compensation. But the interview data I share in this thesis allows for a careful examination of the conjecture that local Maasai attitudes toward lions have improved due to the compensation program.

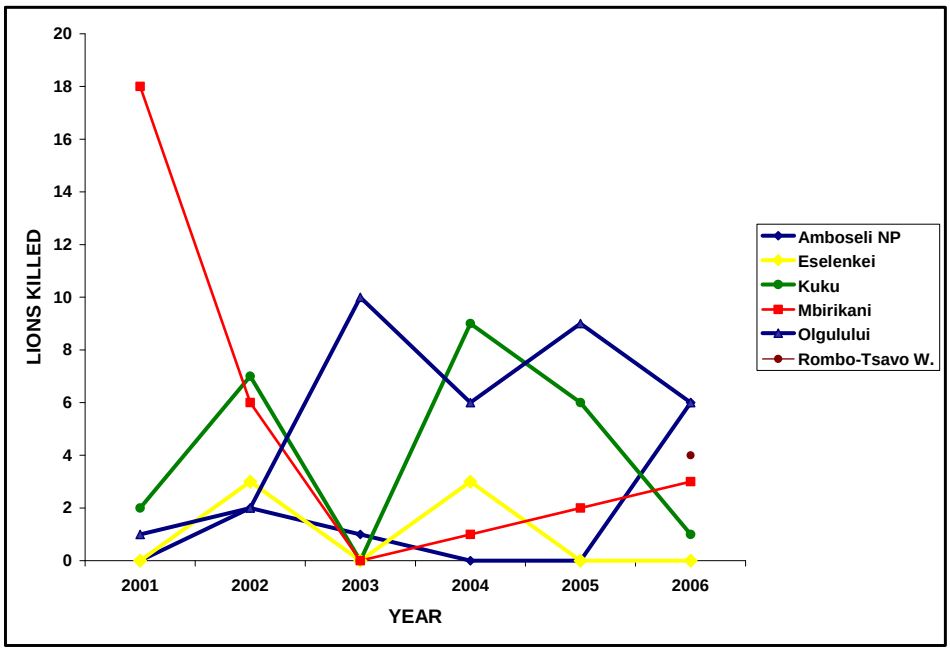


Figure 3.1: Trends in Lion Killings in 6 sub regions of Amboseli-Tsavo Ecosystem, 2001-2006 (Frank et al. unpublished data)

Table 3.1 and Fig 3.1 highlight the vulnerability of the dwindling lion population to illicit killings. Understanding the root causes of why so many lions are being killed is critical to conservation efforts in the Amboseli-Tsavo ecosystem, and may provide insights for other areas of Maasailand.

3.4 Maasailand Environment and Social Change

The next three sections will discuss how Maasai livelihoods and social structure are changing in southern Kenya in response to economic pressures, land tenure, and wildlife perturbations. Maasailand is characterized as an area with low precipitation and highly variable rainfall patterns, sporadic droughts, and spatially heterogeneous pasture resources (Homewood & Rogers 1987; Homewood 2004 in Goldman 2006). Typically there are two rainy seasons throughout the year: short rains (from November-December) and the long rains (from April-June). Rainfall generally varies from 300mm to 900mm per year (Berger 1993). Rainfall is the single most important factor influencing land-use practices for both livestock and cultivation in Maasailand (Ntiati 2002; Reid et al. 2004).

In addition to rainfall variance, a confluence of economic, social, and political factors, both locally and externally driven, has resulted in a major shift in Maasai livelihood patterns (Campbell 1979; Western & Nightingale 2002). Over the past 20 years agropastoralism has increased and prospered while the number of transhumant Maasai have declined (Barrow et al. 1993; Hackel 1999; Campbell 2000; Cheeseman 2001; Seno & Shaw 2002). This shift towards cultivation is viewed as a means of diversification to reduce vulnerability to drought and risk of famine (Campbell & Axinn 1980; Rutten 1992). However, Kimani and Pickard (1998) state that with the present level of farming technology in Kajiado District, dryland farming is not a viable option for the majority of people living in these areas and is likely to cause additional degradation and poorer yields.

Another factor driving land-use change is increasing immigration of other ethnic groups into Maasailand, which has resulted in ethnic heterogeneity (Kimani & Pickard 1998;

Ntiati 2002). A census conducted in 1989 of the total population of Kajiado District revealed that Maasai accounted for only 57% (many are farmers), and that the population included 24% Kikuyu and 8% Kamba (Kenya 1994). Due to this amalgamation of ethnicities, Maasai are continually drawn into the possibilities of economic diversification and profit-making schemes which are visible in agricultural activities, wildlife-based tourism, and other economic ventures (Campbell 1979; Campbell 2000; Cheeseman 2001).

This change in land use is currently transforming the entire economy of the Amboseli ecosystem, from a mixed wildlife-livestock system to a diversified agriculture-based system. Scholars argue that one area of particular concern is conflict among farmers, pastoralists, wildlife conservationists, individual land owners and government due to the illegal use of protected areas (Wells et al. 1992; Hoare 1999; Campbell et al. 2003c). The proximity of wildlife, farm fields and ranching has created frequent conflict between farmers, herders and wildlife (Ntiati 2002; Campbell et al. 2003a; Reid et al. 2004). As cultivation and other farming practices encroach upon wildlife habitat, human-wildlife conflict has intensified (Campbell et al. 2003a; Okello 2005). In addition, increased utilization of swamp areas for cultivation has destroyed valuable dry season habitat for both livestock and wildlife (Western & Nightingale 2002; Okello 2005), and in turn both must inevitably share grazing and water resources elsewhere. As a result, Maasai utilize a variety of methods to cope with these changes and decrease their vulnerability to environmental risks (see Chapter 1, Section 1.2).

3.5 Group Ranches and Subdivision in Maasailand

Changes in livelihood patterns and land-use practices in Maasailand have predominantly resulted from the establishment of group ranches and the process of subdivision. In 1968 the Kenyan Government introduced the concept of group ranches with the overall aim of addressing the issues of land degradation and overgrazing by encouraging pastoral Maasai to graze only within the group ranch boundaries (Kimani & Pickard 1998, also refer to Chapter 2). Government officials hoped this would encourage Maasai to reduce their livestock numbers (Galaty 1992; Kimani & Pickard 1998). However, according to later government reports, group ranches were unsuccessful (Pasha 1986; Graham 1989; Munei 1991) and pastoralists did not restrict their livestock within the group ranch boundaries, nor did they reduce their stock holdings. Presently, excessive grazing in national parks is still commonplace, especially during the dry season (Bonham, R, pers comm; pers obser). Reid et al. (2004), provide an example of this problem using Rombo Group Ranch, where 50% of the 380 km² ranch has been subdivided. The remaining areas of the ranch are highly overgrazed and more than 70% of the livestock (roughly 18,000 cattle) are entering Tsavo West National Park each year to access pasture.

As a result of their frustration caused by the loss of grazing areas, the Maasai began demanding the subdivision of group ranches. Their primary motivation behind subdivision was to security of land tenure and to secure loans available only to individuals owning land (Kimani & Pickard 1998) as well as preventing encroachment of immigrants onto their land (Pasha 1986; Graham 1989; Kimani & Pickard 1998). Increasingly, group ranches in Kajiado District are taking part in subdivision; from only seven ranches in 1984 to 22 in 1996 (Kimani & Pickard 1998). Subdivision causes increased fragmentation due to the use of

fences, and as a result interferes with wet and dry season traditional grazing regimes for both livestock and wildlife (Kimani & Pickard 1998; Ntiati 2002) The ramifications of fencing on wildlife populations is immense; for instance, subdivided group ranches that previously supported a wide diversity of wildlife no longer do, except on ranches that have set aside a wildlife sanctuary (Groom, R, *in preparation*). However, one major limitation of wildlife sanctuaries is that the Kenyan Wildlife Act restricts the size allocated to sanctuaries on group ranches to 20 km² (Kenya Act in Ntiati 2002). Furthermore, it is estimated that 65-80% of wildlife in Kenya live outside designated protected areas (World Bank 1994). In Kajiado District, where buffer zones are absent between protected areas and community land, local farmers and pastoralists experience high rates of conflict with wildlife, and in turn these communities have become less tolerant of wildlife (Okello 2005). As more people fence their land, wildlife movements will be restricted and there will doubtlessly be an increase in human-wildlife conflict (Ntiati 2002).

As a result of changes in livelihood, social structure, and pressure to subdivide, the Maasai have adopted a more individualistic view on life and in turn have shifted away from traditional communal livestock husbandry and land management to individualized livestock practices (i.e., less splitting/sharing herds) (Western & Nightingale 2002). The increase of sedentarization in Maasailand is causing rapid changes in the ecosystem (i.e., land insecurity) and within Maasai culture (Western & Nightingale 2002). For example, as subdivision is approaching on MGR, the younger men compete over valuable land and access to water and pasture and thus begin to challenge the traditional age-set hierarchy within their community (Campbell 1979; Ntiati 2002; Reid et al. 2004). An erosion of gerontocracy, traditional beliefs, and cultural norms and practices are leading to a new era of Maasai (Adams &

McShane 1996). Many fear that the implications of subdivision may only exacerbate the situation for Maasai as they could lose their best land and be pushed into drier more marginalized areas (Kimani & Pickard 1998). In addition, degradation of land and soil erosion will likely take place after subdivision (Ntiati 2002). Moreover, the current breakdown of group ranches into privatized lands is a result of fear that can be ascribed to the pressures of modernization and highly correlated to a shift towards individualization rather than traditional communal ownership of natural resources (Ntiati 2002). All of these factors will likely increase human-wildlife conflict and displace much of the wildlife presently living on communal lands. All of the group ranches (see section 2.1), with the exception of Kuku and Eselenkei, are currently undergoing the process of subdivision (Reid et al. 2004). Some scholars decry "the death" of Maasai culture and with it the traditional knowledge that has sustained a community and ecosystem for centuries (Adams and McShane 1996; Campbell 1979).

3.6 Social and Environmental Changes on Mbirikani Group Ranch (MGR)

Up until this point, I have discussed the vast social, economic, and political changes that have occurred in Kenyan Maasailand. This section will provide additional information regarding demographic, economic, and wildlife interactions on MGR. The total number of members on the ranch is approximately 11,000 (Groom, R *in preparation*) and is increasing at a rate of 5.6 % per year. This rapid increase is largely attributed to high levels of immigration into the area (Ntiati 2002), as well as natural population growth. A study conducted by Mbogoh et al. (1999) noted that a typical household on the ranch was found to have an average of 16.3 people (6.6 adults, 4.5 children aged between the years of 6 and 15,

and 4.8 are children 6 years old or below). Campbell et al. (2003a) reports that herders on MGR are highly dependent first upon famine relief food, followed by dependence upon purchases made at market for their main sources of food, whereas farmers on the ranch depend upon their market purchases first and stored food second. Interestingly, the same study indicated that 42% of herders report that they are not proactively working to reduce the chance of food shortage in the future (Campbell et al. 2003a). This may be a direct reflection upon their reliance on food relief (pers. obser). In addition, 89% of farmers and 91% of herders on MGR report problems with wildlife (Campbell et al. 2003a). The main concern for farmers is the eating of crops by wildlife, while predation was the chief concern reported by herders.

Human-wildlife interactions are shaped by herbivore numbers and grazing patterns. Thus, an understanding of stocking composition is critical for the sustainable management of livestock. Mbogoh and Munei (1999) report that the average cow herd composition per household on Mbirikani is 76.4 head of cattle. Paul Ntiati of the African Wildlife Foundation (AWF) estimates there are twice as many livestock (approximately 95,000 goats, sheep, cattle and donkeys) than wildlife on the group ranch as of 2005 (Ntiati 2002), and some experts believe that this heightens opportunities for livestock-carnivore conflict (Kolowski & Holekamp 2006). In addition, the carrying capacity of livestock on the group ranch has been assessed to be two head of livestock per person, which is approximately 80% less than the current livestock numbers on the ranch (presentation by P. Ntiati 2005 in Rodriguez 2005). There is no doubt that in areas with little wildlife prey and large numbers of livestock, conflict between livestock and carnivores will be high (Rao 1996). In one year alone on MGR, over 200 cows and 300 shoats (sheep and goats combined) were killed or maimed by

wildlife (Maclennan, S *in preparation*). Unlike other areas in Kenya, wildlife tourism does not seem to sufficiently counterbalance these costs (Mbogoh et al. 1999).

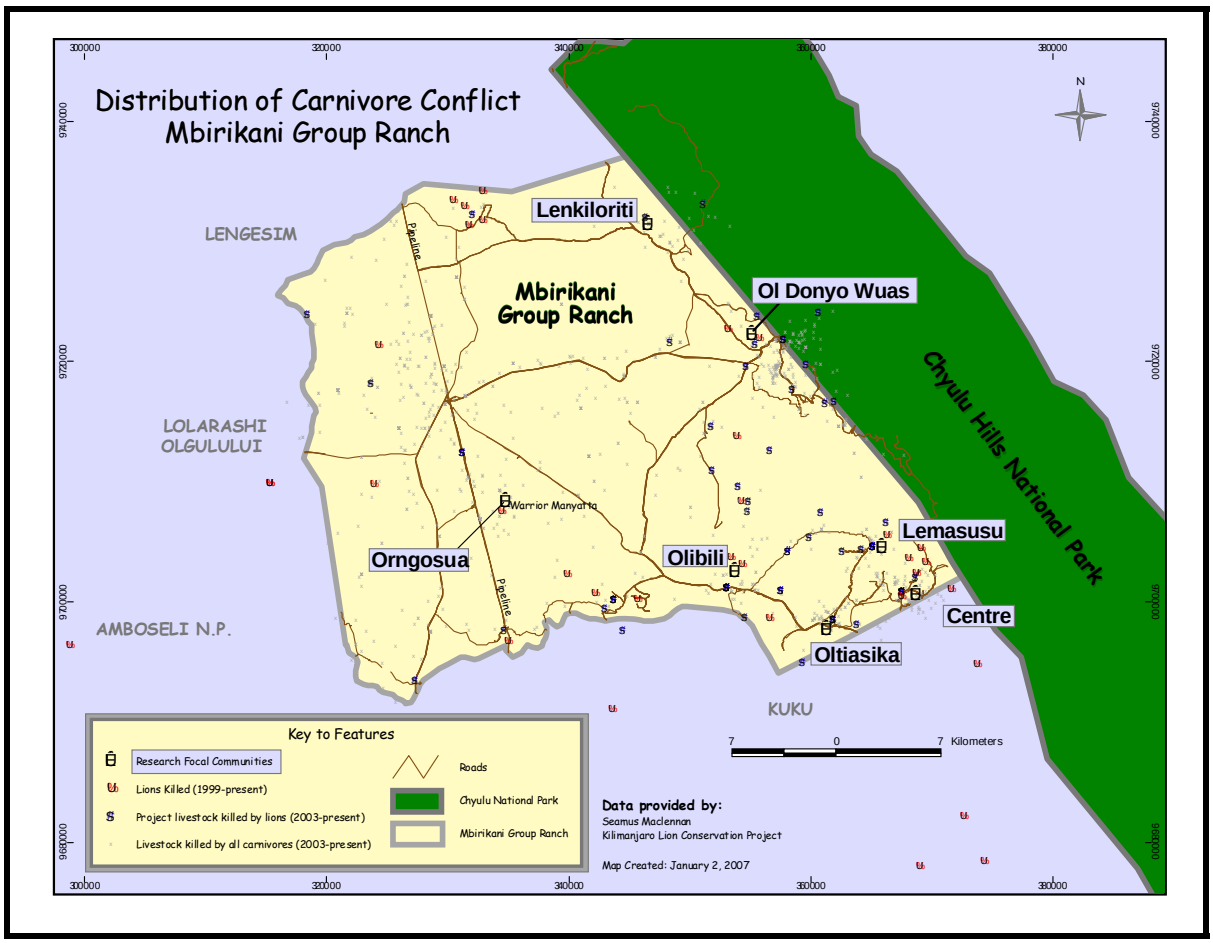
In an effort to provide benefits to the local communities on MGR, the Predator Compensation Fund (PCF) was introduced in April 2003 with the core aim of paying people to tolerate livestock lost to carnivores. A recent study evaluating the PCF suggested that the program has increased tolerance of carnivores (largely in areas that experience less conflict) (Rodriguez 2006). The cost to run a program of this magnitude depends on private donors each year; for instance, in the first 24 months of the project, over $30,000 was paid out as compensation for killed livestock (Rodriguez 2006). A further analysis of local peoples' attitudes towards the compensation program is discussed in the following chapters.

Chapter IV: Methods

This chapter explains the research methodology, outlines the statistical analysis, and provides a short discussion of possible limitations and biases in the research. The interdisciplinary nature of this research necessitates both quantitative and qualitative components.

4.1 Sampling:

To evaluate the relative importance of social and ecological factors shaping attitudes and conservation outcomes in a high-conflict region, I chose seven focal communities within MGR; each characterized by high rates of livestock depredation by carnivores and representing the areas with the highest number of lion killings by Maasai on the ranch Maclennan, *in preparation*) (see MAP 4.1). This suggests that these study sites are not necessarily representative of Maasai communities' relations with wildlife. Rather, it offers a chance to evaluate the relative importance of social and ecological factors shaping attitudes and conservation outcomes in high-conflict regions. In addition, through the KLCP I obtained background data on rates of livestock depredation and lion killing on MGR. This offered a rare chance to choose my focal communities based on 'hot-spots' of conflict. On MGR hyena, cheetah/leopard, and lion most frequently depredate on livestock respectively. Survey communities lie between 02° 45' S to 02° to 75' S and 37° 57' E to 37° 70' E.



Map 4.1: Distribution of Carnivore Conflict on Mbirikani Group Ranch

4.2 Qualitative Methods

The use of questionnaires that depend on qualitative information is a common tool for assessing local peoples' attitudes (Ervin 2003; Goodman 2003; Hockings 2003). A qualitative methodology allows for a thorough probing of in-depth human feelings, attitudes, tolerance levels, coping strategies, and perceived risk and threats from wildlife. During May and June 2005 I focused my research on PRA's (Participatory Rural Appraisals) and participatory observation in an effort to gain an overall understanding of Maasai cultural intricacies, which were later crucial in questionnaire design. I conducted a total of 31 PRA

interviews and three all-male focus groups, and found participants opportunistically through participatory observation activities and regular visits to *bomas*. In addition, I made certain not to conduct the five PRAs (described below) in the same order each time, as this could cause respondents to inflate complaints about lions or other predators based on topics of previous PRAs.

Specifically, the following five PRA techniques were used. This were provided by IRDC [The International Research Development Centre] (1995-2004) and Freudenberger's (1994) PRA manual:

1) **Participatory mapping and modeling** — Using local materials (i.e., sticks and pebbles), I asked five participants to draw historical maps about where lions used to live, and where past Maasai-wildlife conflicts may have occurred. This allowed me to interview villagers by "interviewing the map" and examine where current conflict "hotspots" were located.

2) **Local Histories/Timelines**—During two different focus groups, I recorded major historical community events and changes which provided a more detailed account of how specific livelihood practices have changed or are currently changing. This technique provided temporal change data in various dimensions (i.e., environmental, historical, political).

3) **Key probes** — I asked questions addressing key issues regarding socio-economics, livelihood strategies, and coping techniques to five different informants and to three households. This technique was specifically related to accessing various factors that affect tolerance and attitudes toward carnivores and conservation.

4) **Wealth Indicators**— I conducted 20 individual informal interviews to determine how Maasai perceive wealth (i.e., cows, daughters, etc.) and how classes of wealth are broken down based on number of each asset.

5) **Futures possible** — As part of one focus group, I asked people about future goals for their community and what type of changes they perceive are possible in one year, and to predict what will happen if nothing is done or if something is done. People's desires, wishes, and expectations were thus revealed. More specifically, I asked about individuals preferences for a variety of interventions against lion predation to see which solutions were likely to be viewed favorably by the Maasai as a whole.

4.3 Administration of Quantitative Questionnaire

The PRAs we conducted were essential in designing the quantitative questionnaire. A Maasai assistant (Jacob Mayiani) and I piloted 20 questionnaires to verify respondents' understanding of the questions and also to improve how the questioning was carried out. During this time I chose to interview only men as it was difficult for women to take time out of their day to speak with me. Women were busy collecting water, preparing food, and taking care of children and have very little time to do anything else. Also, woman had a lot of trouble answering questions, and they would often reply "these questions are for men, women don't get involved in such matters" (pers. obser.).

During the first field season (May-August 2005) Jacob and I conducted a total of 45 interviews. We completed the remaining 55 between January-April 2006. Of the total 100 interviews, we conducted 86 together, all of which were in the Kimaasai language. Thirteen interviews were conducted solely by Jacob Mayiani in Kimaasai, and I conducted eleven alone in Kiswahili (n=5) or English (n=6). All of the interviews were conducted in the community to which the interviewee belonged, and the majority took place at their *boma* (90% n=100) or at our residence in Center community (10% n=100). The average time for

each interview was approximately 80 minutes which included follow-up questions from the respondents.

4.4 Quantitative Methods

The principal quantitative method utilized was a semi-structured household questionnaire directed toward individuals that were chosen as described below. J. Roque de Pinho, developed many of the questions used in my questionnaire (Joana Roque de Pinho, dissertation in progress). Although the use of the same interview format allows for a much wider range in statistical comparisons, a semi-structured interview allows for interviewees to add their own personal experiences and elucidate subject matters that may be too restricted in highly structured questionnaire format (see Appendix III for a sample of the questionnaire).

The questionnaire covered the following topics:

a) Basic demographic information at the household level
b) Local and national political views and attitudes
c) Affluence scale and livestock dependence
d) Herding practices
e) Wildlife perceptions, cultural changes, traditions

One hundred household interviews were conducted throughout the ranch (which was approximately 12% of the households on the ranch) to enable comparisons of techniques and investments in protecting livestock from predators, and to assess variation in tolerance and attitudes toward carnivores. I selected interviewees opportunistically by using the following criterion: 1) male only 2) occupies a home within the sample area boundaries 3) does not share a herd with a person previously interviewed 4) of Maasai ethnicity only.

To verify the accuracy of quantitative questions, I utilized a quasi-PRA method that allows less educated people to conceptualize numbers or values of a specified topic by using pebbles or beans. I primarily used pebbles as the main medium to express numbers of livestock (current and past), other assets, children, and wildlife. In addition, I relied on key informants to back-check the accuracy of the values provided using the pebble method.

The dependent variable I used to analyze my first hypothesis on respondents' reported propensity to kill a carnivore was coded from the question, "what is your normal response if your cow has been killed by a predator?" into a dichotomous variable—kill or not kill. My second hypothesis that assesses respondents' attitudes toward the compensation scheme is also dichotomous (yes or no) derived from the following question, "Do you think the compensation program is working for you?" Both of the questions were translated from Kimaasai and thus the English translation presented is as close to the actual meaning as possible.

4.5 Data Analysis

I analyzed all data using the Statistical Package for Social Scientists (SPSS) PC version 12.0 (SPSS Inc., Chicago, USA). Jacob Mayiani prepared the questionnaire data for analysis, over a three-month period in Nairobi. We first coded all questions (n=75) and entered the data into a spreadsheet software. We then transferred the data into SPSS format, using Stat Transfer 6 program (Circle System Inc, Seattle, WA) which was coded into appropriate labels for each variable within SPSS.

I tested continuous independent variables for collinearity using Spearman rank analysis and Pearson r correlations, as appropriate. I used Pearson Chi-square to test for

association between categorical variables (see Appendix I and II for correlation matrices). I removed two variables prior to running the logistic regression due to high collinearity: 1) REGION (broken into my seven focal communities) was highly correlated with clan and religious affiliation 2) PREVIOUSLY COMPENSATED was highly correlated to times compensated and thus both REGION and PREVIOUSLY COMPENSATED were discarded. See Table 4.1 for the variables includes in the AIC tests and explanations of each variable.

Table 4.1: Variables included in AIC test for both hypotheses

Hypotheses and predictors	*Explanations and variable type*	
Included in both hypotheses:		
Age	Respondents' age-groups	3 categories: young, middle, and old
Cattle herd	# of cows owned (as a wealth indicator)	Continuous (0-2000 cows)
Share herd	Does the respondent share his herd with another individuals	2 categories: yes, no
Stock use	Primary purpose in rearing livestock	3 categories: sale, domestic use, tradition
# of children	# of children currently enrolled in school	Continuous (0-20)
Religion	Respondents religious affiliation	3 categories: Kenyan Assemblies of God (KAG), other, none
Clan	Clan in which respondent belongs	3 categories: Ilmolelian, Ilaiser, and Illaitayiok
Lion problem	Perceived magnitude of lion problem	3 categories: serious, moderate, low
PA important	Attitude towards protected areas and conservation	2 categories: yes, no
Lion like *	Positive attitude towards lions (1st time)	2 categories: like, dislike
Lion dislike*	Negative attitude towards lions (2nd time)	2 categories: like, dislike
Freqloss	Frequency of conflict with predators	3 categories: low, medium, high
Dep5yr	Proportion of cows killed by predators in 5yrs relative to the overall number lost to other factors (including: drought, disease, sales, and theft)	Continuous: (0-44%)
Dep1yr	Proportion of cows killed by predators in last 1yr relative to the overall number lost to other factors (including: drought, disease, sales, and theft)	Continuous: (0-50%)
Comptimes	Number of times compensated from	Continuous variable: (0-10)
Propensity to kill hypothesis		
Olamayio	Persistence of ritual lion hunts on MGR	2 categories: yes, no
NARC	Attitudes towards the national govt. in Kenya	2 categories: like, dislike

Comp attitude	Attitudes towards the compensation program	2 categories: like, dislike
Lion here	Perceptions of lion presence in the area	4 categories: not common, rare, common, very common
GR	Attitudes towards the group ranch committee	2 categories: like, dislike
KWS	Attitudes towards the Kenyan Wildlife Service	2 categories: like, dislike
Compensation hypothesis		
Residency	Number of years residing in a community	Continuous variable: (1-40yrs)
Employment	Respondents type of employment	4 categories: pastoralist, game- scout, livestock trader, other (includes: farmer, teacher, and laborer)

* Lion like/dislike where two different questions asked to verify the accuracy of the respondent (they are not inverse responses).

After choosing the appropriate independent variables to avoid collinearity, we ran logistic regressions (backward stepwise procedure) and recorded the -loglikelihoods for each resulting model, in order to calculate Akaike's Information Criterion (AIC). Compared to hypothesis testing, AIC is superior in model selection (i.e. variable selection). It provides accurate measures of the strength of each model that represents possible hypotheses relative to the entire set of models considered (Mazerolle 2006). This is accomplished by calculating the overall AIC_c (for a small sample size), Delta AIC_i, and AIC weight (w_i).

$$\mathbf{AIC_c} = -2(\text{log-likelihood}) + 2 + \frac{2K(K+1)}{(n-K-1)}$$

$$\mathbf{Delta\ AIC_i} = \Delta_i = AIC_i - \min AIC$$

$$w_i = \frac{\exp(-\Delta_i/2)}{\sum_{r=1}^{R} \exp(-\Delta_r/2)}$$

Subsequently, I extracted the best models (models with Delta $AIC_i < 2$; (Mazerolle 2006) and the regression estimates for each predictor for each model which was then weighted by the AIC weight (w_i) to provide the model average for that specific predictor. In essence, I used

all the information available from the set of all possible best models to make inferences about the relationships among predictors and the relative strengths of predictors.

It is commonly agreed that multi-model averaging/inference reduces bias and increases precision (Burnham & Anderson 2002). The average regression estimates (model estimates) that were calculated in the last step were inserted into a logistic regression (AKA: constraining the beta values). The model produced is the "consensus" model, which contains the best estimate of each predictor to explain the dependent variable with the greatest precision. Finally, the unconditional standard error (SE) and the 95% confidence intervals of each coefficient were calculated to evaluate the range of variation in predictive power for each variable retained in the model.

Unconditional SE = $\widehat{\text{se}}(\bar{\hat{\beta}}) = \sum_{i=1}^{R} w_i \sqrt{\widehat{\text{var}}(\hat{\beta}_i \mid g_i) + (\hat{\beta}_i - \bar{\hat{\beta}})^2}$

95% CI= estimate + (1.96)SE and estimate – (1.96)SE

Only those predictors whose Beta coefficients had confidence intervals that excluded 0 were considered significant. After producing the logistic regressions, I explored the effect size and direction of relationships for the significant predictors. All tests were two-tailed unless indicated otherwise.

4.6 Limitations and research biases

The issue of bias in quantitative and qualitative research is an important one, and demands special attention and discussion. Due to Maasai cultural and pastoral activities (specifically: seasonal movements, polygamy—meaning many elders rotate between

homes/communities, the timing of market days, ceremonies and herding strategies), it was difficult to pre-select interviewees as they often could not be located for months. However, I do not believe that this biased my study as I was able to include approximately 87% of the total possible participants in the seven focal communities. In addition, subsequent to the first field season, 25% of my interviews had missing values. Jacob revisited each home and collected the missing data. Therefore, since certain respondents may have been interviewed in different places and at different times of the year this could have a biased effect on respondents' attitudes towards specific questions. However, when testing this possibility on my most sensitive variables no evidence of bias emerged.

In addition, to ensure accuracy on quantitative questions, either the pebble method (explained above) or key informants were used, specifically regarding livestock numbers and livestock conflict rates with carnivores. I chose two key informants who have resided in the community for most of their life and who have extensive insight on conflict between local people and carnivores. One informant was a Maasai long-term resident and game-scout who verifies claims regarding compensation and knows precise details regarding herd size and conflict rates at each home. The second informant is also a Maasai and long-term resident who runs the livestock borehole and keeps accurate records of livestock numbers per home. Approximately 15% of livestock numbers collected during interviews were subsequently corrected by key informants, by an average underestimate of 100 livestock.

The reason that 10% of the interviews were conducted at my home was purely due to chance. These interviewees came past my home for a visit, and we decided to take advantage of the opportunity for an interview. I do not believe this skewed the results in any way as this

was only a small proportion of my sample size, and in all other way the interviews were the same as for the other 90%.

As an outsider asking personal questions, people may have thought that if they emphasize their problems and hardships they may receive something in return. I tried to discourage this assumption by living in the communities for almost two months prior to initiating the questionnaire. During this time I did not pry about carnivore conflict or other sensitive topics. I instead spent time attending workshops, church services, helping women carry water, and herding livestock in the hills. All of these participatory activities allowed the community to get to know me and vice-versa, but most importantly it built the trust needed to enable me to subsequently record data confidently and accurately.

To summarize, I used a qualitative approach which primarily aided in the design of the questionnaire but also provided the essential background information needed to fully analyze and conclude the findings; as well as a quantitative questionnaire that addressed the major issues necessary to investigate the research questions posed in this study (see Chapter I, Section 1.7).

Chapter V: Results

This chapter is divided into several sections; first I will briefly describe the qualitative results of this study to set a foundation for the quantitative analysis. Quantitative sections are broken into my two research questions: 1. How do social and ecological variables affect propensity of Maasai to kill lions? 2. What are local citizens' attitudes toward the current compensation scheme on Mbirikani Ranch? Each section is further split into smaller subsections which explain the strongest predictors indicated by the logistic regressions and AIC results.

5.0 Qualitative Results

The time I spent living in the community and observing the issues first hand allowed me to further understand the intricacies of the communities and the conflict they face on a daily basis. Attitudes and perceptions of wildlife varied considerably according to livestock use, religious affiliation, and proportion of livestock lost to carnivores. In addition, other external factors that were immeasurable quantitatively; such as political and age-set tensions played a very large role in the diversity of variation of respondent's attitudes towards carnivores and conservation initiatives. For instance, a warrior stated,

> We often don't like wildlife because our age-set is left out when jobs come and we are harassed by the older age-sets who are employed as game scouts. We warriors would start to like wildlife if we were given [an] opportunity to work with them and not just stand on the sideline" (Anonymous warrior, in MGR, 2005).

In April 2006, 15 lions were killed in and around Amboseli National Park, said to be triggered by age-set tensions driven by the opportunity to gain alternate income between the murran age group (Ilkiponi) and the junior elders (Ilkidotu). "We are tired of the older game scouts that harass us and we will continue to kill lions because we know the game scouts [junior elders] will come to our area to arrest us and then we can beat them" (Anonymous group of warriors, Olgulului Group Ranch, 2006).

During my time living with the community I often heard varied responses by community members immediately after they lost livestock to predators. There was a distinct difference in attitudes to carnivores based on the number of livestock owned and an individuals' dependence on their livestock. For example, an elder that owned very few livestock stated,

> "I cannot lose anymore livestock since I need to feed my family. So the answer is to look for poison and poison the remaining carcass, so that that animal that attacked that cow if it decide[s] to come back it will feed on the carcass and die, just like my dead cow. I have no mercy because I have also lost my cow"
> (Anonymous elder, in MGR, 2006).

Another elder who owns over 3000 cows and primarily uses his cattle for business (i.e., livestock trader) stated,

> "To me my general relationship with wildlife is good, I like wildlife because of the benefit that I have seen from wildlife, situations whereby one cannot finish his schooling and ask[s] for help from the group ranch through the KWS [Kenyan Wildlife Service] bursaries. Even our borehole here got some fund[s] from the group ranch which is important so we can give water to our livestock and we can sometimes use the national park to get grass--and these are all because of wildlife. So I think many of us like them because of all these benefits"
> (Anonymous elder, in MGR, 2006).

The majority of elders that I spoke to stated that they no longer sanction lion hunts carried-out by *murrans* on the group ranch. This is best exemplified by a quote stated by a *murran* during a focus group meeting:

> "The elders don't support the killing of lions because they are scared of their son getting jailed and also they are the one to suffer the losses trying to get them out of jail by selling cows and paying fines, and also their sons might get injured or attacked by the lion--since lion hunts are very dangerous and either the lion will win or the *murran* will win—but not both"
> (Anonymous *murran*, in MGR, 2005).

Traditionally, Maasai acknowledge two types of lion killing: *Olamayio* and *Olkiyioi*. *Olamayio* is a manhood ritual and is only carried out by the warrior (murran) age-set, while *Olkiyioi* killings are only in retaliation for lost livestock and all age-sets participate (Spear & Waller 1993). Maasai society currently follows five age-set groups, males are given an age-set when reaching adulthood (through circumcision) and this grouping remains with an individual throughout his entire life. Through various focus groups and informal conversations the differences between the two forms of lion killing have become clearer. It was best described by an elder:

> "…*Olkiyioi* means crying… [to call] people to come together because a problem has occurred. So in *Olkiyioi* people gather and go kill a lion that has attacked a cow, a type of retaliatory action by the whole community. *Olamayio* was formed only for *murrans* and for recreation purposes and simply to have fun and show off your strength for women. It brings immense prestige to the warrior who spears the lion first and is very important to Maasai culture"
> (Anonymous elder, pers. comm., in MGR, 2005).

Today a confluence of other factors (i.e., political tensions between age-sets, western influences and conservation interventions) may alter the motivation for warriors to kill lions and thus it has become more difficult to differentiate between *Olamayio* and *Olkiyioi*. However, it is important to understand this difference in initial motivations for killing lions,

in order to investigate potential mitigation measures to reduce conflict and increase local tolerance of carnivores.

5.0.1 Quantitative Section

My assistant and I conducted one hundred interviews in seven focal communities on Mbirikani Ranch. There are no missing values in this data set. One hundred percent of the interviewees were male and of Maasai ethnicity. Respondents fell into five age-set categories: 22% Ilkiponi (18-29 yrs old), 53% Ilkidotu (30-42 yr old), 15% Ilkishumu (43-54 yrs old), 7% Ilseuri (55-65 yrs old), and 3% Ilnyangusi (66-79 yrs old). My study sample is broken into three clans or ancestral divisions: 73% Ilmolelian, 23% Ilaiser, and 4% Illaitayiok. In addition, thirteen out of twenty possible sub-clans that exist among the three clans on MGR were present in this study. Also, 73% of the interviewees had never attended school, 13% had completed primary school, and the remaining 14% had either completed or attended parts of secondary school. Lastly, 61% of respondents were pastoralists, 12% were employed as game scouts, 9% were livestock traders, and the remaining 18% indicated "other" (i.e., farmer, teacher, and laborer).

During the PRA stage of my research, I examined Maasai perceptions of wealth. The top three indicators (in order of importance) were 1) number of children 2) number of cows and shoats (goat and sheep combined) and 3) farm ownership (see table 5.1).

Table 5.1: Wealth Indicators

Wealth Indicators	Range	Mean	Median	Mode
Number of children	0-50	8	5	4

Number of cows	3-2000	215	100	100
Number of shoats	0-1500	240	200	200

One-hundred percent of respondents owned livestock. My data indicated that 74% of respondents owned a farm while 26% did not. However, 24% of those who owned a farm were not currently cultivating their land. The average farm size was 3.5 acres.

5.1 Variables affecting reported propensity to kill

In this section I will examine the specific variables that affect people's reported propensity to kill carnivores. The dependent variable was coded from the question, "what is your normal response if your cow has been killed by a predator?" into a dichotomous variable—kill or not kill. 25% of interviewees responded "kill" and 75% responded "not kill". See Table 4.1 in Methods for a list of independent variables used and their association.

5.1.1 Logistic Regression and AIC Results

Table 5.2 illustrates the backward stepwise nominal logistic regression of 20 models combining the 20 predictors that were not collinear (see Table 4.1 in Methods and Appendix I and II) and includes the specific predictors that were removed at each step. Table 5.2 also shows that model 10 has the lowest AIC and therefore is the best model of the set. There are two measures associated with AIC to compare models. First, the Delta AIC_i which looks at each model relative to the best model (#10 in this case) and the second is the AIC weight which represents the strength of the model relative to the entire set of contender models. Therefore, after calculating the Delta AIC_i and the Delta weight a total of five models remain as contenders for the best model. Specifically, Models 9-13 (Table 5.3)

Table 5.2: Backward Stepwise Regression for AIC

Number of predictors	-2log likelihood	K	N	AIC	Delta AIC_i	Variable removed at each step	p-value of removed variable
20	27.384	21	100	81.23	12.223		
19	27.592	20	100	78.22	9.23	Lion here	0.940
18	36.124	19	100	83.62	14.63	Clan	0.998
17	36.124	18	100	80.57	11.57	# of children	0.994
16	36.128	17	100	77.59	8.59	GR	0.951
15	36.409	16	100	74.96	5.97	cattle herd	0.602
14	36.666	15	100	72.38	3.38	Lion dislike	0.614
13	37.082	14	100	70.02	1.03	Freqloss	0.523
12	39.131	13	100	69.36	0.37	NARC	0.182
11	42.110	12	100	69.70	0.70	Share herd	0.122
10	43.998	11	100	69.00	0.00	Dep5yr	0.186
9	47.131	10	100	69.60	0.60	PA important	0.091
8	55.740	9	100	75.74	6.74	Age	0.090
7	59.821	8	100	77.40	8.41	Lion problem	0.059
6	64.801	7	100	80.02	11.02	*Olamayio*	0.034
5	69.665	6	100	82.57	13.57	KWS	0.039
4	79.300	5	100	89.94	20.94	Stock use	0.020
3	86.793	4	100	95.21	26.22	Comp attitude	0.011
2	95.801	3	100	102.05	33.05	Religion	0.007
1	104.121	2	100	108.24	39.25	Comptimes	0.012
Constant		1	100			(Dep1yr)	0.009

As noted in the Methods Chapter, when there are multiple models that may contend for the "best model", it is necessary to base the inference on a weighted average of the best models, an approach termed multimodel inference or model averaging (Mazerolle 2006). I performed this model averaging procedure to explore the independent variables that have the greatest effect on reported propensity to kill a lion. In addition, it provides the information needed to create a "consensus" model (Table 5.4).

Table 5.3: AIC Contender Models

Best Models	-2Loglikelihood	N	K	AIC	Delta AIC_i	EXP Delta AIC	AIC-Weight	Evidence Ratio
1	37.082	100	14	70.023	1.025	0.599	0.155	1.670
2	39.131	100	13	69.364	0.366	0.833	0.215	1.201
3	42.110	100	12	69.696	0.698	0.705	0.182	1.418
4	43.998	100	11	68.998	0.000	1.000	0.258	1.000
5	47.131	100	10	69.603	0.605	0.739	0.191	1.353

The consensus model had a significant result overall (χ^2=17.281, p<0.0001). The Hosmer and Lemeshow Fit test suggests that this model is a very good fit (the closer the value is to 1 the better the fit.)

Table 5.4: AIC Consensus Model from the five contending models

-2loglikelihood	**df**	**Chi-square**	**p-value**	**Hosmer and Lemeshow Fit Test**		
				Chi-square	**df**	**p-value**
93.481	1	17.281	<0.0001	3.832	8	0.872*

* p >.05 indicate a good fit and support of the model

Table 5.5 shows the confidence interval of the beta coefficients for each predictor in the consensus model. Any whose confidence intervals cross zero were deemed insignificant.

Table 5.5: Coefficients, SE and upper/lower confidence intervals for the predictors used in the consensus model

Predictors	**# of models present**	**Regression estimate of all 5 models**	**SE**	**Upper 95%**	**Lower 95%**
Dep1yr*	5	16.654	2.47	21.500	11.807
Religion*	5	4.635	2.046	8.646	0.728
Stock use*	5	-3.910	1.965	-0.059	-7.762
Comp attitude	5	2.608	1.901	6.334	-1.118
Comptimes	5	-2.212	1.907	1.525	-5.950
Age	5	-1.331	1.920	2.431	-5.094
Lion prob	5	2.103	1.892	5.811	-1.605
Olamayio	5	-2.525	3.450	4.237	-9.288
KWS	5	3.323	1.887	7.022	-0.377
PA important	4	2.168	2.341	6.756	-2.421
Dep5yrs	3	5.880	5.726	17.103	-5.342
Share herd	2	0.744	2.230	5.114	-3.626
NARC	1	0.369	2.187	4.655	-3.917
Intercept	5	-9.159	3.398	-2.499	-15.819

Only three variables passed the test in Table 5.5 (indicated by an asterisk). Proportion of cows lost to depredation by carnivores in the past year (Dep1yr), religious affiliation (religion), and livestock dependence (stock use). The decision to focus on these three predictors principally reflects that coefficients + or – 1 SE (confidence intervals) that exclude 0 have the most consistent direction and strength of relationship to the dependent variable.

In sum, individuals who have a greater proportion of cattle mortality attributable to predators relative to other causes (i.e., disease, drought, theft) reported the greatest propensity to kill lions. Henceforth, this variable is termed 'proportional loss to carnivores'. The following section will explain the rationale of these three predictors identified as most consistently influencing an individuals propensity to kill a lion.

5.1.2 Influence of depredation on reported propensity to kill

Eighty-five percent of the interviewees indicated that their livestock (cow, goat, sheep or donkey) had been attacked by a predator in the past year. Of these, 25% lost livestock weekly. People who would not kill a lion had a mean proportional loss to carnivores in the past year of 11% (Figure 5.1). By contrast, individuals reporting they *would* kill a lion had a mean of 22%. In addition, the minimum point of the interquartile range of the kill category is 11%.

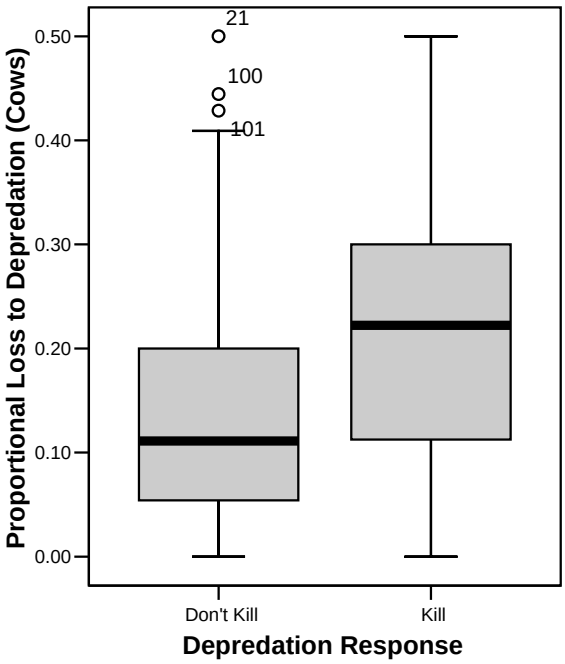
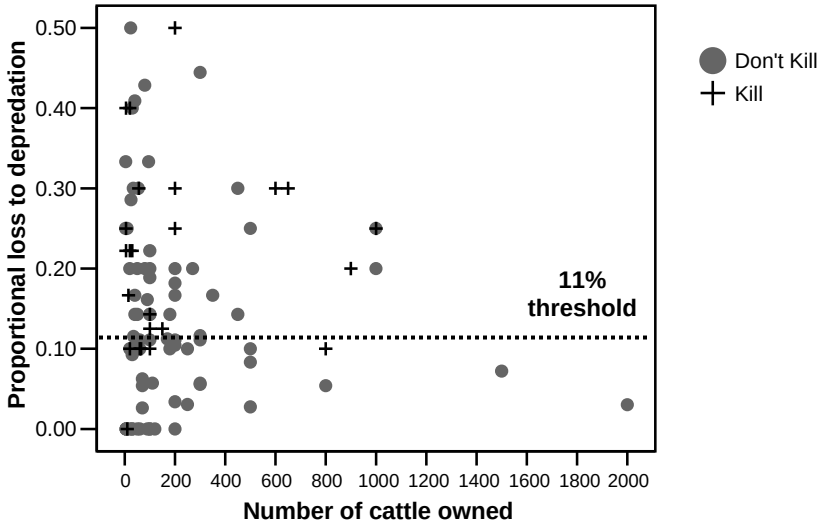


Figure 5.1: Proportion of cattle lost attributable to attacks by carnivores in one year and respondent's propensity to kill/not kill lions

I next examined herd size and proportional loss to carnivores to assess which wealth class experiences a higher proportional loss to carnivores. Those individuals who owned fewer cows lost a higher proportion of their cattle to carnivores in the past year relative to other factors (Figure 5.2). Furthermore, roughly 60% of respondents attributed >11% of their cattle killed in the past year to carnivores alone (examine the crosses and dots above the 11% threshold).

Figure 5.2: Propensity to kill response in relation to an individual's proportion of cattle lost to depredation and herd size



Interestingly, there was no correlation between the absolute number of cows or shoats attacked by carnivores and reported propensity to kill a lion (Mann Whitney U test: Cows z=-0.775, p=0.438; Shoats z=-0.334, p=0.731). To confirm this finding, we tested respondent's

propensity to kill a lion against frequency of depredation (how often they lose livestock to predators). There was no correlation (χ^2=0.475, p=0.789). However, there was a strong positive correlation between the number of cows owned and the frequency of depredation on livestock (Kruskal Wallis: χ^2=38.187, p<0.0001) (Figure 5.3), as well as the absolute number of cows attacked by predators and the frequency of depredation on livestock (Kruskal Wallis: χ^2=31.00, p<0.0001). Moreover, those who experienced a higher frequency of livestock lost to predators would not necessarily have had a higher reported propensity to kill a lion—it is rather an individual's proportional loss of cows to carnivores that drove lion killings (Mann Whitney U test: z=-2.757, p=0.006).

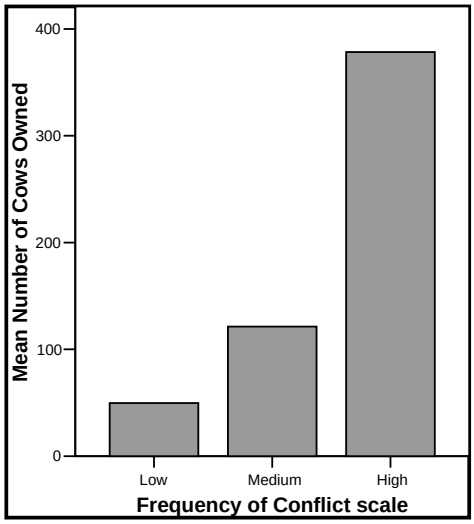


Figure 5.3: Total number of cows owned and frequency of depredation

5.1.2.1 Perceptions of depredation

Understanding people's perceptions of conflict is equally important for understanding actual conflict rates (Naughton-Treves 1997; Naughton-Treves 1998; Marker et al. 2003). The majority (87%) of respondents indicated that they perceived an increase in human-carnivore conflict in their area in the past two years. Most (68%) indicated that this increase in conflict with predators was due to an overall growth in the carnivore population in the area, and 21% believed that carnivores had become more aggressive and specialized at killing livestock.

To understand the magnitude of this conflict I asked people to list the three major problems their livestock confront. Figure 5.4 illustrates the main problems facing Maasai livestock today. Disease and drought were undoubtedly the greatest issues affecting livestock. Depredation represents only 16% of respondents concerns. When I asked interviewees to list the three most common problems facing their livestock in the past three years, depredation was mentioned by 36% of respondents as one of the top three concerns.

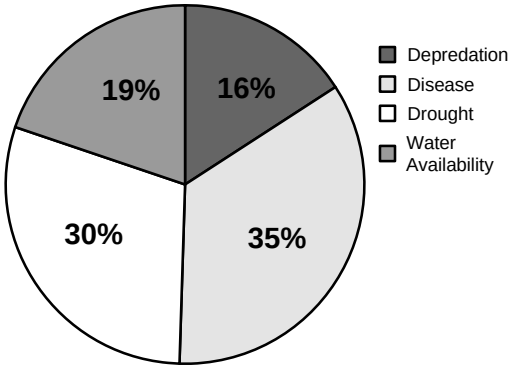


Figure 5.4: Major problems faced by respondents' livestock.

Since depredation is clearly not one of the most significant problems indicated for Maasai livestock, I asked interviewees, "why do you think there has been an increase in lion killing in the past 3 years". Interestingly, 59% indicated that there was no increase in lion killings. While 31% stated that the increase in lion killings was due to an increase in predation incidents by carnivores. There was significant association between those that thought the increase in lion killings was due to an increase in depredation on livestock (31%) and those that responded by saying they would kill a carnivore (χ^2=9.469, p=0.009). These results indicate lower individual tolerance towards carnivores.

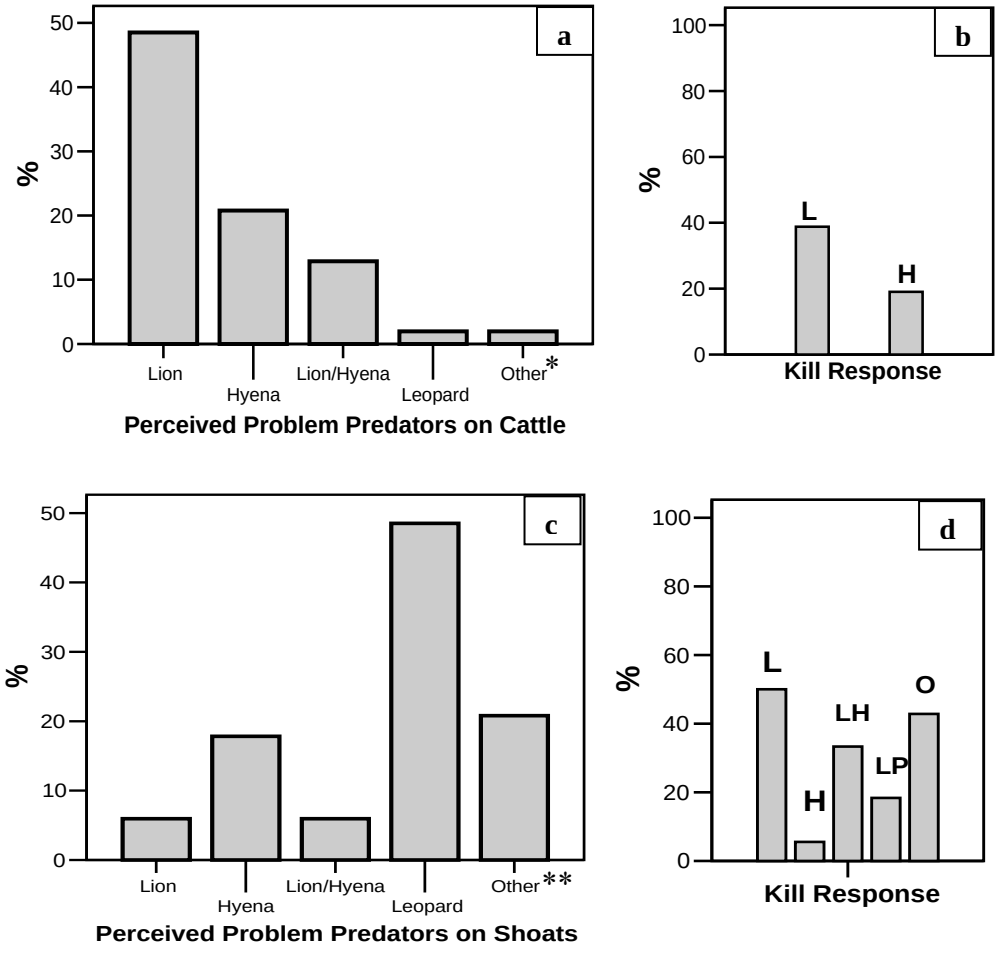
Respondents that perceived lions as a serious problem (40%) exhibited a higher reported propensity for killing a carnivore (χ^2=4.617, p=0.032). However, there was no correlation between those respondents that perceived lions as a serious problem and their

proportion of livestock lost to depredation by carnivores in the past year (Mann Whitney U test: z=-0.554, p=0.580).

Lastly, there was a strong correlation between people's experience of losing cows and shoats to lions and their reported propensity to kill (Cows: χ^2=17.404, p=0.008; Shoats: χ^2=9.775, p=0.021). Figure 5.5a and b illustrate that lions were the most likely animal to be killed in response to attacking livestock, regardless of which predator caused the damage. For instance, people perceived lions (48%) as the major threat to their cows, followed by hyenas (34%), and as a result, 39% of interviewees claimed they would respond by killing a lion while only 19% indicated hyena (note: the kill category only included lion and hyena). On the other hand, the main perceived predators of shoats were leopards (49%), other (20%), hyenas (18%), and lions or lions/hyenas (6%). Although only 6% of shoat depredation was reported to be by lions, they were still the most likely to be killed (50%). Whereas leopards were perceived to have killed shoats 43% more often than lions, they were only targeted for killing by 18% of respondents.

Analysis of the compensation data indicated that between May 2005 and May 2006 (the period of data collection), 274 cows were verifiably killed by predators on MGR. Hyenas were responsible for 65%, lions 22%, and leopard/cheetah 13%. During the same period, 867 shoats were killed, primarily by hyenas (45%) and leopard/cheetah (43%), while lions killed only 1% of shoats.

Figure 5.5: Perceived livestock predators a) predators on cattle b) kill response for cattle predators; c) and d) show the same but for shoats



* Other category includes: cheetah, elephant, and buffalo
** Other category includes: cheetah, jackal, and python

5.1.3 Religious affiliation and reported propensity to kill lions

The AIC tests concluded that religious affiliation significantly affects an individual's reported propensity to kill a predator. The interviewees' religious affiliations were

categorized as follows: approximately half (48%) belonged to Kenyan Assemblies of God (KAG, an evangelical sect), 21% belonged to other churches (primarily Catholic and Anglican), and nearly one third (31%) were not associated with any church, either following traditional Maasai beliefs or none at all. Univariate tests showed a statistical correlation between church affiliation and reported likelihood of killing a lion (χ^2=6.885, p=0.026). Roughly one third (35%) of those affiliated with KAG responded that they would kill a lion, while only 14% of those affiliated with other churches or no church reported a likelihood of killing a lion. To rule out the possibility that KAG members were not simply suffering higher losses, we investigated proportion of cattle lost to depredation and found losses were uniform across all religious groups (Kruskal Wallis: χ^2=1.095, p=0.578) (Figure 5.6).

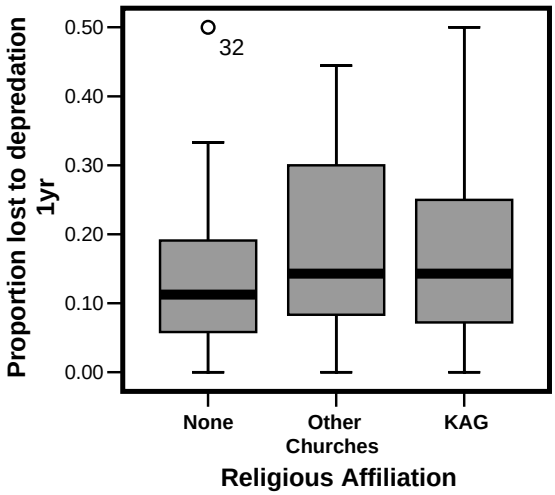


Figure 5.6: Proportion of livestock lost to depredation during 2005 and religious affiliation

5.1.4 Livestock dependence and how it influences propensity to kill

The last variable deemed significant from the AIC results was livestock use and level of dependence on livestock. Dependence on livestock was categorized into three groups from the following question "what is the main reason you produce your livestock?" Sixty-eight

percent answered domestic consumption, 27% for sale, and only 5% for traditional (status) reasons. Respondents who kept livestock for sale had twice the propensity to kill a lion compared with the majority who produced livestock for subsistence or the minority for traditional reasons (χ^2=8.744, p=0.013) (table 5.6).

Table 5.6: Univariate test examining livestock use and propensity to kill/not kill

Livestock Use	Depredation Response %	
	Don't Kill	Kill
Sale	55.6% (15)	44.4% (12)
Domestic Consumption	84.1 % (58)	15.9% (11)
Tradition	80% (4)	20% (1)

( ) = n

In addition, there was no correlation between livestock use and total number of cows owned (Kruskal Wallis: χ^2=1.796, p=0.409). However, there was a correlation between numbers of shoats owned and livestock use (Kruskal Wallis: χ^2=8.091, p=0.018), indicating that Maasai sell more shoats then cows. Lastly, a Kuskal-Wallis test concluded that there was no correlation between livestock use and the proportion of livestock lost to depredation by predators in the past year (χ^2=3.047, p=0.218) and no correlation between livestock use and frequency of conflict with carnivore (χ^2=7.076, p=0.132).

5.1.5 Compensation effect on propensity to kill

Although the compensation variables did not yield significant results in the AIC test, they warrant a brief explanation given conservationists' emphasis on this strategy. Univariate tests indicate that the more times an individual was compensated for their livestock attacked by a predator the less inclined they would be to kill a carnivore (Mann Whitney U test: z=-2.574, p=0.010). In addition, respondents who believed that the compensation program was working for them were less likely to report killing a predator (χ^2=8.358, p=0.004). In

essence, these univariate results suggest that compensation is discouraging people from killing lions. However, the strength of these variables are quite weak overall (see Table 5.5) and so we cannot conclude that compensation plays a powerful role in halting or accelerating people's propensity to kill lions in high conflict areas on MGR. The next section will focus on a more in-depth analysis of people's attitudes toward the compensation program which will subsequently shed light on the importance of understanding the role of attitudes and perceptions in conservation projects.

5.2 Variables affecting attitudes toward the compensation program

In this section, I will elucidate specific variables that influenced respondents' attitudes towards the compensation program. The dependent variable was derived from the following question, "Do you think the compensation program is working for you?" Roughly half (46%) of respondents indicated yes, and half (54%) responded no. Respondents' who disapproved of compensation indicated that it was unfair due to the penalties (53%), and those who approved said the program replaced their cow or that it was "better than nothing." In addition, it important to note that 88% of the respondents had been previously compensated, while only 12% had never received compensation

5.2.1 Logistic Regression and AIC Results

Table 5.7 illustrates the backward stepwise nominal logistic regression of 17 models, combining the 17 predictors that were not collinear (see Table 4.1) and includes the specific predictors that were removed at each step. The AIC results indicate that model 5 is the best model of the set.

Table 5.7: Backward Stepwise Regression

Number of predictors	-2log likelihood	K	n	AIC	Delta AIC_i	Variable removed at each step	p-value of removed variable
17	91.157	18	100	135.60	17.00		
16	102.383	17	100	143.85	25.25	Employment	0.992
15	102.461	16	100	141.02	22.42	Stock use	0.990
14	102.473	15	100	138.19	19.59	Religious	0.915
13	102.501	14	100	135.44	16.84	Dep1yr	0.867
12	102.538	13	100	132.77	14.17	Lion like	0.846
11	102.649	12	100	130.24	11.64	Lion prob	0.741
10	102.743	11	100	127.74	9.14	Freqloss	0.758
9	102.98	10	100	125.45	6.85	Share herd	0.628
8	104.157	9	100	124.16	5.56	Clan	0.600
7	104.313	8	100	121.90	3.30	Catte herd	0.700
6	104.874	7	100	120.09	1.49	# of children	0.466
5	**105.695**	**6**	**100**	**118.60**	**0.00**	Dep5yrs	0.368
4	109.579	5	100	120.22	1.62	Residency	0.056
3	115.398	4	100	123.82	5.22	Age	0.090
2	118.562	3	100	124.81	6.21	Comptimes	0.092
1	126.238	2	100	130.36	11.76	Lion dislike	0.011
Intercept						(PA attitude)	0.001

Table 5.8 illustrates the three best models chosen by their AIC weights from the stepwise regression (Table 5.7). In addition, the consensus model is significant, indicated by the chi-square value (28.021) and p-value (<0.0001). The Hosmer and Lemeshow Fit test provides evidence that this model is a good fit suggested (p=0.363) (Table 5.9).

Table 5.8: AIC Candidate Models

Best Models	-2Loglikelihood	N	K	AIC	Delta AIC_i	EXP Delta AIC	AIC-Weight	Evidence Ratio
1	104.874	100	7	120.09	1.49	0.47	0.25	1.729055325
2	105.695	100	6	118.60	0.00	1.00	0.52	0.81954371
3	109.579	100	5	120.22	1.62	0.45	0.23	1.841404303

Table 5.9: AIC Consensus Model

-2loglikelihood	df	Chi-square	p-value	Hosmer and Lemeshow Fit Test		
				Chi-square	Df	p-value
111.509	1	28.021	<0.0001	8.765	8	0.363*

* p >.05 indicate a good fit and support of the model

Table 5.10: Regression estimates, SE and upper/lower confidence intervals for the consensus predictors

Predictors	# of models	Regression estimate	SE	Upper	Lower

	present	of all 5 models		95%	95%
PA important	3	1.554	0.397214	2.333	0.776
Lion dislike	3	1.843	0.402858	2.632	1.053
Age	3	-1.896	0.401186	-1.109	-2.682
Residency	2	0.038	0.397025	0.817	0.740
Comptimes	3	-0.296	0.722191	1.119	-1.712
Dep5yrs	1	0.505	0.863632	2.198	-1.188
Intercept	3	0.178	0.486264	1.131	0.775

Finally, Table 5.10 reveals that attitudes towards protected areas and conservation (PA important), lion dislike, age, and residency are all correlated with respondents' attitudes toward the compensation scheme. I will discuss these predictors as well as other possible interactions among other variables in the following sections.

5.2.2 The influence of protected areas and conservation initiatives on compensation attitudes

There was a strong statistical correlation between those that thought protected areas and conservation initiatives were not a good idea (38%) and their dislike towards the compensation scheme (χ^2=12.785, p<0.0001). In addition, respondents who believed that they were receiving no benefits (41%) from protected areas or conservation highly disliked the compensation scheme (χ^2=10.282, p<0.0001). Lastly, there was a strong correlation between those who had a negative attitude towards protected areas and conservation and those who disliked lions (χ^2=4.971, p=0.026). Figure 5.7 illustrates the problems faced by respondents who live near protected areas.

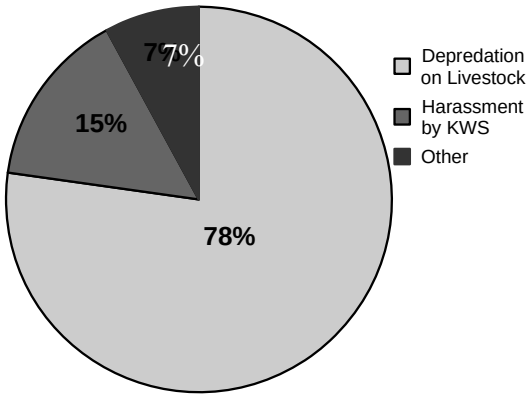


Figure 5.7: Negative aspects reported of living near a protected area

5.2.3 Dislike of lions and how that influences attitudes towards the compensation program

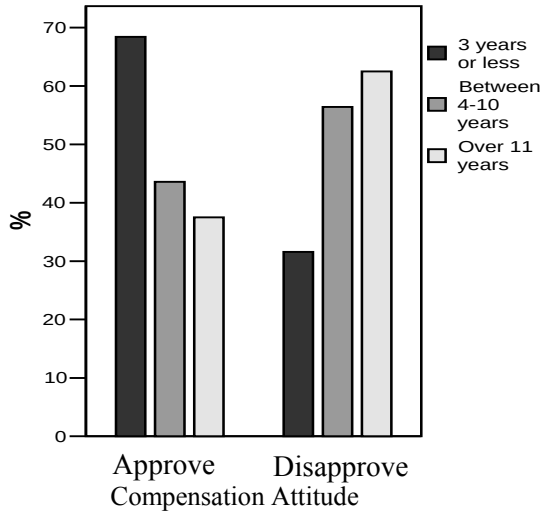
AIC results illustrated that respondents who disliked lions (measured by coding responses that indicated lions as the animal they dislike) were also much more likely to disagree with the compensation program (χ^2=10.167, p<0.0001). Interestingly, there was no correlation between those respondents who disliked lions and the top predators that attacked their livestock (Cows: χ^2=3.559, p=0.313 Shoats: χ^2=2.452, p=0.484). Hence, people's dislike of lions had no significant relationship to which predator caused them the most problems. However, there was a correlation between those that disliked lions and the lack of benefits received from the compensation program (χ^2=12.578, p=0.002). For example, 83% of people who disliked lions also claimed to be receiving little benefits from the compensation program. On the other hand, of those who reported to like lions, 53% thought the compensation program was benefiting them, while 41% saw little benefits. In addition, there was a moderate relationship between the number of times an individual was compensated

and their feelings toward lions (χ^2=8.960, p=0.030), illustrating that those who had been compensated more times had a more positive view of lions.

5.2.4. Demographic variables that shape attitudes towards the compensation program

Both 'years of residency' and 'age' affected respondents' attitudes towards the compensation scheme. Length of residency was found to be correlated with attitudes towards the compensation scheme (Mann Whitney U test: z=-2.588, p=0.010). Figure 5.8 illustrates that as the number of years an individual resided in a community increased, their attitude towards the compensation program decreased.

Figure 5.8: Residency and compensation attitude



In addition, there was a moderate correlation between age and attitude towards the compensation scheme. The older age-groups (over 40 years of age) were less likely to approve of the compensation program (70% disapproved); while only 45% of those less than 40 years old claimed to dislike the program. Note that residency and age are not intercorrelated (Kruskal Wallis: χ^2=2.180, p=0.336).

5.2.5 Experience with the compensation program and effect on compensation attitude

Up until this point, I have reviewed the significant variables specified in the AIC tests. However, an individual's experience with the compensation program, reported in qualitative and quantitative data (i.e., times compensated), is important, and will be briefly discussed, as it provides additional insight on causal factors affecting attitudes. Statistically there was a positive relationship between respondents who had been previously compensated (88%) and their attitude towards the compensation program (χ^2=4.833, p=0.027). On the other hand, there was no correlation between compensation attitudes and the number of times one was compensated. Apparently, if someone was compensated ten times they would be no more likely to express positive feelings towards the program than someone who had only been compensated once (Mann-Whitney U test: z=-1.481, p=0.139). Furthermore, there was no correlation between the proportion of livestock lost to carnivores in the past year and the number of times compensated (Spearman Rank: r_s=0.142, p=0.157). However, there was a relationship present between frequency of predator attacks on livestock and the number of times compensated (Kruskal Wallis: χ^2=13.802, p<0.0001), although these variables were not intercorrelated. This suggests, that how often (and hence how many) livestock were killed was more important to consider when understanding compensation affect than was the proportion of livestock lost to depredation, which differs from the propensity to kill results.

To confirm this claim, I tested for a correlation between number of times compensated and the number of cows owned; there was a strong correlation between the two (Spearman Rank: r_s=0.347, p=0.002). The reason I chose to test this was because there was a strong statistical relationship between the number of cows owned and the frequency of depredation on livestock (Kruskal Wallis: (χ^2=38.187, p=0.0001); implying that people who

owned larger herds experienced a higher frequency of livestock killed by predators than those with smaller herds (see Figure 5.2b). However, as stated in the first section, those who experienced a higher frequency of livestock lost to predators would not necessarily have had a higher reported propensity to kill a lion—it is instead the proportional loss to carnivores that drives lion killings. I found no correlation between the number of cows owned (wealth indicator) and attitude towards the compensation scheme (Mann-Whitney U test: $z=-0.583$, $p=0.560$).

Chapter VI: Discussion

Assessing peoples' attitudes and tolerance toward carnivores can be tricky, as attitudinal variables often interact in complex ways. Thus far there is no objective definition for 'tolerant' or how it allows an individual or a community to willingly coexist with carnivores. Collecting accurate and reliable data entails long periods of time in the field to gain the trust of community members (Scholte et al. 1999 in Dickman 2005; Bauer & Hari 2001) and possible biases in research methods need to be considered. These are discussed below.

Research has indicated that the most hostile attitudes towards carnivores are among farmers and ranchers living in close proximity to protected areas or carnivore home ranges (Kellert 1985; Bright & Manfredo 1996 in Naughton-Treves et al. 2003). These hostile attitudes often reduce people's tolerance of carnivores, limiting their ability to cope psychologically with livestock loss. In addition, respondents may exaggerate their loss (Naughton-Treves 1997; Gillingham & Lee 2003) or attribute death of their animals to predators regardless of the actual cause of death (Wagner 1988; Oli et al. 1994; Mishra 1997;

Treves et al. 2002). This may result in inflated perceptions of conflict and thus the possibility for exaggeration in respondents' claims in this study cannot be ignored. The results indicate that Maasai living in my survey areas perceived high levels of conflict with carnivores; however, actual rates (on a per head of livestock basis) are quite low compared to other studies (Rudnai 1979; Frank 1998) where methodology was similar.

Along with the risk of respondents amplifying their rates of conflict, there is also the possibility that respondents may have provided a response that they believe the interviewer wants to hear, rather than their true response. Only 25% of the interviewees indicated that they would retaliate and kill a predator after their livestock was attacked. This could be interpreted to mean that this community is generally tolerant in comparison to others: Marker et al. (2003) reported that close to 80% of farmers in Namibia indicated that they would remove a problem cheetah, while Naughton-Treves et al. (2003) found that 59% of rural residents in Wisconsin would kill a wolf if it threatened their livestock. However, comparisons across sites are hindered by marked variation in legal and social contexts.

At Mbirikani, it is quite possible that respondents were uncomfortable talking about illegal activities, such as killing lions, to an outsider (Hussain 2000). To attenuate this concern my Maasai assistant and I distanced ourselves from conservation projects and spent a substantial amount of time in the community building trust. Our time spent living in the area allowed community members to open up to us and discuss incidents of lion killings as they slowly began to accept us as allies rather than affiliates of KWS or another governmental institution. An example of this was one afternoon; a gathering of about ten *murran* came by my home to drop off a present of fresh milk from one of their mothers to whom I had given a lift earlier that day. They were setting out to kill a lion that had attacked

a cow the evening before. I invited the men in for a cup of traditional *chai* and we talked until late. When dusk approached, the lead *murran* exclaimed: "I guess it is too late to find that damn lion today. Maybe another day…" (Anonymous *murran*, in MGR, 2006). This example and the following quote illustrate the trust built between myself and the community which allowed me to carry out my research confidently. The following quote came from an elder in one of the communities where this study was performed:

> "If a lion kills my cow I will send my son after it. As long as my son is safe and has manage[d] to kill the lion, I will be very happy, because it has paid for the cow that [it] has attacked. The damn lion made me lose my milk, let it also die, and that's why *murrans* (warriors) are here" (Anonymous elder, in MGR, 2006).

Also, it is difficult for people to remain objective about topics like predation as a cow in Maasai culture is a symbol of wealth, status, and more broadly a mark of their pastoral identity (Spear 1993). For example, an elder stated, "I don't want to talk about my dead cow; it is like talking about someone[s] dead child" (Anonymous elder, in Mbirikani Ranch, 2005). Questions examining livestock death needed to be carefully asked after prior trust had been built between the interviewer and the interviewee. After following these guidelines, respondents were much more open to talk about topics like Maasai cultural changes, religion, and their living livestock.

6.1 Reported Propensity to Kill a Carnivore

Though reported propensity to kill is only a proxy measure of tolerance, it is a relevant indicator of the factors driving people to kill lions. My results indicate that the proportional loss to carnivores rather than the actual frequency of livestock attacked (or absolute numbers of cows lost) is the most important predictor motivating Maasai to kill

carnivores. This finding implies that a single depredation event is particularly devastating for someone who owns very few livestock, which is consistent with other studies (i.e., Oli et al. 1994; Mishra 1997). One depredation event incurs a higher proportion of loss for a poor person (owning less livestock) than for a rich one, thus perhaps making the former more likely to retaliate. This may be due to the high cost of effective herding (i.e., hiring herders) (Naughton-Treves 1997; Jackson & Wangchuk 2001), inability to purchase material to improve livestock bomas and residing in high risk areas (Saberwal et al. 1994; Ogada et al. 2003). Further data should be collected to disentangle the multiple factors interacting to shape respondents' propensity to kill a lion and individual risk of depredation.

We found that if an individual's proportional loss of cows to carnivores is less than 11% of their overall cattle loss per year they are unlikely to kill lions. This threshold could help guide management interventions by exploring mitigation measures to reduce cattle loss by predators below the 11% threshold.

My findings illustrate that in addition to the proportion of cattle lost to depredation, perception of lions as the major predator on livestock shapes propensity to kill a lion; though lions appear to kill only a small percentage of livestock on the ranch. For example, the compensation program recorded lions took 62 out of 1141 (5%) of all livestock attacked between May 2005 and May 2006 (Maclennan, S., *in preparation*.). Similarly, other studies support that perceptions drive retaliatory killings. Marker et al. (2003) found that 60% of white farmers in Namibia indiscriminately removed cheetahs even though they did not consider cheetahs problematic. In this study, although perceived lion conflict with shoats was quite low compared to that of leopards, Maasai disproportionately remove lions in response to their livestock attacked (see below for possible reasons). It should be noted that the vast

majority of Maasai residents on MGR are unable to recognize the difference between leopard and cheetah, and this must be taken into account when reviewing these results.

These results differ from those of Kissui (Kissui *in press*) on traditional Maasai in Tanzania, and Ogada et al. (2003) on commercial ranches in Kenya, who found that the retaliatory killings were directed at the specific predator who killed livestock. The latter study concluded that white ranchers in Laikipia do not indiscriminately kill carnivores, but rather kill only those that have attacked their livestock. Kissui concluded the same, in communal Maasai areas. The divergence in Kissui's findings is probably because lions were the main predator on livestock in his study area and thus retaliatory killings were consistent with the frequency of lion attacks on livestock.

It is likely that lions are most vulnerable to retaliatory killing by pastoralists living on communal lands because: 1) lions are the easiest carnivore to kill using traditional methods (spearing), while leopards, hyenas, and cheetahs are much more difficult to track and kill; 2) killing a lion provides immense prestige within Maasai society, whilst killing other predators does not (Ikanda & Packer *in press*) ; and 3) the great cultural significance of cattle to Maasai is such that although lions kill fewer livestock than other predators, they predominantly attack cattle which incites the greatest resentment (Dickman 2005; Bagchi & Mishra 2006). Therefore, people may particularly resent the loss of their most valuable livestock and react accordingly. While peoples' tolerance of conflict with carnivores and their likelihood of retaliating appears to be influenced most strongly by their proportional loss of cattle to carnivores, it is also driven by perceived conflict, with lions disproportionately killed for the majority of livestock attacked.

These results illustrate Maasai desire to eliminate the most tangible factor (carnivores) perceived to be reducing their livestock. Killing carnivores is simpler and cheaper than preventing drought or disease. Individuals who recognized depredation as one of the major problems affecting their livestock (largely those whose proportional loss to carnivores is high) were more likely to retaliate on lions.

Beyond household experiences and conditions, large-scale sociopolitical and ecological factors also shape conflict and local attitudes toward wildlife. Some studies have shown that after the implementation of conservation initiatives, conflict (perceived or actual) increases. For example, Oli et al. (1994) found that since the establishment of a protected area in Nepal, snow leopards have been often held responsible for an increase in predation compared to before. On Mbirikani Ranch, Maasai perceived an increase in livestock depredation in the past two years, most often attributed to conservation activities on the group ranch. Respondents indicated that this increase in conflict was a result of a growing lion population and a change in lion behavior (becoming more aggressive). An elder stated,

> "…these days lions have become very aggressive. In the past if a lion ate a cow it would go all the way to Namelok (roughly 40km away), but now it kills a cow and just goes up the hill and waits until tomorrow. They are not afraid anymore. Also, you know they used to never walk on the road because they knew we could see their paws [tracks] and hunt them down, but now they walk and do whatever they like because they know they are protected."
> (Anonymous elder, in Mbirikani Ranch, 2005)

Surprisingly, the majority of respondents perceived an increase in lion-livestock conflict, although actual numbers of lions on the group ranch are quite low (see Chapter 3 section 3.3). Many studies have shown that compensation schemes often cause livestock farmers to become less risk-averse in caring for their livestock as they know they will receive

reparation for their loss (Wagner et al. 1997; Nyhus et al. 2003), and thus traditional husbandry techniques are abandoned. In addition, compensation programs may increase stocking rates, therefore making more livestock available to be attacked by predators (Rondeau & Bulte 2004). The compensation program on Mbirikani Ranch has paid out about 3 million KSH, enough to replace 300 cows, which would replace less than 1% of the 45,000 cows on the ranch (Hill, T, pers. comm.).

Monthly relief food may have caused Maasai to become less dependent on their livestock for income, because they need no longer rely on selling livestock for cash to purchase food. Also, religious commitments can inadvertently cause Maasai to become less vigilant about their livestock (as I will explain in the section below). Lastly, conservation has long highlighted the importance of wildlife, perhaps causing local people to feel that they are of lesser importance to government or NGO's (Berger 1993). Maasai may exaggerate conflict as a way to emphasize their hardships due to wildlife and conservation interventions (Naughton-Treves 1997; Gillingham & Lee 2003). It is important to note that my intent is not to ascribe causality of Maasai perception of increased conflict with these explanations but rather to offer insight on possible motivations behind Maasai perceptions.

I found there to be a strong correlation between respondents' religious affiliation and their tolerance of carnivores. More specifically, the respondents who were affiliated with the evangelical KAG (Kenyan Assemblies of God) church had a higher reported propensity to kill predators then those who attended different churches or no church at all. Gitau (2000) suggested that only a few Kenyan churches have attempted to incorporate environmental issues in sermons. One such church, the Roman Catholic Church in Kenya, has proactively integrated environmental topics within their framework, and in accordance with my findings,

Maasai who attended Catholic Church were more tolerant of carnivores. Comparable findings with Maasai in Tanzania suggested that the Tanzanian Assemblies of God (TAG) are less tolerant of cultural practices, relative to the Catholic Church who tend to be more tolerant and accepting of Maasai culture and less insistent upon change (Hodgson 2006 pers. comm.). However, those respondents who did not attend church illustrated higher tolerance than those affiliated to any church. It is important to note that religious affiliation is not highly correlated with any other significant variable and thus the results are independently driven (see Appendices I and II). For example, proportion of livestock lost to depredation by carnivores was somewhat uniform across all religious categories, and KAG members were not suffering disproportionate losses.

My results indicate that not only does religious affiliation affect tolerance of carnivores; it can also influence individual risk of livestock predation. For example, church crusades (chiefly KAG run) are an increasing event on Mbirikani Ranch. KAG teachings demand a total cessation of Maasai cultural practices, such as elongated ears, dress, and perhaps the traditional lion killings (see below for explanation). Additionally, these crusades can last up to one week and many of the attendees (especially the elders) do not return to their *bomas* during this period. As a result of their absence, no one is present at the *bomas* to make key decisions about livestock. For example, during one crusade I attended, two elders lost a total of 35 cows. When I asked one elder why he did not return home to take care of his livestock, he replied, “There is no need to return home when I am in the house of God; he will protect my livestock from danger” (Anonymous elder, in MGR, 2005). This quote exemplifies how some Maasai have abandoned traditional husbandry techniques due to religious commitments and as a result may be losing livestock. Therefore, perhaps the

influence of religion has caused Maasai to become less vigilant about their livestock. Presently, there are very few studies that focus on the relationship between Maasai, environment and religion, and there are virtually no studies that examine how different church affiliation affects Maasai livestock husbandry and overall tolerance and attitudes towards carnivores. There is a pressing need to collect data in this area, which later could be a critical stepping stone for conservation progress.

The last significant variable in my results indicate that an individual's form of livestock use and level of dependence is highly correlated with reported propensity to kill a carnivore. Respondents who rear livestock for sale purposes, rather than just for domestic consumption or traditional reasons, have a higher reported likelihood of retaliating. There was no correlation found between those that sell their livestock and the proportion of livestock lost to predators or overall frequency of livestock depredation. This finding is similar to Bagchi and Mishra (2006), who concluded that tolerance and attitudes towards carnivores is directly related to the economic value of livestock. As Maasai increasingly participate in the livestock market and trade arenas it will be vitally important to further understand the links between economics and tolerance of carnivores.

The discussion of my findings up to this point has focused only on those variables that were statistically significant in the AIC tests. However, the lack of significance of the *Olamayio* (traditional lion hunts) variable merits a brief discussion because past studies examining Maasai-lion conflict have illustrated that the influence of *Olamayio* killings were considerable (Ikanda 2005; Ikanda & Packer *in press;* Frank et al. unpublished data). Statistical analyses strongly suggest that *Olamayio* is not commonly practiced on Mbirikani Ranch today. Respondents indicated that the ramifications of *Olamayio* killings, specifically

arrests, fines, and injury, are too severe to sanction traditional lion hunts. However, this attitude is very much site specific, as it is common fact that *Olamayio* persists on ranches adjacent to Mbirikani, specifically around Amboseli National Park and Ngorongoro Crater in Tanzania (see Ikanda 2005; Ikanda & Packer *in press;* Frank et al. unpublished data).

In conclusion, the AIC statistical tests evaluated the strength of 20 possible predictors and concluded that proportion of livestock losses to depredation, religious affiliation, and livestock dependence are key factors correlated with peoples' reported propensity to kill lions on Mbirikani Ranch. My results indicate that these variables are not highly intercorrelated and therefore are individually significant. The fact that these predictors are most powerful when combined illustrates how these variables build on one another. Moreover, my findings highlight that local perceptions of conflict, although at times diverging from actual loss patterns, are essential to understanding the driving forces behind lion killings in Maasailand.

6.2 Attitudes toward the Compensation Scheme

As indicated from the above discussion, an individual's reported propensity to kill lions is linked to several social, economic, and cultural factors. In an attempt to halt lion killings on Mbirikani Ranch, a compensation program was initiated in early 2003. This program reimburses people for livestock lost to lions and other carnivores, in essence, 'paying' people to become more tolerant of these losses. Although the compensation program worked closely with local community members throughout all stages of the project, my findings suggest that in high conflict areas on Mbirikani Ranch compensation does not significantly improve people's attitudes or their perceptions of lions. These results are similar to other studies that found that compensation payments do not alter individual citizen's

tolerance (Naughton-Treves et al. 2003; Nyhus et al. 2005) and may not stop people from killing wildlife illegally (Nyhus et al. 2005). Tolerance has been defined as: "1) to allow the existence or occurrence of something without interference 2) to endure with forbearance" (Oxford Dictionary 2002). In sum, evidence from Mbirikani illustrate that many of the residents do "endure" some conflict with carnivore without retaliating (Rodriguez 2006). For example, from July 2003 through December 2006, there have been only five lions killed on Mbirikani Ranch compared to 63 killed on the surrounding group ranches (Predator Compensation Program data 2006).

Although univariate tests show an association between the numbers of times an individual is compensated and a lower reported propensity to kill lions, my multivariate test reveals that this association disappears due to a stronger association with three other variables: proportion of livestock lost to depredation, religious affiliation, and livestock dependence. People residing in areas of high conflict indicated a stronger dislike of the compensation program than did those in low conflict regions of the ranch. These areas also illustrated negative attitudes towards the local lodge, which is in partnership with PCF. Therefore, disproportionate attitudes towards PCF, in high-conflict areas, may have been influenced by individual (or communal) dislike of the local lodge rather than PCF exclusively. Studies have shown that even though compensation may not "buy" an individual's tolerance of a carnivore, these payments can have an important political role and earn carnivores some tolerance at a broader level (Naughton-Treves et al. 2003).

A related study, performed in other areas of Mbirikani where conflict is lower and human population density is higher, documented greater tolerance of carnivores and attributed this to the compensation scheme (Rodriguez 2006). In other words, the effect of

compensation on attitudes may vary according to how severe the conflict is or the nature of the analysis, and as I illustrated in my literature review (see section 1.5.2), conflict is typically higher in areas that exhibit low human densities. Undoubtedly, the success of compensation is also determined by institutional arrangements for payment and their acceptability in local contexts. The most commonly cited complaints against the program among the respondents were: inadequate payment for livestock (program does not consider sex or breed of stock), unfair penalties and rules, length of time it takes to get compensated, and the overall emotional attachment they have for their livestock. These findings have also emerged in other studies of compensation (Linnell & Broseth 2003; Naughton-Treves et al. 2003; Nyhus et al. 2003; Rodriguez 2006).

Other respondents complained about the variation in compensation payments for different predators. For instance, those individuals who lost livestock to hyenas were compensated significantly less than those whose livestock were attacked by lions, cheetahs and leopards. This disparity in compensation values could in turn cause additional resentment towards the compensation scheme. Tom Hill (director of PCF), explained "we cannot afford to pay for all hyena depredations; we are here to save lions. Hyenas are not highly persecuted by Maasai and we have to decrease payouts from those animals that are less threatened" (Hill, T, pers comm.). The compensation program documented that 32% of livestock killed within my study area involved spotted hyenas (Maclennan, S., KLCP lion biologist, unpub). Therefore, 32% of claimants received only half of the standard reparation that would be given to an individual who lost their livestock to a lion, leopard, or cheetah. Maclennan's findings concur with other studies that found hyenas to be the main predator of livestock in communal Maasai land (Kolowski & Holekamp 2006). However, Ogada et al.

(2003) concluded that on Laikipia commercial ranches (in northern Kenya) lions were responsible for 68% of livestock attacks while hyenas accounted for only 15% of kills. This is likely due to improved *boma* construction, which prevents hyena depredation at the boma at night (Mwebi, O. unpubl). Although multiple studies have found lions to be the most serious predator on Kenyan rangelands (Ogada et al. 2003; Patterson et al. 2004), in Chyulu Hills, in high conflict regions, hyena attacks on livestock were the most frequent, followed by cheetah and leopard attacks, with lion attacks being the least frequent. This divergence in findings is likely due to the fact that the majority of lions residing adjacent to Chyulu Hills N.P. have been eliminated by the local community whereas other predator populations have not been decimated to the same extent.

My interview data indicate that the majority of respondents had been compensated in the past for their livestock losses, but that only about half of those compensated held a positive attitude towards the program. Those individuals who have been compensated at least once held a much more positive opinion of the compensation program than those individuals who had never received compensation. In addition, respondents who were compensated multiple times were not any more likely to hold a positive view regarding the compensation program. These findings imply that compensating an individual repeatedly will not necessarily result in a more favorable view towards the program or conservation efforts in general (see discussion below on PA's). However, by not compensating people each time their livestock is attacked could be highly detrimental as this could possibly cause additional resentment towards carnivores and conservation efforts (Naughton-Treves et al. 2003).

My results also indicate that the number of times an individual was compensated was associated with a higher degree of conflict experienced (i.e., frequency of attacks on a per

head of livestock basis). This result was expected because the compensation payments are determined by frequency of reported attacks. I also found that individuals with larger herds were compensated more frequently. This concurs with other studies that suggested that individuals who owned larger herds experienced a higher rate of livestock depredation by carnivores then did smaller herds (Mishra 1997; Wydeven et al. 2004). But it might also be related to the sense of entitlement that larger herd owners have, which makes them more likely to register a claim with the compensation program (Naughton-Treves et al. 2003). Overall, my findings suggest that those who reported a higher frequency of livestock losses to carnivores commonly had the following characteristics: 1) owned a larger herd; 2) did not have a more positive feeling towards the compensation program despite multiple compensation payments; and 3) did not have a higher reported propensity to kill a lion.

I also found a strong relationship between respondents' attitudes toward compensation and their opinions on other conservation interventions. Specifically, those who disapproved of protected areas and conservation goals also disliked the compensation scheme. My interviews revealed that these individuals were frustrated by the lack of benefits from the PA and perceived increased conflict with carnivores. An elder stated:

> "…those foxes [government/wazungu] have taken all our fertile land as PA's for wildlife, and those wildlife are killing people, eating our livestock, damaging our crops…they just get money from wildlife and they forget about the problems people encounter from wildlife, and there are so many people and they all want to have a share. Now how can a pocket that has a hole get filled up? It's hard."
> (Anonymous elder, in MGR, 2006).

Specifically, those individuals who felt that they received little or no benefits from protected areas also disliked the compensation program. The lack of benefits coupled with the costs associated with conservation (i.e., depredation, crop raiding, lost access to

resources) have negative effects on local attitudes (Heinen 1993; Fiallo & Jacobson 1995; Sekar 1998). However, those respondents who voiced a positive feeling towards the compensation program also indicated that PAs were overall beneficial.

In addition to the lack of benefits mentioned above, respondents who disliked protected areas and conservation also disliked lions and, more generally, carnivores, as they believed that conservation had allowed predators to survive in their community and continue to prey on their livestock. These individuals were also more likely to report that they would kill a carnivore in response to losing their livestock. These results bolster the prediction that negative conservation (and carnivore) attitudes are reflected in less conservation-oriented behaviors (Abbot et al. 2001; Holmes 2003). On the other hand, other studies found that positive attitudes towards protected areas do not always result in constructive conservation behavior either (Heberlein 1981 cf Naughton-Treves 1997). Moreover, it is important to note that attitudes towards conservation and protected areas are shaped by individual and community perceptions, which are a result of the degree of interaction and experience between wildlife, local people, and conservation managers (Newmark & Leonard 1993; Fiallo & Jacobson 1995; Ite 1996 in Holmes 2003). During an informal interview with a highly respected elder in the community, I asked, "How did you feel when Amboseli was made a National Park?" The elder replied:

> "Let's be honest, now. If I take your property away from you without your consent, will you be happy? Now for the fox [government or wazungu] who forced us to move from the park, have they succeeded [in] containing these animals in that park? Have the wildlife stop[ped] roaming all over the group ranches and eating our cows? So they could have just left it and just let us live with them like [the] time before. We have lost our land [and] our rights to use it [PA's]. So it was a very bad idea" (Anonymous elder, in MGR, 2006).

In addition, two demographic variables influenced attitudes toward the compensation program: duration of residency and age of respondent. Interestingly, duration of residency and age of respondent were not intercorrelated (see Appendix II). My data suggest that people who have resided in a community less than three years were much more optimistic about the compensation scheme and subsequent conservation strategies. Individuals with longer histories in the area had more negative attitudes towards compensation. These results contradict Holmes (2003), who found that negative conservation attitudes were indicated by fewer years of residency. This discrepancy is most likely site-specific and driven by past experiences of land entitlement and conservation intensification adjacent to study communities. For example, Maasai often mention that they are fearful about conservation programs procuring their land for wildlife purposes as was done in the past (refer to Chapter 2, Section 2.5). This fear of losing land to conservation efforts is a realistic concern, especially since it is commonly agreed that rural communities are most vulnerable to the establishment of protected areas (Gadgil 1990; Mishra et al. 1992; Neumann 1998; Sekar 1998).

Lastly, my results illustrate that younger individuals are more accepting of the compensation program and protected areas, probably due to their higher level of education, which is highly correlated to age (i.e., younger people have more years of education). However, it could also be attributed to that fact that younger people have experienced less problems (i.e., depredation, land evictions, etc.) and therefore hold a more positive outlook. Similar results were found in India, suggesting that younger people held a more positive view about tourism and conservation initiatives (Sekar 2003). Other studies have shown that increased years of education is correlated with increased tolerance of carnivores and a higher

likelihood of filling a compensation claim (Naughton-Treves et al. 2003). My results indicate no correlation between age or education level and tolerance of carnivores or number of claims sought. This finding implies that younger people are not less likely to report an inclination to kill a carnivore in response for losing their livestock.

6.3 Conclusions

In conclusion, this study reveals the complexity of human-carnivore conflict through in-depth analyses of socio-ecological factors and individual attitudes and perceptions towards carnivores and conservation. My overall aim was to uncover the factors compelling Maasai to kill lions, in an effort to find possible mitigation measures for reducing livestock-carnivore conflict and increasing local people's tolerance towards carnivores, specifically lions. Although my findings focus on Maasai in a southern Kenyan context, they offer insights for similar situations dealing with livestock-carnivore conflict elsewhere. My results suggest that communities adjacent to Chyulu Hills perceive high rates of conflict with predators and that roughly one quarter of respondents in high conflict regions are inclined to kill lions. However, actual rates of lion depredation on livestock is extremely low, only 0.08%. Maasai may be accurate in their perception that conflict has increased, but not because lion numbers are increasing, but rather because traditional husbandry roles are eroding possibly due to the dependence from relief food, compensation and religious commitments. Such conflict is rooted not only in actual losses but in resentment and vulnerability linked to land use changes, lost territory, and conservation imposition. As a result of these attitudes, Maasai have lost much of their tolerance required to coexist with lions.

Strategies to assuage this conflict need to be considered immediately before the last remaining lions are eliminated. These strategies should include efforts to reduce the proportion of cows killed by carnivores to less than 11% by improving husbandry (specifically reducing the number of livestock lost in the hills and thus vulnerable to carnivore attacks). Conservationists also ought to communicate more with religious leaders about wildlife and potentially work with churches on incorporating environmental issues into their teachings. I also suggest regulations on routine relief food aid (specifically for the affluent class), as continuing aid can encourage local people to become dependent on subsidy programs rather than proactively finding other solutions. Instead of selling cows to acquire food, Maasai are currently relying on the relief food provided each month to feed their families.

The analysis of attitudes towards the compensation program has highlighted key factors that should be targeted when considering community-based conservation alternatives. Specifically, these factors include allowing older, less educated, long-standing residents to participate in conservation endeavors while also increasing education about carnivores (specifically lions) and the importance of protected areas and conservation initiatives.

Additionally, studies have shown that incessant conflict between people and carnivores can easily damage local community support for conservation (Mishra 1997; Gadd 2005). In the past year, Maasai in southern Kenya have begun pushing for the degazettement of Amboseli N.P., as they strongly believe that the costs associated with living with wildlife outweigh any of the benefits they receive in return (Mynott 2005). Conservationists are adamantly against handing over the park to the Maasai as the believe that Maasai politicians lack the ability or expertise to conserve wildlife and habitat, as well as provide security and

infrastructure for tourism (Ngowi 2006). Balancing the needs of both conservationists and the communities is becoming increasingly more complex.

I believe that carnivore conservation should be addressed through improving local livelihoods and empowering social institutions, which would ensure that collective participation and interest are taken into account (Hussain 2003; Treves et al. *in press*). In addition, conservation organizations should work in conjunction with communities and develop appropriate programs that comply with their culture and needs. I do not believe that transferring all rights and responsibility of PA's to local communities would be advantageous at this time as they lack the required experience and knowledge.

A conservation program aimed at alleviating conflict with wildlife should not be limited to controlling the problem, but rather be allowed to work to increase local people's tolerance of wildlife and improve defense systems to prevent further loss (Naughton-Treves 1998). One example of a successful program is the Laikipia Predator Project, which has worked with communities in various ways to help them improve their husbandry practices through the construction of better *bomas* and education on improved herding strategies, which in turn has shown to be decreasing livestock-carnivore conflict considerably. The ultimate challenge in resolving human-wildlife conflict issues involves devolving sufficient authority and ownership of lions to communities, promoting local participation in the conservation process (mainly through co-management strategies), and to ensure ongoing communication between communities, government, and conservation organizations (Agrawal & Gibson 1999; Goldman 2003; Naughton-Treves 1997).

Clearly, it is critical to incorporate a scheme that allows local people to see tangible economic benefits for tolerating carnivores on their land. These results indicate that in high

conflict areas compensation alone is not enough to transform attitudes or alter perceptions of carnivores. A program that devolves sufficient decision-making authority to the local communities and encourages large-scale participation in conjunction with compensation is likely to increase local tolerance levels. I will discuss the details of such an alternative in the next chapter.

Chapter VII: Future Suggestions "Lion Guardians"

Studies around the globe suggest that where livestock and carnivores coexist conflict is inevitable, and Mbirikani Ranch is no exception. Carnivores of all sizes are built to kill and eat prey, while livestock are built to be eaten, as they have lost most their anti-predator behaviour (Breck 2004). Therefore, wherever carnivores and livestock overlap and share resources there is likely to be conflict. To ameliorate this problem for communities, conservation interventions attempt to increase tolerance of local people towards carnivores by providing benefits in various ways. On Mbirikani Ranch, the current compensation program is one example of where paying people for their lost livestock has shown to be increasing people's tolerance towards carnivores, principally in low-conflict areas. In addition, the compensation program and the efforts carried about by ODWT (i.e., game scouts) has provided a framework to build from, one that focuses largely on providing the infrastructure for local people to participate in conservation activities.

During my time spent in the community and through the data collected for this thesis it has become increasingly evident that that need for community participation in conservation programs is essential to achieving long-term success. My assistant and I conducted focus-groups where we discussed possible future programs that would aid in increasing local tolerance towards carnivores. One elder in the meeting stated:

> "We would like to urge all the conservationists to come forward and work hand in hand with us, because we've accepted living with wildlife and seeing them like our properties, and we want to see more benefits coming in, because we also suffer a lot of conflict from wildlife, and make sure that not just [a] few individual[s] enjoy the benefits but everyone since we all have to live with them"
> (Anonymous elder, in MGR, 2006).

At another focus group a *murran* stated, "Let us *murrans* help conservationist[s] monitor lions. Our tradition and culture makes us the best and most experienced people to save lions. We can track lions in the dark, with our eyes closed, and we will never fail at it" (Anonymous murran, in MGR, 2006).

Through these types of discussions with local communities and collaboration with on-going conservation projects in the area (specifically: ODWT and PCF), a program called "Lion Guardians" has been created as an avenue towards increasing local tolerance. Lion Guardians is an organization of Maasai warriors responsible for conserving lions by monitoring lions and other carnivores, educating their communities in improved livestock management and the economic value of wildlife. The premise of Lion Guardians is to encourage large-scale local community participation at all levels, from the design of the project through the implementation and fine-tuning processes. We predict that "ownership" of conservation will result in increased levels of tolerance towards carnivores by local people and promote a viable path towards coexistence. Lion Guardians will address chronic

unemployment among young Maasai men, and will incorporate key aspects of Maasai tradition and culture within a conservation-based structure, working closely Kilimanjaro Lion Conservation Project (KLCP), Ol Donyo Wuas Trust (ODWT), and the Predator Compensation Fund (PCF).

Lion Guardians is a template that is adaptable in nature and involves existing local institutions working together towards the same goal. The situation on the ground is dynamic and ever-changing. Maasai are still totally dependent on their great herds of cattle, sheep and goats, but due to modernization and massive socioeconomic change (refer back to Chapter II) they have lost much of their traditional tolerance and ability to cope with carnivores and conflict. Today they regard wild animals as an unmitigated nuisance rather than an economic resource or embodiment of Maasai culture. If lions are to persist in this ecosystem, it is essential to increase tolerance of local communities by getting them involved in conservation. If lions are to persist in southern Kenya, conservationists need to devolve the responsibility of implementation to the communities and assume a facilitating rather than dictating role in the conservation process.

Maasai often argue that they dislike conservation programs because they are unable to understand the foreign framework and rules. Based on extensive consultation with local Maasai communities, carnivore conservationists, economists, sociologists, and other stakeholders, Lion Guardians is a novel approach to conservation, incorporating the traditional role of warriors with proven solutions for reducing lion depredation on livestock and bringing financial benefits of conservation to those individuals that incur the costs of living with carnivores. Building on ancient knowledge, research by the Laikipia Predator Project has shown that traditional time-tested African livestock husbandry practices

effectively protect cattle from lions (Ogada et al. 2003), *if* local people have the motivation to tolerate rather than kill predators. Lion Guardians is designed to provide that motivation while reminding Kajiado Maasai that they already know how to "Live with Lions".

Lion Guardians will incorporate five effective mechanisms for reducing conflict and benefiting local people:

1. Employment and the prestige, status, and benefits associated with it
2. Cash, in the form of salary paid to warriors, which trickles down to other family members, and to a central community fund
3. Monitoring populations and movements of lions and other carnivores
4. Educating and assisting in reducing depredation on livestock by carnivores
5. Community involvement, encouraging all members to play a role in the design, implementation, and long-term maintenance of the program

1. Employment

During the preliminary stages of this research, we collected data on family relationships to determine the best distribution of benefits that could be felt at the greatest distance. Lion Guardians will be employed using data on social networks, familial ties, attitudes towards conservation, and other socioeconomic factors to pick out eight "target" individuals who would most effectively influence their community. There will be four two-person teams, and each team will be responsible for monitoring one lion pride. As the lion population increases, more Lion Guardians will be employed. There will be one project coordinator employed from the group ranch who will be responsible day-to-day running of the project. We aim to find out what critical number of employed guardians is required to affect changes in the behaviour of individuals in the community.

2. Cash

Although employment of individuals will be central to the project, the Community as a whole will benefit directly. A community benefit fund will be established, and an equivalent of 20% of each Lion Guardian's wages will be deposited monthly. Expenditure of this money will be decided by the Lion Guardian committee (described below), allowing additional community members to participate, while also quickly seeing direct benefits of conservation and employment. Although the fund will initially be small, community participation in decision-making is a critical component. It is not intended to build a school or a well, but to provide a forum for participation while also aiding in the maintenance or development of a small community project (i.e. buying diesel for the well pump, or donkeys to distribute water). In addition, a picture of a lion will be visible on all projects, as a constant reminder of the source of the benefits. Moreover, there is a direct relationship between the number of Lion Guardians employed and the amount of money deposited into the community fund. As lion numbers increase, additional Lion Guardians will be needed to monitor the increasing population, which will in turn, build up the community fund.

3. Lion Guardian duties

Initially, all Lion Guardians will receive technical and ecological training by other experienced Maasai. They will learn how to use GPS units, track lions using telemetry technology, and conduct transects. Much of this will be emulated from the "Event Book" system created in Namibia by the LIFE program, which differs from conventional monitoring in that communities dictate how and what needs to be monitored, while scientists only facilitate the process (see Stuart-Hill et al. 2005). The advantage of using such a system is that it is geared toward illiterate employees, chiefly by using pictures and symbols rather than

words. Also, the original 'event book' where all the data is collected never leaves the community (only copies) and baseline analysis is done at the community level. Both these aspects provide the community with a sense of ownership and responsibility of their natural resources (please refer to Stuart-Hill et al. 2005 for additional information).

More specifically, the Lion Guardians will be in charge of monitoring the lion population, training their community in sound livestock management (with the help of elders as is customary), searching for cattle lost in the bush (and thus vulnerable to predators), patrolling no-grazing areas, and, when necessary, dealing with verified problem lions in the traditional *Olkiyoi* and *Olamayio* custom—allowing *murrans* to prove themselves as they did in the past. These are essentially the traditional community roles of *murrans* (aka: Lion Guardians), more precisely targeted to benefit progressive conservation. In addition, Lion Guardians will aid in showing an educational film in the Maasai language focused on predator conservation, effective traditional husbandry techniques, and livestock management. This video was filmed on Mbirikani Ranch and in Laikipia District and thus many of the actors in the film are family member or relatives, allowing the viewers to more readily identify with the issues. Preliminary feedback indicates that this film has shown great success and acceptance with the Maasai living in Laikipia District and on Mbirikani Ranch.

4. Large-scale community participation

A high level of community participation is critical to achieving conservation goals. The purpose of the Lion Guardians committee is to ensure that additional community members participate in the project. These individuals are elected by their community and include both men/women, educated/uneducated, all subclans, and all adult age groups. In

addition, it will also target and promote those individuals who are older, less educated, long standing residents—as this study show that these individuals currently exhibit less tolerance towards carnivores and conservation. The committee will rotate annually which will allow for a wider level of participation in the community while also curbing corruption (a ubiquitous problem in Kenya) as individual's will have little opportunity to abuse the system.

Lastly, the community strongly pushed for a project that incorporates culturally acceptable and negotiable penalties for killing lions or breaking the rules. Rather than using threat of governmental intervention to modify behaviour, the Maasai would rather use traditional penalties which could include paying out cows and/or losing grazing rights to fertile areas. Most importantly, Lion Guardians will use Maasai culture and traditional knowledge as the backbone for sustainable conservation. It will use the traditional Maasai meeting (*Enkiguena*), which is central to customary Maasai decision-making and processes, as the main medium to carry out the project (refer to Goldman 2006 for additional information on *Enkiguena*).

Currently there are five lion guardians paid by ODWT and managed by myself, KLCP, and one Maasai coordinator. These guardians are employed in five communities on the ranch where lion-livestock conflict is highest. Each guardian has been trained to record lion and other carnivore presence on a simple form using pictures rather than words making it easier for illiterate guardians (see Appendix IV). In addition, every employee has a cell phone which is used to report back any significant sightings of lions or any illegal activity to KLCP. We are seeking funding for GPS and telemetry units which will assist the lion guardians in data collection. Training the Lion Guardians on community outreach will begin

in March 2007 and focus primarily on improving bomas and informing their community about “safe spots” to herd livestock.

Lion Guardians has been running for less than three months, and is receiving overwhelming support and enthusiasm from the community. For example, on Feb 10, 2007, a group of six *murran* attempted to kill a lion for *Olamayio*. Together with ODWT game scouts, the five lion guardians successfully deterred the young *murrans* from killing the lion. Afterwards, one guardian stated “It has never happened when a lion’s worst enemy [warriors] has become its greatest friend” (Anonymous *murran*, in MGR, 2007). Our intention in creating Lion Guardians was to provide the opportunity for young Maasai warriors to use their skills for conservation instead of killing lions. Lion Guardians is not a panacea for human-carnivore conflict but instead it is a template that is adaptable in nature and involves various institutions working together toward a shared goal—one of coexistence and not killing.

Appendix I: Correlation Matrix for Variables used in Propensity to Kill Hypothesis

Correlation Definitions

Categorical * Continuous: r_s >0.70 (Spearman rank analysis)
Continuous * Continuous: r >0.70 (Pearson r correlations)

Variables**	Age	Cow Size	Share herd	Stock use	# of children	Religion	Clan	Lion problem	PA important	Lion Like	Lion dislike
Age	--------	0.088			0.079						
Cow Size	0.088	---------	-0.135	0.134	0.195	-0.098	-0.126	-0.006	0.149	0.015	-0.039
Share herd		-0.135	--------		-0.117						
Stock use		0.134		--------	0.257						
# of children	0.079	0.195	-0.117	0.257	--------	0.059	-0.062	-0.101	-0.029	-0.015	0.012
Religion		-0.098			0.059	-------					
Clan		-0.126			-0.062		--------				
Lion problem		-0.006			-0.101			----------			
PA important		0.149			-0.029				---------		
Lion Like		0.015			-0.015					--------	
Lion dislike		-0.039			0.012						--------
Freqloss		0.618			0.330						
Dep5yr	-0.026	0.024	0.027	0.118	0.059	0.024	0.132	0.121	-0.104	0.035	0.015
Dep1yr	0.032	0.041	0.105	0.129	0.030	0.045	0.218	0.055	-0.110	0.040	-0.049
Comptimes	- 0.079	0.139	-0.117	0.050	0.018	0.059	-0.062	0.101	-0.029	-0.015	0.012
Olamayio		-0.012			-0.071						
NARC		-0.021			-0.132						
Comp attitude		0.058			0.148						
Lion here		0.062			0.134						
GR		0.167			0.145						
KWS		0.101			0.028						

n=100

** see table 4.1 in methods chapter for variable explanation and type

Variables ***	Freqloss	Dep5yr	Dep1yr	Comptimes	*Olamayio*	NARC	Comp attitude	Lion here	GR	KWS
Age		-0.026	0.032	-0.079						
Cow Size	0.618	0.024	0.041	0.139	-0.012	-0.021	0.058	0.062	0.167	0.101
Share herd		0.027	0.105	-0.117						
Stock use		0.118	0.129	0.050						
# of children	0.330	0.059	0.030	0.018	-0.071	-0.132	0.148	0.134	0.145	0.028
Religion		0.024	0.045	0.059						
Clan		0.132	0.218	-0.062						
Lion problem		0.121	0.055	0.101						
PA important		-0.104	-0.110	-0.029						
Lion Like		0.035	0.040	-0.015						
Lion dislike		0.015	-0.049	0.012						
Freqloss	---------	-0.095	0.081	0.330						
Dep5yr	- 0.095	--------	0.371	0.011	-0.021	-0.153	0.084	0.080	0.108	0.126
Dep1yr	0.081	0.371	----------	0.065	-0.002	-0.202	0.008	0.006	-0.053	0.057
Comptimes	0.330	0.011	0.065	----------	-0.071		-0.148	0.134	0.145	0.028
Olamayio		-0.021	-0.002	-0.071	-------	------				
NARC		-0.153	-0.202	-0.132			---------			
Comp attitude		0.084	0.008	-0.148				------		
Lion here		0.080	0.006	0.134					-------	
GR		0.108	-0.053	0.145						---------
KWS		0.126	0.057	0.028						

Categorical * Categorical: p value<0.0001 (Pearson Chi-Square)

Variables**	Age	Share herd	Stock use	Religion	Clan	Lion problem	PA important	Lion Like	Lion dislike
Age	-------	0.030	0.663	0.554	0.640	0.044	0.404	0.166	0.999
Share herd	0.030	------	0.670	0.385	0.082	0.737	0.425	0.173	0.719
Stock use	0.663	0.670	-------	0.417	0.408	0.057	0.528	0.812	0.327
Religion	0.554	0.385	0.417	------	0.005	0.061	0.555	0.073	0.022
Clan	0.640	0.082	0.408	0.005	------	0.236	0.593	0.104	0.078
Lion problem	0.044	0.737	0.057	0.061	0.236	-------	0.413	0.044	0.001
PA important	0.404	0.425	0.528	0.555	0.593	0.413	---------	0.026	0.033
Lion Like	0.166	0.173	0.812	0.073	0.104	0.044	0.026	--------	0.001
Lion dislike	0.999	0.719	0.327	0.022	0.078	0.001	0.033	0.001	--------
Freqloss	0.345	0.908	0.132	0.538	0.472	0.129	0.267	0.957	0.820
Olamayio	0.648	0.470	0.660	0.680	0.244	0.928	0.947	0.405	0.978
NARC	0.010	0.246	0.013	0.930	0.216	0.102	0.994	0.165	0.109
Comp attitude	0.133	0.671	0.814	0.472	0.808	0.060	0.001	0.015	0.001
Lion here	0.427	0.699	0.583	0.187	0.711	0.011	0.233	0.189	0.212
GR	0.265	0.275	0.616	0.993	0.572	0.221	0.222	0.367	0.326
KWS	0.137	0.362	0.306	0.918	0.112	0.626	0.001	0.300	0.444

Variables **	Freqloss	*Olamayio*	NARC	Comp attitude	Lion here	GR	KWS
Age	0.345	0.648	0.010	0.133	0.427	0.265	0.137
Share herd	0.908	0.470	0.246	0.671	0.699	0.275	0.362
Stock use	0.132	0.660	0.013	0.814	0.583	0.616	0.306
Religion	0.538	0.680	0.930	0.472	0.187	0.993	0.918
Clan	0.472	0.244	0.216	0.808	0.711	0.572	0.112
Lion problem	0.129	0.928	0.102	0.060	0.011	0.221	0.626
PA important	0.267	0.947	0.994	0.002	0.233	0.222	0.001
Lion Like	0.957	0.405	0.165	0.015	0.189	0.367	0.300
Lion dislike	0.820	0.978	0.109	0.001	0.212	0.326	0.444
Freqloss	--------	0.369	0.516	0.564	0.635	0.271	0.183
Olamayio	0.369	---------	0.974	0.222	0.792	0.347	0.148
NARC	0.516	0.974	---------	0.593	0.765	0.170	0.444
Comp attitude	0.564	0.222	-0.132	--------	0.003	0.255	0.613
Lion here	0.635	0.792	0.765	0.003	--------	0.393	0.830
GR	0.271	0.347	0.170	0.255	0.393	---------	0.778
KWS	0.183	0.148	0.444	0.613	0.830	0.778	---------

Appendix II: Correlation Matrix for Variables used in Compensation/Conservation Attitude

Correlation Definitions

Categorical * Continuous: r_s >0.70 (Spearman rank analysis)
Continuous * Continuous: r >0.70 (Pearson r correlations)

Variables**	Age	Cow Size	Share herd	Stock use	# of children	Religion	Clan	Lion problem	PA important	Lion Like	Lion dislike
Age	-------	0.088			0.079						
Cow Size	0.088	--------	-0.135	0.134	0.195	-0.098	-0.126	-0.006	0.149	0.015	-0.039
Share herd		-0.135	---------		-0.117						
Stock use		0.134		---------	0.257						
# of children	0.079	0.195	-0.117	0.257	---------	0.059	-0.062	-0.101	-0.029	-0.015	0.012
Religion		-0.098			0.059	---------					
Clan		-0.126			-0.062		---------				
Lion problem		-0.006			-0.101			----------			
PA important		0.149			-0.029				----------		
Lion Like		0.015			-0.015					--------	
Lion dislike		-0.039			0.012						---------
Freqloss		0.618			0.330						
Dep5yr	-0.026	0.024	0.027	0.118	0.059	0.024	0.132	0.121	-0.104	0.035	0.015
Dep1yr	0.032	0.041	0.105	0.129	0.030	0.045	0.218	0.055	-0.110	0.040	-0.049
Comptimes	- 0.079	0.139	-0.117	0.050	0.018	0.059	-0.062	0.101	-0.029	-0.015	0.012
Residency	0.147	0.291	0.088	0.168	0.240	0.209	0.282	0.228	0.131	0.285	0.197
Employment		0.163			0.131						

n=100

** see table 4.1 in methods chapter for variable explanation and type

Variables **	Freqloss	Dep5yr	Dep1yr	Comptimes	Residency	Employment
Age		-0.026	0.032	-0.079		
Cow Size	0.618	0.024	0.041	0.139	0.291	0.163
Share herd		0.027	0.105	-0.117		
Stock use		0.118	0.129	0.050		
# of children	0.330	0.059	0.030	0.018	0.240	0.131
Religion		0.024	0.045	0.059		
Clan		0.132	0.218	-0.062		
Lion problem		0.121	0.055	0.101		
PA important		-0.104	-0.110	-0.029		
Lion Like		0.035	0.040	-0.015		
Lion dislike		0.015	-0.049	0.012		
Freqloss	---------	-0.095	0.081	0.330		
Dep5yr	- 0.095	--------	0.371	0.011	0.056	0.033
Dep1yr	0.081	0.371	----------	0.065	0.008	0.016
Comptimes	0.330	0.011	0.065	----------	0.027	0.129
Residency	0.030	0.056	0.008	0.027	---------	0.076
Employment		0.033	0.016	0.129	0.076	----------

Categorical * Categorical: p value<0.0001 (Pearson Chi-Square)

Variables**	Age	Share herd	Stock use	Religion	Clan	Lion problem	PA Important	Lion Like	Lion Dislike	Freqloss	Employ -ment
Age	-------	0.030	0.663	0.554	0.640	0.044	0.404	0.166	0.999	0.345	0.014
Share herd	0.030	------	0.670	0.385	0.082	0.737	0.425	0.173	0.719	0.908	0.023
Stock use	0.663	0.670	-------	0.417	0.408	0.057	0.528	0.812	0.327	0.132	0.480
Religion	0.554	0.385	0.417	------	0.005	0.061	0.555	0.073	0.022	0.538	0.306
Clan	0.640	0.082	0.408	0.005	------	0.236	0.593	0.104	0.078	0.472	0.902
Lion problem	0.044	0.737	0.057	0.061	0.236	-------	0.413	0.044	0.001	0.129	0.050
PA important	0.404	0.425	0.528	0.555	0.593	0.413	---------	0.026	0.033	0.267	0.039
Lion Like	0.166	0.173	0.812	0.073	0.104	0.044	0.026	--------	0.001	0.957	0.001
Lion dislike	0.999	0.719	0.327	0.022	0.078	0.001	0.033	0.001	--------	0.820	0.102
Freqloss	0.345	0.908	0.132	0.538	0.472	0.129	0.267	0.957	0.820	--------	0.063
Employment	0.014	0.023	0.480	0.306	0.902	0.050	0.039	0.001	0.102	0.063	----------

APPENDIX IV: Monitoring Form

JINA LA SIMBA SCOUT_____ ENEO _____

SIMBA MONITORING FORM

TARAHE	NYAYO	KUONA	SAUTI	WAPI? GPS	REPORT BY	SIMBA	CHUI	DUMA	FISI	WENGINE
					✓ X					

Literature Cited

Kenya Wildlife Conservation and Management Act. 376.

Abbot, J. I. O., D. H. L. Thomas, A. A. Gardner, S. E. Neba, and M. W. Khen. 2001. Understand the links between conservation and development in the Bamenda Highlands, Cameroon. World Development **29**:1115-1136.

Adams, J., and T. O. McShane 1996. The Myth of Wild Africa: Conservation Without Illusion. University of California Press, Los Angeles.

Agrawal, A. 1997. Community in Conservation: Beyond Enchantment and Disenchantment. Conservation and Development Forum, Gainesville, Florida.

Agrawal, A., and C. Gibson. 1999. Enchantment and disenchantment: the role of community in natural resource conservation. World Development **27**.

Ahmed, A., A. Azeze, M. Babiker, and D. Tsegaye. 2002. Post-Drought recovery strategies among the pastoral households in the horn of Africa: A review. Page 80. Development Research Report Series no. 3. OSSREA, Addis Ababa.

ALDEV 1962. African Land Development in Kenya 1946-62. English Press, Nairobi.

Ale, S. B. 1998. Culture and Conservation: Religion and the Snow Leopard in Nepal. Page 1. International Snow Leopard Trust.

Anderson, D., and R. Grove 1987. Conservation in Africa: people, policies, and practice. Cambridge University Press, Cambridge, UK.

Bagchi, S., and C. Mishra. 2006. Living with large carnivores: predation on livestock by the snow leopard (*Uncia uncia*). Journal of Zoology **268**:217-224.

Balakrishnan, M., and D. E. Ndhlovu. 1992. Wildlife utilization and local people: a case-study in Upper Lupande Game Management Area, Zambia. Environmental Conservation **19**:135-144.

Baldus, R. D. 1988. Conflict between wildlife and people: village development planning for three settlements bordering Selous Game Reserve. Deutsche Gesellshaft fur Technische Zusammenarbeit (GTZ), Dar es Salaam.

Bank, W. 1994. Land use and land tenure in the arid and semi arid lands of Kenya. World Bank ASAL Team Working Paper 10. World Bank, Nairobi.

Barrett, C. B., and P. Arcese. 1995. Are integrated conservation development projects (ICDPs) sustainable on the conservation of large mammals in Sub-Saharan Africa? World Development:1073-1084.

Barrett, C. B., and P. Arcese. 1998. Wildlife harvest in integrated conservation and development projects: linking harvest to household demand, agriculture production, and environmental shocks in the Serengeti. Land Economics:449-465.

Barrett, C. B., K. Brandon, C. Gibson, and H. Gjertsen. 2001. Conservation tropical biodiversity amid weak institutions. Bioscience **51**:497-502.

Barrow, E., P. Lembuya, P. Ntiati, and D. Sumba. 1993. Knowledge, attitudes, and practices concerning community conservation in Kuku and Rombo group ranches around Tsavo West National Park. Community Conservation Discussion Paper 12. African Wildlife Foundation.

Bauer, H., and S. Hari. 2001. Assessment of the people-predator conflict through thematic PRA in the surroundings of Waza National Park, Cameroon. PLA Notes **41**:9-13.

Bauer, H., and S. Van Der Merwe. 2004. Inventory of free-ranging lion *Panthera leo* in Africa. Oryx **38**:26-31.

BBC. 2003. Kenyan lions killed in revenge attacks in BBC, editor. June, 23 2003.

Becker, D. 1999. Protecting a *garua* forest in Ecuador: the role of institutions and ecosystem valuation. Ambio **28**:156-161.

Berger, D. 1993. Wildlife Extension: Participatory Conservation by the Maasai of Kenya. English Press Ltd., Nairobi, Kenya.

Berkes, F. 2004. Rethinking Community-Based Conservation. Conservation Biology **18**:621-630.

Bonner 1993. At the hand of man: peril and hope for Africa's wildlife. Knopf, New York.

Boomgaard, P. 2001. Frontiers of Fear: Tigers and People in the Malay World, 1600-1950. Yale University Press, New Haven, CT.

Brashares, J. S., P. Arcese, and M. K. Sam. 2001. Human demography and reserve size predict wildlife extinction in West Africa. Pages 2473-2478. Royal Society of London-Series B, London.

Breck, S. 2004. Minimizing Carnivore-Livestock Conflict: the importance and process of research in the search for coexistence in N. Fascione, A. Delach, and M. Smith, editors. People and Predators: from conflict to coexistence. Defenders of Wildlife, Washington D.C.

Bright, A. D., and M. Manfredo. 1996. A conceptual model of attitudes toward natural resource issues: a case study of wolf reintroduction. Human Dimensions of Wildlife **1**:1-21.

Britain, G. 1934a. Kenya Land Commission: Evidence and Memoranda. 4 Volumes. His Majesty's Stationary Office, London.

Brooks, J., M. Franzen, C. M. Holmes, M. Grote, and M. Borgerhoff Mulder. 2006. Testing hypotheses for the success of different conservation strategies. Conservation Biology **20**:1528-1538.

Burnham, K. P., and D. R. Anderson 2002. Model Selection and Multimodel Inference: A practical information-theoretic approach. Springer, New York.

Butler, J. R. A. 2000. The economic costs of wildlife predation on livestock in Gokwe communal land, Zimbabwe. African J Ecol **38**:23-30.

Campbell, D. 1979. Response to Draught in Maasailand: Pastoralists and Farmers of the Loitokitok Area, Kajiado District. Page 43. Institute for Development Studies University of Nairobi, Nairobi.

Campbell, D. 1986. The prospect for desertification in Kajiado District, Kenya. The Geograhical Review **152**:44-55.

Campbell, D. 1993. Land as ours, Land as mine: Economic, Political and Ecological Marginalization in Kajiado District in T. Spear, and R. Waller, editors. Being Maasai. James Currey Ltd, London, UK.

Campbell, D. 1999. Response to drought among farmers and herders in southern Kajiado District, Kenya: A comparison of 1972-1976 and 1994-1995. Human Ecology **27**.

Campbell, D., and G. H. Axinn. 1980. Pastoralism in Kenya: obsolete societies en route to extinction, or appropriate technologies for a fragile environment? Pages 1-13. Field Staff Report #30. American University, Washington D.C.

Campbell, D., H. Gichohi, A. Mwangi, and T. Smucker. 2003a. Globalization and Local Heterogeneity: An overview of diversity in land use and development issues in Loitokitok Division, Kajiado District, Kenya. LUCID Working Paper Series #21, Nairobi, Kenya.

Campbell, D., H. Gichohi, R. Reid, A. Mwangi, L. Chege, and T. Sawin. 2003b. Interactions between people and wildlife in Southeast Kajiado District, Kenya. LUCID Working Paper Series Number: 7 **18**.

Campbell, D., D. Lusch, T. Smucker, and E. Wangui. 2003c. Land use change patterns and root causes in the Loitokitok Area, Kajiado District, Kenya. LUCID Report #19, Nairobi, Kenya.

Campbell, D., and S. E. Migot-Adhola. 1979. Midterm Evaluation of Aspects of the Foot and Mouth Disease Control Programme in Kajiado and Narok Districts, Kenya. Vetinary Department. University of Nairobi, Nairobi.

Campbell, D. G., H.; Chege, L. 2000. Land use conflict in Kajiado District, Kenya. Land Use Policy **17**:337-348.

Chardonnet, P. 2002. Conservation of the African Lion: Contributions to a Status Survey. International Foundation for the Conservation of Wildlife, Paris, France.

Cheeseman, T. 2001. Conservation and the Maasai in Kenya: Tradeoffs or mutualism? In policy failure in Kenyan conservation and Maasailand.

Collett, D. 1987. Pastoralists and wildlife: the Maasai in D. Anderson, and R. Grove, editors. Conservation in Africa: people, policies, and practice. Cambridge University Press, Cambridge.

Conforti, V. A., and F. C. C. De Azevedo. 2003. Local perceptions of jaguars (*Panthera onca)* and pumas (*Puma concolor)* in the Iguacu National Park area, south Brazil. Biological Conservation **111**:215-221.

Conover, M. 2002. Resolving human-wildlife conflicts: the science of wildlife damage management. CRC Press, Boca Raton, Florida.

Cutter, S., J. Mitchell, and M. Scott. 2000. Revealing the Vulnerability of People and Places: A case study of Georgetown County, South Carolina. Annals of the Association of American Geographers **90**:713-737.

Dey, S. C. 1991. Depredation by wildlife in the fringe areas of North Bengal forests with special reference to elephant damage. Indian Forester **117**:901-908.

Dickman, A. 2005. An assessment of pastoralist attitudes and wildlife conflict in the Rungwa-Ruaha region, Tanzania, with particular reference to large carnivores. Page 95. Biodiversity, Conservation and Management. University of Oxford, Oxford.

Dictionary, O. E. 2002. Oxford English Dictionary. Oxford University Press, New York, NY.

Doran, M., A. Low, and R. Kemp. 1979. Cattle as a store of wealth in Swaziland: implication for livestock development and overgrazing in east and southern Africa. American Journal of Agricultural Economics **61**:41-47.

Doremus, H. 1999a. Restoring Endangered Species: The importance of being wild. The Harvard Law Review **23**.

Doremus, H. 1999b. RESTORING ENDANGERED SPECIES: THE IMPORTANCE OF BEING WILD. The Harvard Environmental Law Review.

Dorm-Adzobu, C., and P. G. Veit 1991. Religious Beliefs and Environmental Protection: the Malshegu Sacred Grove in Northern Ghana. WRI, Nairobi.

Dyson-Hudson, and Dyson-Hudson. 1972. Pastoralism: self-image and behavioral reality. Journal of Asian and African Studies **7**:30-47.

Eliot, C. 1901. Africa. Page 9 in M. F. Hill, editor. Permanent Way: The Story of the Kenya and Uganda Railway. East African Railways and Harbours, Nairobi.

Eliot, C. 1903. Memorandum on Native Rights in Navaisha Province. Page 21 in G. R. Sanford, editor. An Administrative and Political History of the Masai Reserve. Waterlow and Sons, London.

Eriksen, S., K. Brown, and M. Kelly. 2005. The dynamics of vulnerability: locating coping strategies in Kenya and Tanzania. The Geographical Journal **171**:287-305.

Ervin, J. 2003. Rapid assessment of protected area management effectiveness in four countries. Bioscience **53**:833-841.

Ferraro, J. P., and A. Kiss. 2002. Direct payments for biodiversity conservation. Science **298**:1718-1719.

Fiallo, E. A., and S. K. Jacobson. 1995. Local Communities and protected areas: attitudes of rural residents toward conservation and Machalilla National Park, Ecuador. Environmental Conservation **22**:241-249.

Finn, F. 1929. Sterndale's Mammalia. Thacker and Co., Bombay, India.

Folke, C. e. a. 2002. Resilience for sustainable development: building adaptive capacity in a world of transformations. Rainbow series 3. International Council for Scientific Unions (ICSU), Paris.

Fox, J., S. Sinha, R. Chundawat, and P. Das. 1991. Status of the snow leopard *Panthera uncia* in northwest India. Biological Conservation **55**:283-298.

Frank, L. 1998. Living with lions: carnivore conservation and livestock in Laikipia District, Kenya. Page 63. US Agency for International Development, Conservation of Biodiverse Resource Areas Project, Bethesda, Maryland.

Frank, L., S. Maclennan, L. Hazzah, T. Hill, and R. Bonham. 2006. Lion Killing in the Amboseli -Tsavo Ecosystem, 2001-2006, and its Implications for Kenya's Lion Population. Page 9. Living with Lions, Nairobi, Kenya.

Frank, L., S. Maclennan, L. Hazzah, T. Hill, and R. Bonham. unpublished data. Lion Killing in the Amboseli -Tsavo Ecosystem, 2001-2006, and its Implications for Kenya's Lion Population. Page 9. Living with Lions, Nairobi, Kenya.

Frank, L., R. Woodroffe, and M. Ogada. 2005. People and predators in Laikipia District, Kenya in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and wildlife --conflict or coexistence?

Freudenberger, K. S. 1994. Tree and land tenure: rapid appraisal tools. Food and Agriculture Organization of the United Nations, Rome.

Gadd, M. 2005. Conservation outside of parks: attitudes of local people in Laikipia, Kenya. Environmental Conservation **32**:50-63.

Gadgil, M. 1990. India's deforestation: patterns and processes. Natural Resources **3**:131-143.

Galaty, J. 1982. Being "Maasai"; Being "People-of-Cattle": Ethnic Shifters in East Africa. American Anthropologist **9**:1-20.

Galaty, J. 1992. The land is yours: social and economic factors in the privatization, subdivision, and sale of Maasai ranches. Nomadic Peoples **30**:26-40.

Galaty, J. 1993a. The Eye that wants a person, where can it not see? Inclusion, Exclusion, and Boundary Shifters in Maasai identity in T. Spear, and R. Waller, editors. Being Maasai: Ethnicity and Identity in East Africa. Ohio University Press, Athens, Ohio.

Galaty, J. 1993b. Maasai expansion and new east African pastoralism in R. Wallace, and T. Spear, editors. Being Maasai. James Currey, London.

Galaty, J., and D. Johnson 1991. The world of pastoralism. John Wiley and Sonts Ltd, New York.

Getz, W. M., L. Fortmann, D. Cumming, J. T. du Toit, J. Hiltry, R. B. Martin, M. Murphree, N. Owen-Smith, A. Starfield, and M. Wesphal. 1999. Conservation--sustaining natural and human capital: villagers and scientists. Science **283**:1855-1856.

Ghimire, K. B., and M. P. Pimbert 1997. Social change and conservation. Earthscan, London.

Gibson, C. 1999. Politicians and Poachers: The political economy of wildlife policy in Africa. Cambridge University Press, Cambridge.

Gillingham, S., and P. Lee. 2003. People and protected areas: a study of local perception of wildlife crop-damage conflict in an area bordering the Selous Game Reserve, Tanzania. Oryx **37**:316-325.

Ginsberg, J. R., and D. W. Macdonald. 1990. Foxes, wolves, jackals, and dogs: an action plan for the conservation of canids. World Conservation Union, Gland, Switzerland.

Gitau, S. 2000. The environmental crisis: A challenge for African Christianity. Acton Publishers, Nairobi, Kenya.

Goldman, M. 2003. Partitioned Nature, Privileged Knowledge: Community-based Conservation in Tanzania. Development & Change **34**:833-862.

Goldman, M. 2006. Sharing Pastures, Building Dialogues: Maasai and Wide conservation in Northern Tanzania. Page 570. Geography. University of Wisconsin-Madison, Madison.

Goodland, R. 1982. Tribal peoples and economic development: ecologic considerations. World Bank, Washington D.C.

Goodman, P. S. 2003. Assessing management effectiveness and setting priorities in protected areas in KwaZulu-Natal. Bioscience **53**:843-850.

Graham, O. 1989. A land divided: the impact of ranching on a pastoral society. The Ecologist **19**:184-185.

Grandin, B. 1988. Wealth and pastoral dairy production: a case study from Maasailand. Human Ecology **16**:1-21.

Grandin, B., and P. Lembuya. 1987. The impact of the 1984 drought at Olkarkar Group Ranch, Kajiado, Kenya. Pastoral Development Network 23e. Overseas Development Institute.

Grove, R. 1987. Early themes in African conservation: the Cape in the nineteenth century in R. Grove, and D. Anderson, editors. Conservation in Africa: people, policies and practice. Cambridge University Press, Cambridge.

Guggisberg, C. A. W. 1975. Wild Cats of the World. David and Charles, London.

Hackel, J. D. 1999. Community Conservation and the Future of Africa's Wildlife. Conservation Biology **13**:726-734.

Halderman, J. 1987. Development and Famine-Risk in Kenya Maasailand. Page 544. Political Science. University of California-Berkeley, Berkeley.

Harcourt, A. H., H. Pennington, and A. W. Wver. 1986. Public attitudes to wildlife and conservation in the Third World. Oryx **20**:152-154.
Heberlein, T. A. 1981. Environmental Attitudes. Zeitschrift fur Umweltpolitik **2**:241-270.
Heinen, J. T. 1993. Park-people relations in Kosi Tappu Wildlife Reserve, Nepal: a socio-economic analysis. Environmental Conservation **20**:25-34.
Hellden, U. 1991. Desertification-Time for an assessment? Ambio **28**:372-383.
Hill, C. M. 1998. Conflicting attitudes towards elephants around Budongo Forest Reserve, Uganda. Environmental Conservation **25**:244-250.
Hilton-Taylor, C. 2000. 2000 IUCN red list of threatened species. IUCN, Gland.
Hoare, R. E. 1999. Determinants of human-elephant conflict in a land-use mosaic. Journal of Applied Ecology **36**:689-700.
Hoare, R. E., and J. T. du Toit. 1999. Coexistence between people an elephants in African savannas. Conservation Biology **13**:633-639.
Hobart, M. 1993. Introduction: The Growth of Ignorance?" In An Anthropological Critique of
Development. The Growth of Ignorance. Routledge, London.
Hockings, M. 2003. Systems for assessing the effectiveness of managment in protected areas. Bioscience **53**:823-832.
Holmes, C. M. 2003. The influence of protected areas outreach on conservation attitudes and resource use patterns: a case study from western Tanzania. Oryx **37**:305-315.
Homewood, K. M. 1995. Development, demarcation and ecological outcomes in Maasailand. Africa: Journal of the International African Institute **65**:331-350.
Homewood, K. M. 2004. Policy, environment and development in African rangelands. Environment Science & Policy **7**:125-143.
Homewood, K. M., and D. Brockington. 1998. Biodiversity, conservation and development in Mkomazi
Game Reserve, Tanzania. Global Ecology and Biogeography **8**:301-313.
Homewood, K. M., and W. A. Rogers. 1987. Pastoralism, conservation and the overgrazing controversy. Pages 111-128 in D. Anderson, and R. Grove, editors. Conservation in Africa: people, policies and Practice. Cambridge University press, Cambridge.
Hotte, M. a. S. B. 2001. Compensation for livestock kills by tigers and leopards in Russia. Carnivore Damage Prevention News **3**:6-7.
Hughes, L. 2005. Malice in Maasailand: The historical roots of current political struggles. African Affairs **104**:207-224.
Hulme, D., and M. Murphree. 1999. Communities, wildlife, and the 'new conservation' in Africa. Journal of International Development **11**:277-285.
Hulme, D., and M. Murphree 2001. African Wildlife and Livelihoods: The Promise and Performance of Community Conservation. James Currey Ltd., Oxford, UK.
Hurt, H. 1999. The Ecological, Economic and Social Sustainability of Natural Resources on Mbirikani Ranch, Kajiado, Kenya. Page 98. Centre for Environmental Technology. University of London, London.
Hussain, S. 2000. Protecting the Snow Leopard and Enhancing Farmers' Livelihoods. Mountain Research and Development **20**:226-231.
Hussain, S. 2003. The status of the snow leopard in Pakistan and its conflict with local farmers. Oryx **37**:26-33.

Ikanda, D. K. 2005. A study of the spatial dynamics and human interactions of African lions *Panthera leo* in the Ngorongoro Conservation Area, Tanzania. Page 126. University of Dar es Salaam, Dar es Salaam.

Ikanda, D. K., and C. Packer. *in press*. Ritual vs. retaliatory killing of African lions in the Ngorongoro Conservation Area.

Infield, M. 2001. Cultural values: a forgotten strategy for building community support for protected areas in Africa. Conservation Biology **15**:800-802.

Ingles, A., A. Musch, and H. Qwist-Hoffman. 1999. The participatory process for supporting collaborative management of natural resources: an overview. FAO, Rome.

Ite, U. E. 1996. Community perceptions of the Cross River National Park, Nigeria. Environmental Conservation **23**:351-357.

Jackson, R. 1979. Snow Leopards in Nepal. Oryx **15**:191-195.

Jackson, R., and R. Wangchuk. 2001. Linking Snow Leopard Conservation and People-Wildlife Conflict Resolution: Grassroots measures to protect the endangered snow leopard from herder retribution. Endangered Species Update **18**:138-141.

Jarvis, L. 1980. Cattle as a store of wealth: comment. American Journal of Agricultural Economics **62**:606-613.

Kabukuru, W. 2004. The Maasai vs the Crown. Page 48. New African.

Kangwana, K. 1993. Elephant and Maasai: conflict and conservation in Amboseli, Kenya. Cambridge University, Cambridge.

Karanth, K. U., and M. D. Madhusudan. 2002. Mitigating human-wildlife conflict in southern Asia. Pages 250-263 in J. Terborgh, P. Van Schaik, M. Rao, and L. C. Davenport, editors. Making parks work: identifying key factors to implementing parks in the tropics. Island Press, Covelo, CA.

Kellert, S. 1985. The public and the timber wood in Minnesota. Transactions of North American Wildlife an Natural Resources Conference **51**:193-200.

Kellert, S., J. N. Mehta, S. Ebbin, and L. Lichenfeld. 2000. Community natural resource management: promise, rhetoric and reality. Society of Natural Resources **13**:705-715.

Kenya, G. o. 1946. Second Interim Report of the Game Policy Committee. Page 6 in G. Printer, editor, Nairobi.

Kenya, G. o. 1994. Kenya Population Census 1989 in G. Priner, editor, Nairobi.

Kimani, K., and J. Pickard. 1998. Recent Trends and Implications of Group Ranch Sub-Division and Fragmenation in Kajiado District, Kenya. The Geographical Journal **164**:202-213.

Kiss, A. 1990. Living with Wildlife: Wildlife Resource Management with Local Participation in Africa. The World Bank. The World Bank, Washington D.C.

Kissui, B. 2006. Tarangire Lion Project. Progress Report. University of Minnesota, St.Paul, MN.

Kissui, B. *in press*. The ecology of human-carnivore conflicts in the greater Tarangire ecosystem, Tanzania. I.

Knight, J. 2000. Introduction. Pages 1-35 in J. Knight, editor. Natural enemies: people-wildlife conflict an anthropological perspective. Routledge, London.

Kolowski, J., and K. Holekamp. 2006. Spatial, temporal, and physical characteristics of livestock depredations by large carnivores along a Kenyan reserve border. Biological Conservation **128**:529-541.

Landry, J. M. 1999. The use of guard dogs in the Swiss Alps: A first analysis. KORA, Muri, Switzerland.

Lindsay, W. K. 1987. Integrating parks and pastoralists: some lessons from Amboseli. Pages 149-167 in D. Anderson, and R. Grove, editors. Conservation in Africa: people, policies, and practice. Cambridge University Press, Cambridge, U.K.

Linnell, J., and H. Broseth. 2003. Compensation for large carnivore depredation of domestic sheep. Carnivore Damage Prevention News **6**:11-13.

Linnell, J., J. Odden, M. Smith, R. Aanes, and J. Swenson. 1999. Large carnivores that kill livestock: Do "problem individuals" really exist? Wildlife Society Bulletin **27**:698-705.

Little, P. 1994. The link between local participation and improved conservation: a review of issues and experiences in D. Western, and R. Wright, editors. Natural Connections: perspectives in community-based conservation. Island Press, Washington D.C.

Liverman, D. 1990. Vulnerability to Global Environmental Change in R. e. a. Kasperson, editor. Understanding Global Environmental Change. Clark University, Worcester, MA.

Lovatt Smith, D. 1997. Amboseli Nothing Short of a Miracle. Kenway Publications, Nairobi.

Loveridge, A. J., T. Lynam, and D. W. Macdonald. 2001. Lion conservation research in W. C. R. Unit, editor. Conflict with people, Oxford, UK.

Maddox, T. 2002. The ecology of cheetahs and other large carnivores in a pastorlist-dominated buffer zone. University of London, London, UK.

Marker, L. L., M. G. L. Mills, and D. W. Macdonald. 2003. Factors Influencing Perceptions of Conflict and Tolerance toward Cheetahs on Namibian Farmlands. Conservation Biology **17**:1290-1298.

Matowanyika, J. Z. 1989. Cast out of Eden: Peasants vs wildlife policy in savanna Africa. Alternatives **16**:30-15.

Matzke, G. D. 1975. Large mammals, small settlements, and big problems: A study of overlapping space preferences in southern Tanzania. Syracuse University, Syracuse, New York.

Mazerolle, M. 2006. Improving data analysis in herpetology: using Akaike's Information Criterion (AIC) to assess the strength of biological hypotheses. Amphibia-Reptilia **27**:169-180.

Mbogoh, S., K. Munei, and P. Thornton. 1999. CRSP study on wildlife, livestock and human interaction in Kajiado District in Kenya: Result the economic survey. Pages 1-65. GL-CRSP, Nairobi.

McNaughton, S., and N. Georgiadis. 1986. Ecology of African grazing and browsing mammals. Annual Review Ecology Systems **17**:39-65.

McPeak, J. 2005. Individual and collective rationality in pastoral production: evidence from northern Kenya. Human Ecology **33**:171-197.

McShane, T. O., and J. F. Grettenberger. 1984. Food of the golden jackal (*Canis aureus)* in central Niger. African J Ecol **22**:49-53.

Mech, L. D., S. H. Fritts, and W. J. Paul. 1988. Relationship between winter severity of wolf depredations on domestic animals in Minnesota. Pages 269-272. Wildlife Society Bulletin.

Meriggi, A., and S. Lovari. 1996. A review of wolf predation in southern Europe: does the wolf prefer wild prey to livestock? Journal of Applied Ecology **33**:1561-1571.

Messmer, T. A. 2000. The emergence of human-wildlife conflict management: turning challenges into opportunities. International Biodeterioration and Biodegradation **43**:97-102.

Mills, M. G. L., and H. Hofer. 1998. Hyenas: status survey and conservation action plan. World Conservation Union, Gland, Switzerland.

Mishra, C. 1997. Livestock depredation by large carnivores in the Indian trans-Himalaya: conflict perceptions and conservation prospects. Environmental Conservation **24**:338-343.

Mishra, C., P. Allen, T. McCarthy, M. D. Madhusudan, B. Agvaantserengiin, and H. Prins. 2003. The role of incentive programs in conserving the snow leopard. Conservation Biology **17**:1512-1520.

Mishra, C., C. Wemmer, J. L. D. Smith, and P. Wegge. 1992. Biopolitics of saving Asian mammals in the wild: balancing conservation with human needs in Nepal in P. Wegge, editor. Mammal conservation in developing countries: A new approach. Agricultural University of Norway, Norway.

Montag, J., M. Patterson, and B. Sutton. 2003. Political and social viability of predator compensation programs in the West. Page 145. Final Project Report. University of Montana--School of Forestry, Missoula, MT.

Moore, K., M. Bertelsen, L. Diarra, A. Kodio, S. Cisse, and P. Wyeth. 2000. Natural resource management institution building in the decentralization context of West Africa: the SANREM CRSP approach. Working Paper 01-02. Virginia Tech; Office of International Research and Development, Blacksburg, VA.

Munei, K. 1991. Study on sub-division of group ranches in Kajiado District. Department of Livestock Production, Kajiado District, Nairobi.

Murphree, M. 1994. The role of institutions in community-based conservation. Pages 403-427 in D. Western, and M. Wright, editors. Natural connections: perspectives on community-based conservation. Island Press, Washington D.C.

Musiani, M., C. Mamo, L. Boitani, C. Callaghan, C. C. Gates, L. Mattei, E. Visalberghi, S. Breck, and G. Volpi. 2003. Wolf Depredation Trends and the Use of Fladry Barriers to Protect Livestock in Western North America. Conservation Biology **17**:1538-1547.

Muthiani, E., and P. Wandera. 2000. Feed preferences, optimal integrated stocking rates of selected browsers and grazers and economic viability of integrating wildlife and livestock in selected ASALs. Pages 1-84. Kenya Agriculture Research Institute, Makindu.

Myers, N. 1975. The silent savannahs. International Wildlife **5**:5-10.

Mynott, A. 2005. Kenya wildlife haven downgraded. BBC, Nairobi, October 11, 2005.

Naughton-Treves, R. Grossberg, and A. Treves. 2003. Paying for Tolerance: Rural Citizens' Attitudes toward Wolf Depredation and Compensation. Conservation Biology **17**:1500-1511.

Naughton-Treves, L. 1997. Farming the forest edge: vulnerable places and people around Kibale National Park, Uganda. The Geographical Review **87**:27-46.

Naughton-Treves, L. 1998. Predicting Patterns of Crop Damage by Wildlife around Kibale National Park, Uganda. Conservation Biology **12**:156-168.

Naughton-Treves, L., and A. Treves. 2005. Socio-ecological factors shaping local support for wildlife: crop raiding by elephants and other wildlife in Africa in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and Wildlife: Conflict or Coexistence. Cambridge University Press, Cambridge.

Neumann, R. P. 1998. Imposing Wilderness: Struggles over livelihood and nature preservation in Africa. University of California Press, Berkeley and Los Angeles.

Newmark, W. D., and N. I. Leonard. 1991. Attitudes of local people towards Kilimanjaro National Park and Forest Reserve. Pages 87-96 in W. D. Newmark, editor. The conservation of Mount Kilimanjaro. International Union for the Conservation of Nature, Gland, Switzerland.

Newmark, W. D., and N. I. Leonard. 1993. Conservation attitudes of local people living adjacent to give protected areas in Tanzania. Biological Conservation **63**:177-183.

Newmark, W. D., D. N. Manyanza, D.-G. M. Gamassa, and H. I. Sariko. 1994. The conflict between Wildlife and Local People Living Adjacent to Protected Areas in Tanzania: Human Density as a Predictor. Conservation Biology **8**:249-255.

Ngethe, S., J. Wabula, H. Ogle, and J. Munyugi. 1994. Contribution to a conservation based management plan for Kuku and Rombo group ranches. Community Wildlife Program. Kenyan Wildlife Service, Nairobi.

Ngowi, R. 2006. People vs. wildlife in parched Kenya. Washington Post, Washington D.C., March 5, 2006.

Norton-Griffiths, M. 1995. Economic incentives to develop the rangelands of the Serengeti: implications for wildlife conservation. in A. R. E. Sinclair, and P. Arcese, editors. Serengeti II: dynamics, management, and conservation of an ecosystem. University of Chicago Press, Chicago.

Norton-Griffiths, M. 2003. How many wildebeest do you need? Kenya Past and Present:1-9.

Noss, A., and R. Cuellar. 2001. Community attitudes towards wildlife management in the Bolivian Chaco. Oryx **35**:292-300.

Nowell, K., and P. Jackson. 1996. Wild cats: status survey and conservation action plan. World Conservation Union, Gland, Switzerland.

Ntiati, P. 2002. Group Ranches Subdivision Study in Loitokitok Division of Kajiado District, Kenya. LUCID Working Paper Series Number: 7.

Nyhus, P., H. Fisher, F. Madden, and S. Osofsky. 2003. Taking the bite out of wildlife damage: the challenges of wildlife compensation schemes. Conservation in Practice **4**:39-41.

Nyhus, P., S. Osofsky, J. P. Ferraro, F. Madden, and H. Fischer. 2005. Bearing the costs of human-wildlife conflict: the challenges of compensation schemes in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and Wildlife: Conflict or Coexistence. Cambridge University Press, Cambridge.

Nyhus, P., and R. Tilson. 2004. Characterizing human-tiger conflict in Sumatra, Indonesia: implications for conservation. Oryx **38**:68-74.

Oates, J. F. 1995. The danger of conservation by rural development: a case study from the forests of Nigeria. Oryx:115-122.

Oates, J. F. 1999. Myth and Reality in the Rain Forest: How Conservation Strategies are Failing in West Africa. University of California Press, Berkeley.

Ogada, M. O., R. Woodroffe, N. O. Oguge, and L. G. Frank. 2003. Limiting Depredation by African Carnivores: the Role of Livestock Husbandry. Conservation Biology **17**:1521-1530.

Ogutu, J. O., and H. T. Dublin. 2004. Spatial dynamics of lions and their prey along an environmental gradient. African J Ecol **42**:8-22.

Okello, M. 2005. Land-use changes and human-wildlife conflicts in the Amboseli area, Kenya. Human Dimensions of Wildlife **10**:19-28.

Ole Parkipuny, M., and D. Berger. 1993. Maasai Rangelands: Links between Social Justice and Wildlife Conservation. Pages 113-132 in D. Lewis, and N. Carter, editors. Voices from Africa. WWF Publications, Baltimore.

Oli, M. K., I. R. Taylor, and M. E. Rogers. 1994. Snow Leopard *Panthera uncia* predation of livestock: An assessment of local perception in the Annapurna Conservation Area, Nepal. Biological Conservation **68**:63-68.

Osborn, F., and G. Parker. 2003. Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. Oryx **37**:80-84.

Ostrom, E. 1990. Governing the commons: the evolution of institutions for collective action. Cambridge University Press, Cambridge.

Ostrom, E., J. Burger, C. Field, R. Norgaard, and D. Policansky. 1999. Revisiting the Commons: Local Lessons, Global Challenges. Science **284**:278-282.

Owen, D. 1979. Drought and Desertification in Africa: Lessons from the Nairobi Conference. Oikos **33**:139-151.

Pagiola, S., J. Kellenberg, L. Vidaeus, and J. Srivastava. 1998. Mainstreaming biodiversity in agricultural development. Finance and Development **35**:38-41.

Parkipuny, M. S. O. 1991. Pastoralism, Conservation and Development in the Greater Serengeti in IIED, editor. Dryland Networks Programme Issues Paper, London.

Pasha, I. K. 1986. Evolution and individuation of group ranches in Maasailand. in R. M. Hansen, B. M. Woie, and R. D. Childs, editors. Range development and research in Kenya. The Ministry of Agriculture, Livestock Development and Marketing, Governments of the Republic of Kenya and the Royal Netherland Embassy., Nairobi.

Patterson, B. D., S. M. Kasiki, E. Selempo, and R. W. Kays. 2004. Livestock predation by lions (Panthera leo) and other carnivores on ranches neighboring Tsavo National Park, Kenya. Biological Conservation **119**:507-516.

Peterson, M. J. 1991. Wildlife, parasitism, science, and management policy. Journal of Wildlife Management **55**:782-789.

Phillips, M. K., E. E. Bangs, L. D. Mech, B. T. Kelly, and B. B. Fazio. 2004. Grey Wolves-Yellowstone: Extermination and recovery of red and grey wolf in the contiguous United States. Pages 297-309 in D. W. Macdonald, and C. Sillero-Zubiri, editors. The Biology and Conservation of Wild Canids. Oxford University Press, Oxford, U.K.

Pitkin, B. 1995. Protected Area Conservation Strategy (PARCS): training needs and opportunities among protected area managers in eastern, central ,and southern Africa. Biodiversity Support Program. World Wildlife Fund, Washington D.C.

Pratt, D., and M. Gwynne 1977. Rangeland management and ecology in east Africa. Hodder and Stoughton, London.

Rao, K. 1996. Management problems: people in protected areas. Pages 65-78. Proceedings of the SAARC Workshop on Wildlife Management. Wildlife Institute of India, Dehradun, India.

Ray, J., L. Hunter, and J. Zigouris. 2005. Setting Conservation and Research Priorities for Larger African Carnivores. Page 216. Working Paper No. 24. Wildlife Conservation Society (WCS), New York.

Reid, R., L. Gashimbi, J. Worden, E. Wangui, S. Mathai, S. Mugatha, D. Campbell, J. Maitima, B. Butt, H. Gichohi, and E. Ogol. 2004. Linkage between changes in land use, biodiversity and land degradation in the Loitokitok Area of Kenya. LUCID Working Paper Series #49, Nairobi, Kenya.

Ribot, J. 2002. Democratic decentralization of natural resources: institutionalizing population participation. World Resource Institute, Washington, D.C.

Rodriguez, S. 2005. Perceptions and attitudes of a Maasai community
regarding predator-livestock compensation,
wildlife conservation and the predators that prey on their livestock. Page 21. School for International Training.

Rodriguez, S. 2006. Perceptions and attitudes of a Maasai community in southern Kenya regarding predator-damage compensation, wildlife conservation and the predators that prey on their livestock. School for International Training (SIT), Brattleboro, VT.

Rogers, W. A. 1989. Policy issues in wildlife conservation. Indian Journal of Public Administration **35**:461-468.

Rondeau, D., and E. Bulte. 2004. Compensation for wildlife damage: habitat conversion, species preservation and local welfare. Economics and the Analysis of Biology and Biodiversity, Cambridge, UK.

Roque de Pinho, J. 2002. Changing attitudes towards wildlife in the Amboseli Ecosystem, Kajiado District, Kenya. Natural Resources Ecology Laboratory. Colorado State University, Fort Collins, CO.

Ross, M. 1927. Kenya from Within. George Allen and Unwin, London.

Rudnai, J. 1979. Ecology of lions in Nairobi National park and the adjoining Kitengela Conservation Unit in Kenya. African J Ecol **17**:85-95.

Rutten, M. 1992. Selling wealth to buy poverty: the process of the individualization of landownership among the Maasai pastoralist of Kajiado District, Kenya, 1890-1990. Verlag Breitenbach, Saarbrucken, Germany.

Saberwal, V. K., J. P. Gibbs, R. Chellam, and A. J. T. Johnsingh. 1994. Lion-Human Conflict in the Gir Forest, India. Conservation Biology **8**:501-507.

Salafsky, N., H. Cauley, G. Balachander, B. Cordes, J. Parks, C. Margoluis, S. Bhatt, C. Encarnacion, D. Russell, and R. Margoluis. 2001. A systematic test of an enterprise strategy for community-based biodiversity conservation. Conservation Biology **15**:1585-1595.

Sanford, G. R. 1919. An Administrative and Political History of the Masai Reserve. Waterlow and Sons, London.

Sanford, S. 1983. Management of Pastoral Development in the Third World. Wiley, New York.

Schaller, G., L. Hong, Talipu, LuHua, R. Junrang, Q. Mingjian, and W. Habin. 1987. Status of large mammals in Taxkorgan Reserve, Xinjiang, China. Oryx **22**:197-204.

Scholte, P., S. Adam, S. Kari, and J. H. Mbouche. 1999. Walking a tightrope: using PRA in a conflict situation around Waza National Park, Cameroon. PLA Notes **35**:7-12.

Sekar, N. 1998. Crop and livestock depredation caused by wild animals in protected areas: the case of the Sariska Tiger Reserve, Rajasthan, India. Environmental Conservation **25**:160-171.

Sekar, N. 2003. Local people's attitudes towards conservation and wildlife tourism around Sariska Tiger Reserve, India. Journal of Environmental Managment **69**:339-347.

Sekhar, N. 1998. Crop and livestock depredation caused by wild animals in protected areas: the case of the Sariska Tiger Reserve, Rajasthan, India. Environmental Conservation **25**:160-171.

Seno, S. K., and W. Shaw. 2002. Land tenure policies: Maasai tradition and wildlife conservation in Kenya. Society of Natural Resources **15**:79-88.

Sillero-Zubiri, C., and K. Laurenson. 2001. Interactions between carnivores and local communities: conflict or co-existence? Pages 282-312 in J. Gittleman, S. M. Funk, D. W. Macdonald, and R. K. Wayne, editors. Carnivore Conservation. Cambridge University Press, Cambridge, U.K.

Sinclair, A. R. E., and M. Norton-Griffiths 1979. Serengeti: Dynamics of an ecosystem. Chicago University Press, Chicago.

Sindiga, I. 1984. Land and Population Problems in Kajiado and Narok, Kenya. African Studies Review **27**:23-39.

Spear, T. 1993. Becoming Maasai in T. Spear, and R. Waller, editors. Being Maasai: Ethnicity and Identity in Eastern Africa. Ohio University Press, Athens, Ohio.

Spear, T., and R. Waller 1993. Being Maasai. James Currey Ltd, London.

Stahl, P., J. M. Vandel, V. Herrenschmidt, and P. Migot. 2001. The effect of removing lynx in reducing attacks on sheep in the French Jura Mountains. Biological Conservation **101**:15-22.

Stander, P. E. 1990. A suggested management strategy for stock-raiding lions in Namibia. South African Journal of Wildlife Research **20**:37-43.

Stander, P. E. 1997. The ecology of lions and conflict with people in north-eastern Namibia. Pages 10-17 in B. L. Penzhorn, editor. A symposium of Lions and Leopards as Game Ranch Animals. Wildlife Group of the South African Veterinary Association, Onderstepoort, SA.

Standring, P. 2004. Revenge killings: African farmers massacre lions. National Geographic.

Starr, M. 1987. Risk, Environmental Variability and Drought-Induced Impoverishment: the Pastoral Economy of Central Niger. Africa: Journal of the International African Institute **57**:29-50.

Stuart-Hill, G., R. Diggle, B. Munali, J. Tagg, and D. Ward. 2005. The event book system: a community-based natural resource monitoring system from Namibia. Biodiversity and Conservation **14**:2611-2631.

Susman, P., P. O'Keefe, and B. Wisner. 1983. Global Disasters: A radical interpretation. Pages 263-283 in K. Hewitt, editor. Interpretations of Calamity. Allen and Unwin, Boston.

Sutton, J. E. G. 1993. Becoming Maasailand. Pages 38-61 in T. Spear, and R. L. Waller, editors. Being Maasai. James Currey Ltd, London.

Talbot, L. 1986. Demographic factors in resource depletion and environmental degradation in East African rangelands. Population and Development Review **12**:441-451.

Talle, A. 1988. Women at a Loss. Stockholm Studies in Social Anthropology. University of Stockholm, Stockholm.

Taylor, R. D. 1999. A review of problem elephant policies an management options in southern Africa. Human Elephant Task Force, IUCN, African Elephant Specialist Group, Nairobi.

Thirgood, S., S. Redpath, I. Newton, and P. Hudson. 2000. Raptors and red grouse: conservation conflicts and management solutions. Conservation Biology **14**:95-104.

Thirgood, S., R. Woodroffe, and A. Rabinowitz. 2005. The impact of human-wildlife conflict on human lives and livelihoods. Pages 13-26 in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and Wildlife: Conflict or Coexistence? Cambridge University Press, Cambridge.

Tignor, R. 1972. The Maasai Warriors: Pattern Maintenance and Violence in Colonial Kenya. The Journal of African History **13**:271-290.

Treves, A., R. Jurewicz, L. Naughton-Treves, R. Rose, and A. Wydeven. 2002. Wolf depredation on domestic animals in Wisconsin 1997-2000. Wildlife Society Bulletin **30**:231-241.

Treves, A., and K. U. Karanth. 2003. Human-Carnivore Conflict and Perspectives on Carnivore Management Worldwide. Conservation Biology **17**:1491-1499.

Treves, A., and L. Naughton-Treves. 1999. Risk and opportunity for humans coexisting with large carnivores. Journal of Human Evolution **36**:275-282.

Treves, A., L. Naughton-Treves, E. K. Harper, D. Mladenoff, R. A. Rose, T. A. Sickley, and A. P. Wydeven. 2004. Predicting Human-Carnivore Conflict: a Spatial Model Derived from 25 Years of Data on Wolf Predation on Livestock. Conservation Biology **18**:114-125.

Treves, A., R. Wallace, L. Naughton-Treves, and A. Morales. 2006. Co-managing human-wildlife conflict. Human Dimensions of Wildlife **11**:383-396.

Treves, A., R. Wallace, L. Naughton-Treves, and A. Morales. *in press*. Co-managing human-wildlife conflict. Human Dimensions of Wildlife.

Turner, B. L., R. Kasperson, P. Matson, J. McCarthy, r. Corell, L. Christensen, N. Eckley, J. Kaspterson, A. Luers, M. Martello, C. Polsky, P. A, and A. Schiller. 2003. A framework of vulnerability analysis in sustainable science. Pages 8074-8079. Proceedings of the National Academy of Science of the United States of America.

Turner, M. 1999. Conflict, environmental change, and social institutions in dryland Africa: limitations of the community resource management approach. Society of Natural Resources **12**:643-657.

Vos, J. 2000. Food habits and livestock depredation of two Iberian wolf packs (*Canis lupus signatus*) in the north of Portugal. Journal of Zoology **251**:457-462.

Wagner, F. H. 1988. Predator control and the sheep industry: the role of science in policy formation. Regina Books, Claremont, CA.

Wagner, K., R. Schmidt, and M. Conover. 1997. Compensation programs for wildlife damage in North America. Wildlife Society Bulletin **25**:312-319.

Waller, R. 1979. The Lords of East Africa: The Maasai in the mid-Nineteenth Century (c. 1840-1855). PhD. Cambridge University, Cambridge.

Waller, R. L. 1976. The Maasai and the British 1895-1905. the Origins of an Alliance. The Journal of African History **17**:529-553.
Waller, R. L. 1985. Ecology, Migration, and Expansion in East Africa. African Affairs **84**:347-370.
Watts, H., and K. Holekamp. 2005. Final report on carnivore monitoring program in Amboseli National Park, Kenya.
Wells, M., K. Brandon, and L. Hannah. 1992. People and Parks: Linking Protected Area Management with Local Communities. World Bank, Washington D.C.
Western, D. 1982. Amboseli National Park: enlisting landowners to conserve migratory wildlife. Ambio **11**:302-308.
Western, D. 2003. Conservation Science in Africa and the Role of International Collaboration. Conservation Biology **17**:11-19.
Western, D., K. Benirschke, J. Berger, D. Janzen, W. Hallwachs, G. Meffe, M. Myers, D. Newmark, D. Woodruff, J. Bradbury, P. Raven, and C. Norman. 1998. Wildlife Conservation in Kenya. Science **280**:1507-1511.
Western, D., and T. Dunne. 1979. Environmental aspects of settlement site decisions among pastoral Maasai. Human Ecology **14**.
Western, D., and M. Nightingale. 2002. Environmental Change and the Vulnerability of Pastoralists to Drought: A case study of the Maasai in Amboseli, Kenya. Africa Environment Outlook Report. UNEP.
Western, D., and M. Wright 1994. Natural Connection: Perspectives in Community-based Conservation. Island Press, Washington D.C.
White, G. F. 1974. Natural Hazards. Oxford Press, New York.
Woodroffe, R. 2005a. The future of coexistence in R. Woodroffe, S. Thirgood, and A. Rabinowitz, editors. People and Wildlife: Conflict or Coexistence? Cambridge University Press, Cambridge, UK.
Woodroffe, R., and L. Frank. 2005. Lethal control of African lion (*Panthera leo*): local and regional population impacts. Animal Conservation.
Woodroffe, R., and J. R. Ginsberg. 1998. Edge effects and the extinction of populations inside protected areas. Science **280**:2126-2128.
Woodroffe, R., Lindsey, P., Romanach, S., Stein, A., M.K. ole Ranah, S. 2005b. Livestock predation by endangered African wild dogs (*Lycaon pictus*) in northern Kenya. Biological Conservation **125**:225-234.
Workshop, E. a. S. A. L. C. Jan. 8-13, 2006. *unpublished data*, Johannesburg.
Wydeven, A., A. Treves, B. Brost, and J. Wiendenhoeft. 2004. Characteristics of Wolf Packs in Wisconsin: Identification of Traits Influencing Depredation in N. Fascione, A. Delach, and M. Smith, editors. People and Predators: From Conflict to Coexistence. Island Press, Washington, D.C.
Yuill, T. M. 1987. Disease as components of mammalian ecosystems: Mayhem and subtlety. Canadian Journal of Zoology **65**:1061-1066.